

TEXTURE

A hydrocolloid recipe collection



Edited by Martin Lersch

Texture – A hydrocolloid recipe collection (v. 3.0, February 2014) edited by Martin Lersch

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Disclaimer

All recipes have not been tested by the editor so there is no guarantee that they actually work as intended and that the directions are complete, accurate and correct.

Words of caution

Always make sure that the hydrocolloid you use is indeed intended for consumption. Chemicals come in different purities. Note that some chemicals are sold “for research use only”. Many of the hydrocolloids mentioned herein are available in “technical grade” purities which might be intended for non-food applications only. If using PVC tubes to make noodles only “food grade” tubes should be used.

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Version history

v. 1 (August 2007)

First version with 111 recipes.

v. 2 (May 2008)

Several new recipes added (now counting more than 220 in total), including recipes with cornstarch, gum arabic, konjac and locust bean gum. In each section recipes are now sorted according to amount of hydrocolloid used. The appendix has been updated with tables for comparison of hydrocolloid properties, hydrocolloid densities and synergies. A major improvement is that recipes have been indexed according both to the texture/appearance of the resulting dish and according to hydrocolloids.

v.2.1 (June 2008)

Gelatin section updated to reflect the fact that the size of gelatin sheets compensates for the different bloom strengths available. Supplier list updated. Typos corrected. Recipes added/deleted.

v.2.2 (December 2008)

Recipes added, now counting more than 270 in total. Supplier list updated. Typos corrected. Some additions/changes in appendix. New index for alcoholic preparations added.

v.2.3 (May 2010)

More than 310 recipes in total. Appendix expanded and updated. Typos corrected. Some pictures added + invitation to contribute own pictures.

v.3.0 (February 2014)

After more than 80,000 downloads of v.2.3 it is time for a major update of Texture featuring:

- many new recipes, now counting 339 in total
- more pictures (A big THANK YOU to all contributing photographers!)
- a new chapter with non-hydrocolloid gels
- a new table with viscosities of 1% solutions of hydrocolloids
- many minor corrections throughout the recipes and appendix
- conversion from US customary volumetric units in new added recipes done with Excel calculator available from <http://blog.khymos.org/2014/01/23/volume-to-weight-calculator-for-the-kitchen/>

Please report typos webmaster@khymos.org.

Additional photographic contributions are always welcome! See p.8 for details.

Foreword

A hydrocolloid can simply be defined as a substance that forms a gel in contact with water. Such substances include both polysaccharides and proteins which are capable of one or more of the following: thickening and gelling aqueous solutions, stabilizing foams, emulsions and dispersions and preventing crystallization in frozen products.

In the recent years there has been a tremendous interest in molecular gastronomy, molecular cooking and modernist cuisine. Part of this interest has been directed towards the “new” hydrocolloids. The term “new” includes hydrocolloids such as gellan and xanthan which are a result of relatively recent research, but also hydrocolloids such as agar which has been unknown in western cooking, but used in Asia for decades. One fortunate consequence of the increased interest in molecular gastronomy and hydrocolloids is that hydrocolloids that were previously only available to the food industry have become available in small quantities at a reasonable price. A less fortunate consequence however is that many have come to regard molecular gastronomy as synonymous with the use of hydrocolloids to prepare foams and spheres. I should therefore emphasize that *molecular gastronomy is not limited to the use of hydrocolloids* and that *it is not the intention of this collection of recipes to define molecular gastronomy*.

Along with the increased interest in hydrocolloids for texture modification there is a growing skepticism to using “chemicals” in the kitchen. Many have come to view hydrocolloids as unnatural and even unhealthy ingredients. It should therefore be stressed that the hydrocolloids described in this collection are all of biological origin. All have been purified, some have been processed, but nevertheless the raw material used is of either marine, plant, animal or microbial origin. Furthermore hydrocolloids can contribute significantly to the public health as they allow the reduction of fat and/or sugar content without losing the desired mouth feel. The hydrocolloids themselves have a low calorific value and are generally used at very low concentrations. It is indeed surprising that the health benefits of hydrocolloids receive so little attention.

One major challenge (at least for an amateur cook) is to find recipes and directions to utilize the “new” hydrocolloids. When purchasing hydrocolloids, typically only a few recipes are included. Personally I like to browse several recipes to get an idea of the different possibilities when cooking. Therefore I have collected a number of recipes which utilize hydrocolloids ranging from agar to xanthan. In addition to these some recipes with lecithin (not technically a hydrocolloid) have been included. Recipes for foams and gels that do not call for addition of hydrocolloids have also been included for completeness. Some cornstarch recipes have been included to illustrate its properties at different concentrations. However, recipes with other starches have been omitted. Similarly, recipes where flour is the only thickener do not fall within the scope of this collection as these are sufficiently covered by other cook books.

All recipes have been changed to metric units which are the ones preferred by the scientific community (and hopefully soon by the cooks as well). In doing so there is always uncertainty related to the conversion of volume to weight, especially powders.¹ To give an example: the amount of flour in a cup depends on whether the flour is sifted, spooned or scooped into the cup. As far as possible, brand names have been replaced by generic names. Almost all recipes have been edited and some have been shortened significantly. To allow easy comparison of recipes the amount of hydrocolloid used is also shown as mass percentages and the recipes are ranked in an ascending order within each chapter.

When collecting and editing the recipes, obvious mistakes have been corrected. But unfortunately the recipes have not been tested, so there is no guarantee that they actually work as intended and that the directions are complete, accurate and correct. An exception to this are all the recipes which now feature pictures. One motivation for including pictures of the actual recipes was that these may serve as a “proof” that the recipe actually works. Furthermore, in the cases where the source of a recipe is a specific website, this may also be taken as a good indication that the recipes in fact has been tested and works. It appears as if some of the recipes are not optimized with regard to proper dispersion and hydration of the hydrocolloids which again will influence the amount of hydrocolloid used. It is

¹ Conversions up until v. 2.3 were done at <http://www.convert-me.com/en/convert/cooking>. Starting with v.3.0 all new recipes have been converted from US customary volumetric units with an Excel spreadsheet calculator available for free download from <http://blog.khymos.org/2014/01/23/volume-to-weight-calculator-for-the-kitchen/>. Hydrocolloid densities are found in the appendix.

therefore advisable to always consult other similar recipes or the table with the hydrocolloid properties. The recipes have been collected from various printed and electronic sources and every attempt has been made to give the source of the recipes. But there is no guarantee that the source given is the original source of the recipe.

Given the many recent books about molecular gastronomy and modernist cuisine I have certainly asked myself: Is there a need for a revision of *Texture*? Since you read this I obviously landed on a "yes". As a toolbox for chefs and amateur cooks I still believe that this collection is unique for several reasons: the ranking of recipes according to the amount of hydrocolloid used, the texture index and the total number of recipes. To the best of my knowledge no other cook books have taken the same approach to collect and systemize recipes this way. And judging by the feedback I have received many chefs and food enthusiasts around the world have found *Texture* to be a useful resource in the kitchen (to which the 80.000 downloads from Khymos alone also testify). I do not regard *Texture* as a competitor to the numerous books available, but rather as a supplement. Inspiration for cooking is best sought elsewhere, but if *Texture* can inspire to experimentation with the texture of foods I believe it has fulfilled its mission.

Since recipes can neither be patented nor copyrighted, every reader should feel free to download, print, use, modify, and further develop the recipes contained in this compilation. *Texture* is published under a Creative Commons Attribution-Noncommercial-Share Alike license. As long as you include an attribution, don't charge any money for it and share it under the same conditions - you are more or less free to do whatever you like with the collection (see more details on p. 2).

The latest version will be available for download from <http://blog.khymos.org/recipe-collection> and updates will be announced on Khymos (<http://blog.khymos.org>) and on twitter (@tastymolecules). Lastly I would like to thank readers for giving me feedback and suggestions on how to improve the collection. Feedback, comments, corrections and new recipes are always welcome at webmaster@khymos.org.

Martin Lersch, Ph.D.,
Chemist and food enthusiast

Fredrikstad (Norway), February 2014

Quick guide

There are several ways of using this collection of recipes. You can search the recipes by...

1. Hydrocolloid

Turn to the section covering the hydrocolloid of interest. In each section, recipes are arranged in an ascending order according to the amount of hydrocolloid used in the recipe. Or you can use the index on page 135 to find particular recipes in the multi-hydrocolloid section.

2. Texture

In the texture index starting on page 127 all recipes have been grouped according to the texture produced and the hydrocolloid used. A table on page 126 shows the different texture-hydrocolloid combinations which are exemplified in the recipe collection.

3. Properties

When looking for a hydrocolloid with special properties, start by looking at the table "Comparison of hydrocolloid properties" on page 120. Having found a hydrocolloid which fits your application you can either turn to the appropriate section or use the texture index.

4. Full text search

Download the pdf and use the search function of Acrobat reader to search the whole document for any ingredient, technique or keyword you are interested in.

5. Alcoholic preparations

Some hydrocolloids require special attention when using ingredients containing alcohol. A separate index of alcoholic preparations is available on page 134.

Before proceeding with a recipe, check the table starting on page 120. Pay special attention to the details regarding dispersion and hydration. Also note possible interactions with promoters and inhibitors.



"Texture" to be enhanced with pictures

Foamed garlic oil

200 g of roasted garlic olive oil
16 g mono-/diglycerides (8%)

Heat oil to 65 °C to dissolve mono-/diglycerides. Allow the oil to come to room temperature, pour it into an iSi, and charge it twice with nitrous oxide. Shake well and foam.

Chad Galliano (inspired by Ferran Adrià) in
<http://chadzilla.typepad.com/chadzilla/2009/01/garlic-oil.html>,



Photo by Chad Galliano

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Chad Galliano (inspired by Ferran Adrià) in
<http://chadzilla.typepad.com/chadzilla/2009/01/garlic-oil.html>,

Would this recipe collection be even better with pictures?

A picture is worth a thousand words, and this is also true for recipes. I therefore invite you to contribute to the recipe collection by taking pictures to accompany the recipes. But before you run to grab your camera, please take note of the following:

- Pictures should clearly show the component described in the recipe. If you take a close up picture against a neutral background it's good if one still has a feeling of what the scale is.
- Only send a picture if you actually followed the recipe! This way the picture can also serve as an indication that the recipe has been tested. However, if you for some reason have modified a recipe for a better or different result I would also be very interested in hearing about this.
- Pictures should be in focus and well lit. But remember that Photoshop can do wonders, so please do send pictures even though the colors seem a little dull.
- Pictures will be cropped to a 1:1 aspect ratio as shown above
- Preferred minimum resolution is 450 x 450 pixels
- It's a requirement that the picture is taken by you and that you are willing to provide it for use in "Texture - A hydrocolloid recipe collection" under a Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported License since the whole recipe collection is published under such a license (see page 2 for more details)
- I reserve the right to crop pictures and do color/brightness/sharpness adjustments
- I reserve the right not to use pictures received (and I only intend to include one picture for every recipe)
- Pictures will be attributed to the photographer as shown in the above illustration.

If you have read the above and agree you're ready to send your texture pictures to me at texture.pictures@gmail.com. Remember to include the **name of the recipe photographed** and **your name** as it should appear under the picture.

Thank you very much for helping me make this collection even more useful



Agar

Tips and tricks

- Addition of glycerol or sorbitol can prevent dehydration of the gel.
- When replacing gelatin or pectin for gels, use 2-3 and 10 times less agar respectively
- For "raw" preparations dissolve agar in small quantity of water. Heat remaining solution to 35-45 °C and mix with agar solution.
- If left uncovered agar gels dry out, but if immersed in water or other liquid it swells and retains its original shape.
- A special property of agar is the large difference between the gelling temperature and the melting temperature. This is known as hysteresis
- The minute amounts of agar needed can be difficult to measure. One trick is to make a 0.1x strength agar by mixing 10 g of agar with 90 g of sugar. For a recipe that calls for 0.5 g agar you then use 5 g of the 0.1x agar/sugar mixture. But keep in mind that you do add a small amount of sugar, so this is not suitable in every recipe.
- Agar alone forms brittle gels, but in combination with locust bean gum elastic gels may be obtained. See the chapter on "Multi-hydrocolloid recipes" for examples (p. 93)

Name	agar (E406)
<i>Origin</i>	polysaccharide obtained from red algae (several species)
<i>Properties, texture</i>	thermoreversible, heat resistant, brittle gel; high hysteresis
<i>Clarity</i>	clear to semi-opaque
<i>Dispersion</i>	in cold or hot water
<i>Hydration (dissolution)</i>	> 90 °C; heating to boil necessary for gelling.
<i>pH</i>	2.5-10
<i>Setting</i>	35-45 °C, rapid (minutes)
<i>Melting</i>	80-90 °C%
<i>Promoter</i>	sugar; sorbitol and glycerol improve elasticity, stronger gel at higher pH
<i>Inhibitor</i>	tannic acid (counteracted by add. of glycerol); prolonged heating at pH outside the range 5.5-8
<i>Tolerates</i>	salt, sugar, alcohol, acid, proteases
<i>Viscosity of solution</i>	low
<i>Typical concentration</i>	0.2% will set, 0.5% gives firm jelly, [0.07-3%] *
<i>Synergies</i>	locust bean gum (only with certain agar types)
<i>Syneresis</i>	yes (can be prevented by replacing 0.1-0.2% agar with locust bean gum)

* Concentrations in [square brackets] show range exemplified in this collection.



Photo by Carlo Milono

Clear liquid by agar filtration

1000 g cloudy liquid or purée
0.7-1.8 g agar (0.07-0.18%)

Strain liquid to remove particles. Bring to simmer, add agar and stir to dissolve. Let cool and freeze. Line a strainer with a cheese cloth or a coffee filter and place the strainer over a bowl. Place the frozen block in the strainer and allow the clear liquid to drain out of the agar network. An agar filtration typically takes 8 hours compared to 2-3 days for a gelatin filtration.

Tip from Ideas in food: Circumvent freezing and speed up process by vacuuming the set agar gel, then filter to obtain clear juice in no time.

Tip: Gelatin can also be used. See p. 29. However, agar filtrations are faster (typically 12h vs. 48h for gelatin) and give higher yields (typically 75% vs. 40-60% for gelatin).

<http://foros.chefuri.net/viewtopic.php?p=36649>,
http://www.ideasinfood.com/ideas_in_food/2009/07/compression-clarification.html

Turkish delight

350 g water
100 g orange juice
1 lemon, juiced
1.2 g agar (0.13%)
450 g sugar
pink or yellow food coloring (optional)
25 g pistachios, skinned/chopped (optional)
25g almonds, skinned/chopped (optional)
icing sugar for dusting

Heat water, orange and lemon juices. Add agar and stir to dissolve. Add the sugar and food coloring and bring to boil. Then simmer on low

heat for 20 minutes, stirring occasionally. Add the nuts. Remove from heat and cool mixture, stirring from time to time until it comes to room temperature. Pour into a square or rectangular dish, cover and leave in fridge until set. Cut into 24 squares using a greased knife, and dust with icing sugar. Store in an airtight container, or wrap in cellophane.

<http://globalveggie.wordpress.com/2008/09/26/turkish-delight/>

Hot lobster gelatin

250 g lobster stock
0.6 g agar (0.24 %)
salt

Mix the lobster stock, salted to taste, with the agar. Bring to a boil over medium heat while stirring continuously. Allow to gel in the refrigerator for at least 2 hours and heat under the salamander (hot air heater) before serving.

<http://www.texturasebulli.com>

Coconut jelly with strawberry sauce

250 g milk
15 g grated coconut
75 g sugar
1 g agar (~ 0.26%)
1/2 lemon, juiced (~20 mL)
25 g cream

Strawberry sauce:
250 g strawberries
50 g sugar

Cook the milk together with the grated coconut and the sugar. When it boils, add the agar and cook for 3 minutes. Leave it to cool down until it is tepid and add the lemon juice and the cream. Pour the liquid in a mold and cool it in the fridge. Cut it into different shapes.

Wash and chop the strawberries, add the sugar and grind. Serve the coconut jelly with a little bit sauce on the top.

Adapted from <http://www.inicon.net>



Photo by Anne Spurkland

Mango cheese cake filling

100 g mango purée
250 g cream cheese
150 g sugar
250 g heavy cream
100 g apple juice
2.5 g agar (0.29%)

Whip heavy cream with some of the sugar. Mix cream cheese, sugar and mango puree. Mix carefully with whipped cream. Heat agar in apple juice to a slow boil and keep for 2-3 min until all agar has dissolved. Leave to cool a little and mix into cream filling. Pour onto cake and leave to set.

Anne Spurkland via <http://www.friekaker.no/?p=473>

Hot vegetable mousse

2.5 g agar (0.33 %)
500 g water
50 g dairy cream (thick)
200 g vegetable purée (mashed and thinned)
pepper
(xanthan)

Prepare the vegetables (try French sweet peas), blend with cream and water and strain. Bring to boil and add agar. Stir well for a few minutes (can use blender). Add flavoring (pepper, etc.). Leave to set for a few hours.

When cold, put into blender and blitz the gel into a mashed runny purée. Pour into 1 L heat resistant whipper. If not runny, add a little water and if too runny add a small pinch of xanthan. Blend again a few minutes.

Follow recommendations of dispenser supplier and charge with nitrous oxide. Heat whipper in saucepan of water till warm (~70 °C). Layer hot vegetable purée on a soup or a very hot plate

<http://www.gastronomie.kalys.com>

Dehydrated lime curd

270 g lime juice
270 g eggs
270 g sugar
4 g agar (0.34%)
350 g butter, cold, cut in cubes

Bring lime juice, eggs, sugar and agar to a boil, whisking constantly. Boil for 1 minute. Transfer to blender, and with blender running at low speed, add butter 1-2 cubes at a time until combined. Strain through chinois, let cool, cover and refrigerate for 12 hours. Spray sheet of acetate with nonstick cooking spray. Spread out chilled curd, about 2 mm thick. Dehydrate at 50 °C for 12 hours or until crisp, preferably in a dehydrator.

Grant Achatz in *Alinea*

Lemon curd with agar

2-3 lemons, juiced
250 g sugar
50 g butter
3 eggs
2 g agar (0.35%)

Bring all ingredients to a boil. Add lemon zest and/or bergamot oil if desired.

<http://www.chefsimon.com>

Terrine of basil

250 g basil water
0.9 g agar (0.36 %)
salt

Combine 1/4 of the basil water and the powdered agar. Bring to a boil over medium heat while stirring continuously, remove from heat and add the rest of the basil water, salted to taste. Allow to gel in the refrigerator for at least 3 hours, in a square container so that it has a thickness of 1 cm.

<http://www.texturasebulli.com>

Fruity flan dessert

3.0 g agar (0.38 %)
750 g whole milk
50 g dairy cream
4.4 g vanilla extract
30 g sugar
pieces of fruit, raisins or gelled dulce

Blend agar, milk and cream and heat to boiling point. Maintain boil for a few minutes. Strain and pour into small pots or ramekins. To flavor, add flavors and aromas at boiling point and stir in. Pour onto pieces of fruit or gelled dulce. You might also try adding some sodium alginate pearls or raisins.

If you mix the gel in a blender and then expand in a whipper or use a whisk you can produce a light heat stable mousse.

<http://www.gastronomie.kalys.com>

Cold sauce with green cardamom

1000 g water
50 g glucose
12 capsules of cardamom
3-4 cm fresh ginger, peeled and minced
zest of 1 lime

For thickening use one of the following

4 g agar (0.38%)
20 g pectin (1.9%)
10 g gelatin (1.0%)

Bring water and glucose to boil and infuse cardamom, ginger for 20 min. Add desired thickening agent and stir until dissolved (if using agar or pectin, mix with 10 g sugar to aid dispersion). Strain and serve.

<http://www.chefsimon.com>

Fruit jelly

5 g agar (~ 0.42 %)
500 g halved peaches in syrup
500 g halved peaches/pears without syrup
200 g sugar (or use 50 g maltitol, 50 g maltodextrin and 100 g glucose)

Flavoring to taste:

1 spent vanilla pod
basil
lemon/orange rind
nutmeg
ginger
green pepper
orange liqueur
orange cordial

Strain the fruit. Collect the syrup from the cans and add the agar. Bring to boil.

Heat the fruit and sugar in a large saucepan. Blend to purée. When boiling add agar and canned fruit syrup. Add flavoring.

Stir well and evaporate 20% of the solution. If desired, add some orange liqueur or orange cordial for extra bitterness. Pour into jam jars or ramekins and leave to set all night.

Variation: With 10 g of agar, you obtain a harder gel closer to a firm jam.

Note: Unless prepared for immediate consumption it is recommended to use a boiling water canner or a pressure canner to minimize the risk of bacterial and fungal growth.

<http://www.gastronomie.kalys.com>

Chocolate pudding

300 g cocoa (60%)
250 g whipped cream
200 g milk
1/2 vanilla pod
70 g egg yolk
50 g icing sugar
4 g agar (0.46%)

For citrus marmalade

1/2 lemon
1/2 lime
1/4 orange
150 g sugar
2 g agar (~ 0.5%)
50 g sugar
120 g water

Cut the chocolate into small pieces and melt it in a double boiler. Boil the cream, milk and vanilla. Once it boils, add the agar and cook for some minutes. Mix the egg yolks and the sugar and add it to the cream mixture. Add the melted chocolate as well and mix very well together. Pour in a bowl and let it rest in the fridge over night.

Citrus marmalade: cut the lemon, the lime and the orange (like for a fruit salad). Cook and add 150 g sugar. Let it cook until getting a coarse purée. Mix 50 g sugar and the agar in the water and heat to dissolve. Put it together with the fruits and cool to set.

<http://www.inicon.net>

Marshmallows with agar

160 g water
3.6 g agar (0.53%)
290 g sugar
230 g light corn syrup
4.4 g pure vanilla extract
pinch of salt
vegetable-oil cooking spray
corn starch

Sprinkle agar into 80 g cold water in bowl of mixer. Bring remaining water, sugar, corn syrup and salt to 114 °C in saucepan. Whisk agar mixture while slowly adding syrup in a steady stream down the side of the bowl. Gradually increase mixer to high. Beat until

mixture is thick, white and has almost tripled in volume (~ 12 minutes). Add vanilla (or other flavoring/food coloring) and beat 30 seconds more. Pour mixture into 30 x 40 cm rimmed baking sheet coated with cooking spray. Smooth with spatula sprayed with cooking oil. Let sit uncovered overnight. Cut out with knife or scissors sprayed with cooking oil. Roll marshmallows in corn starch to keep them from sticking to each other. Store in air tight container, with wax paper between layers.

<http://kanten-world.blogspot.com/2007/12/vegetarian-marshmallows>



Photo by sjschen (Green tea yokan)

Yokan

5 g agar (~0.8%)
2-300 g water
1-200 g sugar
150-300 g inverted sugar
0.2 g citric acid
flavor and color
azuki beans (enough to produce a hard gel)

Agar is dissolved in boiling water with sugar and inverted sugar and maintained at 106 °C for a few hours to reduce the volume. After brief cooling, the azuki bean purée previously prepared and the acid are added together with flavors and colorings. It is left to cool overnight at room temperature. This gel has a dried weight of 70–75%. It is placed in an oven at 55 °C as long as needed to reach a dry weight of 84–86% and is cut in small pieces that are first folded in an oblate (edible paper made of) and later in plastic.

T. Matsuhashi in CRC Handbook of hydrocolloids

Cold cod-fish salad with agar wrapping

For agar film:
100 g water

1 g agar (1.0 %)
1 g glycerol

For cold cod-fish salad:
assorted chopped salad
cod-fish
chick peas
red pepper
minced olives
parsley
oil
salt
vinegar

For agar film: dissolve agar in water. Bring to boil for 1 min on low heat. Remove from heat and leave to cool. When lukewarm, add glycerol. Mix well and pour over a plastic foil to obtain a thin film of agar which gels within minutes.

Once the film has gelled, a little bit of salad is added and is rolled in such a way that the film of agar and glycerol wraps the salad in a roll.

For cold cod-fish salad: chop cod-fish, red pepper, olives and parsley in small pieces and mixed with the chick peas. Next, oil, vinegar and salt are added. All should be mixed well and served on the plate together with the agar and glycerol roll garnishing previously prepared with salad.

Adapted from <http://www.inicon.net>



Photo by Martin Lersch

Soy sauce noodles with agar

40 g soy sauce
60 g water
1.1 g agar (1.1%)

Combine and heat to dissolve agar. Using a syringe, suck solution into a food grade PVC

tube (2 m x 2 mm i.d.) and leave to cool in ice water for 1 min. Blow noodle out of tube with an air filled syringe.

Martin Lersch

Balsamic vinegar pearls (cold oil technique)

180 g balsamic vinegar
2 g agar (1.1%)

Cool a tall glass with vegetable oil in the freezer for about 30 min. Combine and heat until agar is completely dissolved (>90 °C). Drip solution into cold vegetable oil. Collect pearls and rinse with water. Flat pearls indicate the oil is too cold or the glass not tall enough.

<http://www.molecule-r.com/en/content/126-balsamic-vinegar-pearls>

Battered baby squids with agar noodles

Noodles:

300 g white wine vinegar
200 g concentrated fish stock
100 g soy sauce
30 g squid ink
7 g agar (1.1%)

Garlic oil:

3 cloves garlic
250 g extra virgin olive oil

Battered baby squids:

tempura
500 g baby squids
sunflower oil

Noodles: Bring vinegar, fish stock, soy sauce and squid ink to boil. Add agar and leave boiling for 2 minutes. Cool mixture in a mold in the fridge. When cold, cut the mixture to flat noodles with a very sharp knife or with a special device for making noodles. You can also fill a suitably sized pvc tube using a syringe.

Garlic oil: Slice cloves and fry with the olive oil in a pan until light brown color.

Squid: From the baby squid only the tentacles will be used. Clean and salt the tentacles before dipping them in tempura and fry with generous hot oil. Strain.

Serve on spoons, the noodles at the bottom, dress with garlic oil and the baby squid on the top.

Adapted from <http://www.inicon.net>

Agar gel cubes

125 g orange juice (for color add some cordial or red food color)
1.3 g agar (1.0 %)

or

200 g strawberry cordial
500 g water
10 g agar (1.4 %)

or

80 g violet cordial
450 g water
8 g agar (1.5 %)

Bring the liquid(s) and agar to boil. Stir well. Pour into containers. Set aside 2 hours to cool down. Turn agar gel out and cut into cubes.

<http://www.gastronomie.kalys.com>

Hot foam of red fruits

250 g syrup or purée of red fruits/berries
3-4 g agar (1.2-1.6%)

Disperse agar in purée and bring to boil. Leave to set. Blitz with an immersion blender and heat to 70 °C (if agar melts, start over again). Sieve and transfer to an iSi whipper designed for use with hot preparations, charge with nitrous oxide and dispense while still hot. This yields a hot, stable, fluid foam. Keep whipper in a warm bath to avoid blocking of the nozzle.

<http://www.chefsimon.com>

Orange marmalade

1000 g fresh orange juice
14 g agar (1.3%)
65 g honey
vanilla
peel from 3 oranges

Peel oranges carefully (leaving the white behind) and slice thinly. Boil the peel with vanilla, honey and orange juice and reduce to 750 mL. Add agar to the boiling juice. Fill jars or glasses.

Henrik Schellhoss via <http://kochmuetzen.net>

Agar drink with lime

Agar jelly
25 g agar (1.5 %)
1200 g water
480 g sugar
food coloring

Syrup

150 g rock sugar
4 pandan leaves

Drink

freshly squeezed lime juice
ice water
ice cubes

For agar jelly: Put agar, water and sugar in a pot. Mix well and bring to a boil. Once it reaches boiling point, lower heat and simmer for about 15 minutes till the mixture is somewhat clear. Add coloring and stir well. Put into a mold and set in the fridge. When it is set, grate it finely.

For syrup: Put sugar, pandan leaves or pandan essence and water into a pot. Bring to a boil and lower heat. Simmer for another 15 minutes until sugar has melted and the syrup has thickened slightly.

Put into a tall glass some grated agar, syrup, lime juice and top up with ice cubes and ice water.

<http://www.recipezaar.com/147596>

Agar Tobiko (cold oil technique)

Agar mixture

1.5 g agar (1.5%)
50 g water
100 g reduced vinegar + simple syrup

Setting bath

1 g mono-/diglycerides ("glycerin flakes", 2% of oil)
50 g lemon oil

Setting bath: Add glycerin flakes to lemon oil and heat in a medium-size bowl to above 60°C to dissolve, stirring occasionally.

Agar mixture: Stir agar into cold water to disperse. Bring mixture to a boil while stirring and continue boiling until agar is dissolved. Stir boiling, sweetened vinegar mixture into boiling agar mixture. Bring combined mixture back to a boil.

Making beads: Whisk mono & diglyceride oil mixture rapidly while drizzling in vinegar mixture to emulsify. Allow mixture to cool in bowl under observation, occasionally tilting bowl side-to-side to check size of agar beads. If beads are too big, whisk more. However, over-whisking will create beads that are too fine. When agar beads reach the desired tobiko size, quickly pour out mixture into a hotel pan over ice in a thin layer to set agar as quickly as possible. When agar beads are set, place tobiko mixture in a fine chinois and rinse quickly under hot water. Gently drain and dry with paper towels.

Dave Arnold via
<http://cookingissues.wordpress.com/2009/05/18/agar-tobiko/>

Sweet potato jelly

200 g sweet potatoes, diced
200 g coconut milk
20 g agar (1.6 %)
100 g sugar
750 g water
1 pinch salt
2 screwpine leaves, knotted (pandan)
or 2.5 g pandan extract

Steam sweet potatoes until soft. Combine the sweet potatoes and coconut milk in a blender. Strain mixture through a fine sieve. Combine agar powder, sugar, water and pandan leaves in a saucepan and bring to a boil until agar dissolves. Stir in puréed sweet potato and coconut mixture and simmer over low heat. Add a pinch of salt and pour the jelly mixture into a wet tray or mold. Leave aside at room temperature to set, then chill well before cutting into desired shapes.

<http://www.recipezaar.com/92942>

Parmesan spaghetti

200 g fond/stock (not too salt)
100 g parmesan, grated
5 g agar (1.7%)

Stir parmesan into boiling fond. After one hour filter through chinois and store over night in fridge. Filter again if necessary. Bring filtrate to boil while adding agar and stirring constantly.

For thick spaghettis: close one end of drinking straw (diameter ~ 5 mm) and fill with parmesan mix.

For thin spaghettis: fill a suitable plastic tube (typically 2 m length, 2-3 mm diameter) with the mix using a syringe. Immerse the filled tube into ice water for 2-3 minutes. Fill the syringe with air to blow out the spaghetti.

Adapted from Henrik Schellhoss via <http://kochmuetzen.net>

Vinaigrette sheets

100 g rice vinegar
50 g sugar
300 g spring water
1 g salt
16 g agar (2.6%)
150 g olive oil

Bring vinegar, water, sugar and salt to a boil. Add agar and stir until dissolved. Remove from heat and add olive oil while mixing with an immersion blender. Spread the mixture on a silpat or a baking sheet to a thickness of about 1 mm. Let cool and cut to desired shapes.

Pierre Gagnaire via <http://www.pierre-gagnaire.com>

Chocolate flavored doughnut icing

64 % sugar
12 % water
9 % alkalized cocoa powder
9 % vegetable shortening
3 % agar (cold soluble)
3 % skimmed milk powder

Blend all dry ingredients. Slowly add dry ingredients to stirred water at 50 °C. Blend until smooth. Yields a soft icing with minimal flow suitable for doughnuts.

<http://www.cybercolloids.net>

Further recipes with agar can be found in the section “Multi-hydrocolloid recipes” on page 93.



Carrageenan

Tips and tricks

- Used at low levels (0.025-0.035%) iota carrageenan provides a rich mouth feel to milk based drinks.
- The shear thinning property of iota carrageenan gives a certain "melt-in-mouth" feeling
- If used for products with pH < 4.3 carrageenan should be added immediately before cooling to avoid excessive hydrolysis with resulting loss of gel strength/viscosity
- Iota and kappa carrageenan can be used for normal and reversed spherification in combination with calcium and potassium salts respectively

Name	<i>carrageenan (E407) iota type</i>	<i>carrageenan (E407) kappa type</i>
Origin	polysaccharide obtained from red seaweed	polysaccharide obtained from red seaweed.
Properties, texture	thermoreversible, soft, shear-thinning, elastic gel with calcium	thermoreversible, firm, brittle gel with potassium
Clarity		clear/slightly turbid
Dispersion	cold water, dispersion is improved by mixing with sugar (3-5x) or small amounts of alcohol	cold water, dispersion is improved by mixing with sugar (3-5x) or small amounts of alcohol
Hydration (dissolution)	> 70 °C; for high sugar concentrations: add sugar after hydration.	> 70 °C
pH	4-10	4-10
Setting	40-70 °C (0.2-0.8%), higher temp. with increasing electrolyte conc., setting t. incr. w/locust bean gum	30-60 °C (0.2-0.8%), higher temp. with increasing electrolyte conc.
Melting	5-10 °C above setting temperature (unless mixed with starch)	10-20 °C above setting temperature (unless mixed with certain proteins)
Promoter	calcium yields soft and elastic gels, potassium and sodium also promote gelling	potassium, milk protein, calcium
Inhibitor	hydrolysis of solution at low pH with prolonged heating; gels are stable	salts; hydrolysis of solution at low pH with prolonged heating; gels are stable
Tolerates	salt	
Viscosity of solution	medium	low
Typical conc.	1-1.5% for gel; [0.02-1.5%]*	1.5% for gel; [0.02-1.5%]*
Synergies	starch	locust bean gum (increased elasticity, improves clarity, reduced syneresis), konjac, tara, milk protein
Syneresis	no	yes

* Concentrations in [square brackets] show range exemplified in this collection.

Frappuccino

Unflavored mix

1000 g milk
0.5 g carrageenan (0.04%, 0.02% in drink)
125 g sugar
115 g nonfat powdered milk

For Frappuccino

200 g unflavored mix
200 g ice
30 g ground chocolate (Ghirardelli or similar)
1 espresso shot

Unflavored mix: Mix ingredients in blender, at least one day ahead. Chill.

Frappuccino: Pour unflavored mix into blender. Add ground chocolate and a single shot of chilled espresso. Add ice, blend until smooth, and pour into cup.

JR at <http://www.coffeegeek.com>

Pineapple gel

250 g pineapple juice
0.3 g iota carrageenan (0.12%)

Mix the pineapple juice with iota carrageenan and pour into a saucepan. Bring to a boil and allow to gel in the refrigerator.

<http://www.texturaselbuli.com>

Frappuccino

500 g ice
60-120 g espresso
150 g milk
1 g carrageenan (~0.13%)
chocolate syrup to taste
sugar to taste

Blend the espresso, chocolate and milk on low speed, then add carrageenan gingerly, but quick. Then add all the ice right away, and blend on high for about 30 seconds to a minute. Substitute some of the milk with heavy cream if desired.

CoffeeKid at <http://www.coffeegeek.com>

Celery pudding

530 g celery juice
56 g skim milk powder
1.5-1.8 g iota carrageenan (0.25-0.3%)
salt to taste

Combine all ingredients in bowl and combine with immersion blender. Transfer to saucepan and heat to 82 °C. Divide mixture among eight rocks glasses and refrigerate until pudding is set. Cover and keep refrigerated until 15 minutes before serving.

Wylie Dufresne via *Art Culinaire*, Spring 2006

Chocolate foam, chantilly and dessert

3.5 g carrageenan (0.28%)
600 g water
200 g melted chocolate
400 g dairy cream
50 g sugar
1 t instant coffee

Heat all ingredients to minimum 80 °C a few minutes.

Gel: Leave to set. A gel will form.

Fluid gel: Beat the gel into a smooth thick solution. Serve chilled or heated as a hot sauce.

Foam: Pour fluid gel into a heat resistant whipper and charge with nitrous oxide. Shake well. Dispense onto a plate as decoration or onto a hot cocoa or coffee drink. Serve hot or cold.

Alternative preparation: Melt chocolate in a double boiler. Whisk cream and sugar and fold into chocolate. Heat water to boiling point and add carrageenan while stirring. Add the chocolate and cream mix using blender. Add flavoring to taste (amaretto, cordial, instant coffee, liqueur or nuts). Pour hot into ramekins or a large dish. Leave to cool down a few hours. Serve room tempered or chilled. Variation: Blitz this chocolate flan into a rich unctuous cream (add chunky flavoring after this step i.e. nuts, agar drops, sodium alginate pearls, pieces of fruit...)

<http://www.gastronomie.kalys.com>

Milk gel

200 g milk
0.6 g iota carrageenan (0.3%)

Mix the milk with the iota carrageenan and blend with a hand-held mixer until completely dissolved. Pour into a saucepan, heat to 80 °C and allow to gel in the refrigerator.

<http://www.texturaselbuli.com>



Photo by Scott Heimendinger, seattlefoodgeek.com

Cryopoached coconut meringue

387 g coconut milk
67 g sugar
2 g vanilla extract
4 g lime juice
2 g iota carrageenan (0.4%)

Combine ingredients in whipping siphon, close and shake well. Charge twice with nitrous oxide. To serve, dispense meringue onto a spoon and drop it into liquid nitrogen. Turn constantly until evenly frozen on the outside, but still soft on the inside (about 20 seconds).

Scott Heimendinger and Jeth Rollins Odom via
<http://seattlefoodgeek.com/2011/12/cryopoached-coconut-meringue-with-powdered-strawberry/>

Basic foam with carrageenan

1 g iota carrageenan (0.5%)
2 g emulsifier (milk/plant protein, e.g. lecithin)
200 g liquid (e.g. dairy based)

Disperse carrageenan and emulsifier into cold liquid. Allow some time for hydration. Whisk at high speed or dispense from whipper charged with nitrous oxide to make foam.

<http://www.inicon.net>

Fruit-flavored water dessert jelly

sugar 15–20%
carrageenan (kappa/iota blend) 0.60–0.90%
potassium citrate 0.20–0.35%
citric acid 0.30–0.45%
color
flavor
water to 100%

Mix ingredients. Heat. Cool to set.

CRC Handbook of hydrocolloids

Beer gel

200 g white ale
50 g sugar
50 g glucose
0.25 g potassium citrate (0.08%)
2.0 g kappa carrageenan (0.67%)

In a blender combine ale, sugar, glucose, potassium citrate and carrageenan. Blend on high speed for 3 min. Transfer to medium saucepan and bring to a boil. Pour onto a sheet tray lined with plastic wrap. Leave in fridge for 1 hour or until set.

Grant Achatz in Alinea

Gelatinated cucumbers in bloom

20 cucumbers in bloom
100 g brine from pickled gherkins
0.75 g kappa carrageenan (0.75%)

Wash the cucumbers in bloom and refrigerate. Combine 100 g of brine from pickled gherkins with the kappa carrageenan in a saucepan. Bring to a boil. Dip the cucumbers twice in the warm mixture and refrigerate.

<http://www.texturasebulli.com>

Spaghetti with spinach pesto

160 g water
40 g olive oil
60 g fresh leaf spinach
2 g kappa carrageenan (0.74%)
1 clove garlic
4 g sugar
salt and pepper to taste

Disperse carrageenan in water and boil 2 min. Mix with remaining ingredients and puree. Let cool 5 min. Fill syringe, attach silicone tube and fill tube with spinach mixture. Leave to gel in ice cold water for 5-15 min. Fill syringe with water and eject spaghetti from tube.

<http://fr.gastronomie.kalys.com/recettes/spaghetti-pesto-epinard.html>

Maple coating

210 g maple syrup
30 g water
2 g kappa carrageenan (0.82%)

Combine and bring to boil. Dip fruit in coating, refrigerate for an hour and serve.

<http://www.molecule-r.com/en/content/82-maple-coating>

Ginger film and fluid gel

1000 g water
125 g sugar
30 g ginger, microplaned
1 g long pepper, microplaned

1 vanilla bean
10.4 g kappa carrageenan (0.89%)

Combine, bring to boil and ensure everything is properly dissolved. Infuse for 30 min. Strain solids.

Film: Pour 250 g of mix onto acetate lined tray. Allow to cool. Use as wrapping/draping as desired.

Fluid gel: Allow gel to set at room temperature. Dice and puree with blender. Reserve at ambient temperature. If gel re-sets, blend again.

<http://www.willpowder.net/gingerFilm.html>

Peanut butter panna cotta

540 g milk
300 g peanut butter
10 g vanilla extract
210 g white sugar
10 g salt
9.6 g iota carrageenan (0.9%)

Mix all the ingredients in a blender except for the peanut butter and carrageenan. Sprinkle carrageenan into the vortex to disperse. Pour into a sauce pan and bring to boil. Whisk in peanut butter and when thoroughly combined pour into desired cups or molds. Let cool and leave to set in fridge.

<http://chefb.blogspot.com/2008/09/not-beyond-our-limits.html>

Dill custard

100 g dill, pick fronds, discard stems
1500 g heavy cream
12 g salt
18 g simple syrup
15 g iota carrageenan (0.91%)

Bring cream, salt and syrup to a simmer. Transfer to blender, add dill and blend on high speed for 90 s. Pass through chinois twice, first with pressing on the solids, then without pressing. In a medium saucepan, combine liquid and carrageenan. Disperse with an immersion blender for 1 min. Bring to boil and blend for another 2 min. Remove from heat and rest pan in ice water to cool.

Grant Achatz in Alinea

Cake glaze

98.8% fruit juice
1.0% kappa carrageenan (1.0%)
0.2% potassium citrate

Mix buffer and carrageenan in hot fruit juice, stir until dissolved. Pour while hot. Do not move while setting.

<http://www.cybercolloids.net>

Kefir custard

375 g kefir
375 g heavy cream
7 g salt
100 g sugar
10 g calcium lactate (1.1%)
9 g iota carrageenan (1.0%)

Gently warm kefir, cream, salt and sugar over medium heat. When mixture is warm, add calcium lactate and carrageenan, increase heat, bring to simmer and disperse the hydrocolloid with an immersion blender. Continue blending for another 2 min when mixture comes to a boil. Remove from heat, strain and pour into a pan lined with plastic wrap. Let cool at room temperature until set. Cut into squares and cover with plastic wrap and refrigerate until serving.

Grant Achatz in Alinea

Basic gel recipe with iota carrageenan

1-1.5 g kappa carrageenan (1-1.5%)
100 g milk

Disperse carrageenan in cold milk with hand held mixer. Bring to boil and pour solution into desired form/mold. Cool.

<http://www.inicon.net>

Spherification with iota carrageenan

3 g iota carrageenan (1-1.5%)
100 g water (or flavored liquid)

Setting bath
5 g calcium lactate
100 g water

Disperse carrageenan in cold water with hand held mixer. Allow to hydrate in refrigerator overnight. Drip or pour with a spoon into the calcium solution. Leave until set. Remove and rinse.

<http://www.inicon.net>

Basic gel recipe with kappa carrageenan

1.5 g kappa carrageenan (1.5%)
100 g water (or flavored liquid)

Disperse carrageenan in cold water with hand held mixer. Bring to boil and pour solution into desired form/mold. Cool.

<http://www.inicon.net>

Spherification with kappa carrageenan

1.5 g kappa carrageenan (1.5%)
100 g water (or flavored liquid)

Setting bath

5 g potassium phosphate (5%)
100 mL

Disperse carrageenan in cold water with hand held mixer. Allow to hydrate in refrigerator over night. Drip or pour with a spoon into the potassium solution. Leave until set. Remove and rinse.

<http://www.inicon.net>

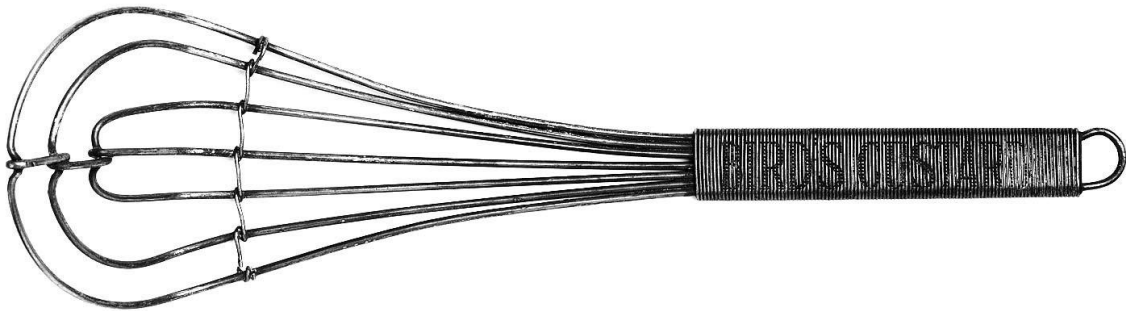
Porcini amber

5 fresh porcini
200 g porcini stock
3 g kappa carrageenan (1.5%)

Slice the porcini to a thickness of 0.3 cm. Mix the stock with the kappa carrageenan and bring to a boil until dissolved. Dip a porcini slice into the mixture and place on a flat tray. Repeat with the rest of the slices.

<http://www.texturaselbulli.com>

Further recipes with carrageenan can be found in the section “Multi-hydrocolloid recipes” on page 93 .



Cornstarch

Tips and tricks

- Cornstarch has about twice the thickening power of flour.

Name	cornstarch
Origin	polysaccharide extracted from maize/corn
Properties, texture	thermoirreversible thickener
Clarity	opaque
Dispersion	cold water
Hydration (dissolution)	62-72 °C
pH	
Setting	thickens when heated > 70 °C
Melting	
Promoter	
Inhibitor	pH around 2-3 lowers viscosity
Tolerates	
Viscosity of solution	high once fully hydrated
Typical conc.	[0.4-10.4%]*
Synergies	
Syneresis	

* Concentrations in [square brackets] show range exemplified in this collection.

Soft meringue for pie filling

Cornstarch gel

10 g cornstarch (0.4-0.8% in final preparation)
80 g water

Meringue

6 egg whites (~210 g)
30 g water
140 g sugar
2-3 g cream of tartar

Stir cornstarch into 80 g cold water. Heat to form a thick gel. Beat egg whites with 30 g water and cream of tartar. Once soft peaks form, add sugar a little at a time. Then add 1-2 T of cornstarch gel. It prevents the meringue from shrinking, beading and weeping. Use meringue for pie filling.

Shirley O'Corrher in Cookwise

John Nott's wine chocolate

350 g port wine
60 g bittersweet chocolate, grated
65 g sugar (or to taste)
3.2 g cornstarch (0.67%)

Put all the ingredients into a heavy saucepan and heat well. Bring to a boil, beating constantly. Then serve in 4 cups or mugs, that have been warmed.

<http://www.recipezaar.com/262183>

Vanilla sauce (No-egg custard)

800 g milk
20 g cornstarch (2.3%)
25 g sugar
10 g vanilla sugar or 5 g vanilla essence

Mix everything while cold in a pan. Bring to boil a simmer for 2-3 min while stirring. Cool and serve.

<http://krydder.org/2007/11/23/vaniljesaus-uten-egg/>

Grapefruit soufflés

250 g grapefruit juice (or lemon/lime/orange)
rind of 1/2 grapefruit, finely minced
100 g sugar
15 g cornstarch (3.2%)
30 g water
2 egg whites (~70 g)

Combine juice, 50 g sugar and rind in a small saucepan over medium-low heat. Simmer until juice is reduced to 150 mL. Strain out rind pieces. Mix starch and water together. Whisk starch mixture into hot juice and continue to whisk over low heat until juice is substantially thickened. Remove from heat and immerse pan into a cool water bath. Whisk until the juice mixture is cold, about 3 minutes. Set aside. Whip egg whites until soft peaks form. Add 50 g sugar and continue whipping until firm peaks form. Fold egg whites into grapefruit mixture in two batches. Divide between 6 soufflé cups and bake at 180 °C for 15 min or until puffed and browned.

It is possible to bake the soufflés in the spent grapefruit halves: Use a grapefruit spoon to clean any remaining pulp and membrane from the inside of 6 grapefruit halves. Dust the inside of the pith with sugar. Fill and bake as above.

*Australian Gourmet Traveller, March 2006 via
http://gorgeoustown.typepad.com/lex_culinaria*

Cornstarch ice cream

600 g cream, half-and-half or milk
100 g sugar
pinch of salt
1 vanilla bean or 4.4 g vanilla extract
30 g cornstarch (4.1%)

Flavorings (use one of the following)

- Substitute honey for half the sugar. Add 120 g good jam to mixture before freezing.
- Substitute buttermilk or yogurt for half the cream or milk.
- Add 240 mL halved, pitted cherries just before freezing.

- Add 240 mL hulled, sliced strawberries, blueberries, or peeled and chopped peaches before freezing.
- 120 g very strong coffee for 120 g cream or milk.
- 240 g coconut milk for 240 g cream or milk; add 120 mL toasted dried coconut if you like.
- Add 120 mL minced mint and 120 mL chopped dark chocolate just before freezing.

Bring 500 g of cream/milk mix, sugar, vanilla seeds/bean (if using) and salt to boil. Let it simmer for some minutes and remove from heat. In a bowl, add remaining cream/milk mix a little by little to the cornstarch while stirring to avoid formation of lumps. Add cornstarch mixture to pot and remove vanilla pod. Cook, stirring, until it starts to thicken and barely reaches a boil, about 5 minutes. Immediately reduce heat to very low and stir for 5 minutes or so until thick. Stir in vanilla extract, if using. If mixture has lumps, strain it into a bowl. Chill until cool, a couple of hours (you can skip this step if you have a machine with a built-in freezer). When cool or if there are no lumps, pour into an ice cream machine and freeze according to the manufacturer's instructions.

<http://www.nytimes.com/2007/08/01/dining/01mrex.html>

Halva balls with feta cheese and pistachio

1 kg feta cheese
400 g water
80 g cornstarch (4.4%)
325 g sugar

200 g crumbled pistachios

Put the feta cheese in cold water to get soft. Then, filter very well and crumble with a fork. Dissolve the corn starch in a cup of water. Bring to boil the remaining water and the sugar. Add the corn starch with the water and let it cook over low fire for 10 minutes. After that time, add the cheese and go on cooking for 15 minutes more. While the halva is still warm, take small portions in the amount of a walnut and make balls with your hands. Sprinkle the halva balls with crumbled pistachios. Serve warm or cold.

<http://turkishanddelicious.blogspot.com>

Chocolate Cornstarch Pudding

100 g sugar
20 g unsweetened cocoa powder
40 g cornstarch (4.8%)
pinch of salt
650 g milk
25 g margarine or butter
5 g vanilla extract

In a saucepan, stir together sugar, cocoa, cornstarch and salt. Place over medium heat, and stir in milk. Bring to a boil, and cook, stirring constantly, until mixture thickens enough to coat the back of a metal spoon. Remove from heat, and stir in margarine and vanilla. Let cool briefly, and serve warm, or chill in refrigerator until serving.

Kelly Powers via <http://allrecipes.com>

Vanilla pudding

12 g cornstarch (4.8%)
200 g milk
30 g sugar
0.5 g vanilla sugar
8 g butter

Stir cornstarch into 20 g of milk. Stir sugar and vanillin sugar into remaining milk and bring to boil. Remove from heat and stir cornstarch mixture into hot milk. Return to heat for a quick boil while constantly stirring. Remove from heat and stir butter into pudding mixture. Pour into suitable serving dish and leave to set, either at room temperature or in the fridge.

Martin Lersch

Pastry crème

1 vanilla bean, split and scraped
240 g whole milk
120 g heavy or whipping cream
65 g sugar
salt
30 g cornstarch (5.4%)
5 large egg yolks (~100 g)

Heat milk, cream and vanilla. Mix sugar, cornstarch and a pinch of salt in another pan. Pour hot milk into sugar mixture, whisking constantly. Heat until the mixture thickens. Add 60 g of the hot mixture to the egg yolks. Then add the egg mix to the remaining milk. Heat and stir until the custard becomes thick and smooth. The cornstarch prevents the egg yolks from curdling.

Shirley O'Corriher

Perfect pastry cream

920 g milk
200 g sugar
80 g milk (room temp)
80 g cornstarch (5.4%)
200 g egg yolks (room temp)

Bring milk and sugar to boil. In the meantime, mix cornstarch with remaining milk to form paste. Add egg yolks and mix until smooth. Pass through fine mesh sieve into a bowl large enough to hold all ingredients. When the milk/sugar mixture reaches a rolling boil (the pot should be tall to avoid spill over) pour the boiling mixture in one go into the cornstarch/egg yolk mixture while stirring as quickly as possible. The recipe should not be scaled down as the greater relative heat loss will prevent the cornstarch and egg yolk to set properly.

*Lai Badal and Pere Castells, Alicia Foundation via Francisco Migoya,
<http://www.thequenelle.com/2009/12/perfect-pastry-cream.html>*

Liquorice candy

125 g all purpose flour
75 g cornstarch (~7.2%)
120 mL wheat gluten
1 1/2 T powdered licorice root
1 1/2 T powdered star anise
700 g molasses

In a 2 L microwave pot, mix all dry ingredients. Mix in molasses and mix thoroughly with a plastic spoon until mixture is smooth. Place mixture in microwave oven and cook for 1.5 minutes. Stop oven and stir mixture. Repeat cook/stir cycle (8 times) for a total cooking time of 13.5 minutes in the microwave oven. Remove pot from oven. Pour liquorice on Teflon cookie sheet. While warm, press licorice to a patty about 1-1.5 cm thick. Allow to cool. Use a plastic knife to cut into strips, then roll into sticks. Sticks may be cut into bite-sized pieces with scissors.

*Ken Heintz and Peter D'Souza via
<http://www.uwstout.edu/chd/rendezvous/Licorice%20Candy.htm>*

Gluten free flour mix

200 g superfine brown rice flour
150 g sorghum flour
50 g potato flour
250 g sweet rice flour
150 g potato starch
100 g arrowroot powder
100 g cornstarch (10%)

Mix and use as normal flour.

<http://glutenfreegirl.com/2010/12/gluten-free-holiday-baking-2010/>

Turkish delight

1000 g water
900 g sugar
225 g cornstarch (~10.4%)
20 g rosewater
10 g lemon juice
6.5 g cream of tartar
red food coloring (optional)

For coating

60 g cornstarch
225 g icing sugar

Place the sugar, 250 g water, and lemon juice in a heavy saucepan over medium heat. Stir until the sugar dissolves and the mixture boils. Reduce the heat and simmer gently, without stirring, until the mixture reaches the soft-ball stage 114 – 118 °C. Remove the saucepan from the heat.

In a second large heavy saucepan over medium heat, stir together cornstarch and the cream of tartar. Gradually stir in the remaining water until no lumps remain. Stir constantly, until the mixture boils and forms a thick, gluey paste.

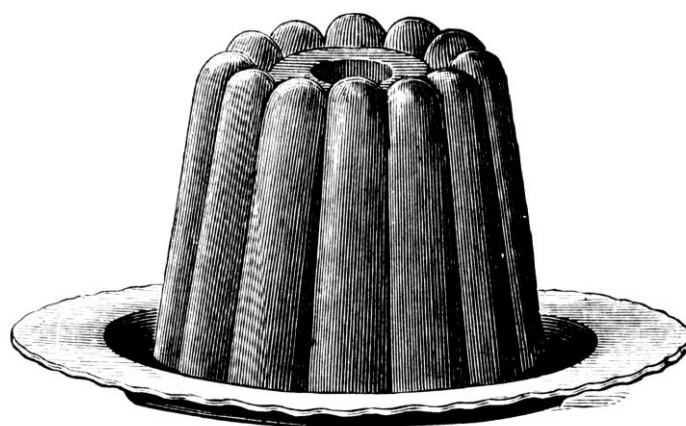
Slowly pour the hot sugar syrup into the cornstarch mixture, stirring constantly. Reduce the heat and simmer, stirring often, to prevent sticking, for about 1 hour, or until the mixture has become a pale golden color. Stir in the rosewater and add food coloring (if used).

Pour the mixture into the prepared baking tin and spread evenly. Cool to room temperature, uncovered, allow to stand overnight to set. Sift the icing sugar and a little cornflour onto a large cutting board. Turn out and cut into 2.5 cm squares with an oiled knife. Roll pieces in the icing sugar mixture to coat well.

Store in an airtight container with sheets of waxed paper, dusted with the sugar mixture, separating every layer. Makes approx.80 pieces.

<http://thefoody.com/sweets/turkishdelight.html>

Further recipes with cornstarch can be found in the section “Multi-hydrocolloid recipes” on page 93.



Gelatin

Tips and tricks

- If using sheets, bloom gelatin in water, squeeze out water and dissolve in desired liquid. If using powder, bloom and dissolve gelatin in the same liquid.
- When making sorbets, try substituting agar, locust bean gum, pectin or gellan for gelatin.
- In ice cream addition of 0.25% gelatin inhibits crystallization of ice and sugar
- Heat stable gelatin gels and foams can be made by addition of transglutaminase which catalyses crosslinking of proteins.
- Gelatin comes with different bloom strengths (= different gelling strength). The size of sheets is normally scaled so as to compensate for this.

Name	Bloom strength	g/sheet
Bronze	125-155	3.3
Silver	160	2.5
Gold	190-220	2.0
Platinum	235-265	1.7

- The following formula (see comments in appendix) can be used for conversion between gelatin A and B with different bloom strengths

$$\text{massB} = \text{massA} \times \frac{\text{bloomstrengthA}}{\text{bloomstrengthB}}$$

- Unless otherwise stated all recipes give the amount of gelatin in grams (platinum type, 240 bloom) and sheets.
- Gelatin of unknown bloom strength is indicated with *
- If a foam/espuma from an iSi whipper is too runny, charge it with an additional

cream charger (but never use more than 2/3 chargers in total, depending on the size of your whipper). The higher pressure will create smaller bubbles and hence a more stable foam.

Name	gelatin (E441)
Origin	protein obtained from collagen in animals
Properties, texture	thermoreversible, soft, elastic gel; melts in mouth
Clarity	clear, transparent
Dispersion	bloom in cold water.
Hydration (dissolution)	~50 °C
pH	4-10 (weaker gels for pH <5 and >9)
Setting	< 15 °C, slow (hours)
Melting	25-40 °C
Promoter	transglutaminase (1-3%), milk, sugar, low alcohol conc., low salt conc.
Inhibitor	salts; acids; prolonged heating; proteases in fresh kiwi, papaya, pineapple, peach, mango, guava, fig, ginger; high alcohol conc.; tannins can cause precipitation;
Tolerates	alcohol up to ~40%
Viscosity of solution	low
Typical conc.	0.5-1.5% for espumas; 0.6-1.7% for gels; [0.12-7.9%]*
Synergies	
Syneresis	

* Concentrations in [square brackets] show range exemplified in this collection.

Rhubarb strawberry sorbet

250 g water
300 g sugar
500 g rhubarb, peeled and sliced
100 g strawberries
1.7 g gelatin; 1 sheet (0.12%)
seeds from ½ vanilla pod
300 g champagne

Mix water and sugar, boil and skim. Add rhubarb, strawberries and vanilla. Stir in bloomed gelatin and cool. Blend in a food processor or blender until smooth. Stir in the champagne and freeze in ice cream maker.

Bo Jensen via <http://aftenbladet.no>

Key lime cloud

300 g key lime juice
300 g water
300 g sugar
1.1 g gelatin; 2/3 sheet (0.12%)
50 g egg white powder *

* 1 egg white equals approximately 5 g egg white powder + 30 g water

Bring 150 g water and all sugar to a boil. Mix rest water with egg white powder to hydrate. Dissolve bloomed gelatin in syrup, cool to 45-50 °C, mix with lime juice, then rehydrated egg whites. Strain, chill to 4 °C, then mount until fluffy.

<http://willpowder.net>



Photo by Martin Lersch

Beer sorbet

150 g water
140 g sugar
0.85 g gelatin (1/2 sheet, 0.14%)
10 g balsamic vinegar

300 g beer (pilsner type, 4.5% alcohol)

Bring water and sugar to boil and stir until sugar has dissolved. Remove from heat, add bloomed gelatin. Add beer and vinegar. Cool and freeze. If freezing without an ice cream maker, mix well once frozen and freeze again.

Martin Lersch in <http://blog.khymos.org/2009/01/31/tgrwt-14-beer-sorbet-with-soy-marinated-melon/>

Tzatziki ice cream

450 g cucumber
2 g gelatin*, powdered (0.19%)
500 g greek style yoghurt
50 g sugar
15 g salt
garlic and pepper to taste

Grind cucumber in blender. Dissolve gelatin in small amount of cucumber juice by gentle heating (unless a cold water soluble gelatin is used). Add to main batch. Blend in yoghurt, sugar and salt. Add garlic and pepper to taste, considering that flavors are less intense when frozen. Cool. Freeze in ice cream maker.

*Elke Scholten and Miriam Peters in *The Kitchen as Laboratory**

Cranberry ginger sorbet

450 g cranberries
470 g boiling water
4.5 g gelatin; ~2½ sheets (0.25%)
60 g cold water
380 g sugar
470 g ginger ale

Combine cranberries and boiling water. Cook for 15 minutes in a covered pan. Mash through strainer. Bloom gelatin in cold water and add to strained cranberries. Add sugar and stir until dissolved. Cool. Add ginger ale and freeze to a mushy consistency. Beat with food processor or electric mixer. Re-freeze until firm.

<http://www.cooks.com>

Citrus foam

375 g orange juice
25 g sugar
375 g heavy cream
1/2 lemon, juiced
2.5 g gelatin; 1½ sheets (0.42%)

Combine orange juice and sugar and reduce over medium heat by half. Add the juice of half a lemon. Bloom gelatin in cold water until soft, about 5 minutes, then squeeze gently to remove excess water and add to warm juice reduction. Add juice to heavy cream and strain through a chinois. Fill 0.5 L whipper and

charge 1-2 times with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

http://www.isinorthamerica.com/recipe/print/print_17.html

Fruit espuma

250 g fruit purée (raspberry, strawberry, passion fruit, etc.)
65 g corn syrup
60 g water
1.7 g gelatin; 1 sheet (0.45%)

Pass fruit purée through a sieve or chinois to remove fruit chunks and seeds. It is very important that the purée be as smooth as possible. Combine purée, water (eliminate if you use juice) and corn syrup in a sauce pan. Over low heat, gently heat fruit mixture until warm and add your gelatin. Remove from heat and stir until gelatin is dissolved. Pour fruit purée into an 0.5 L whipper making sure not to fill it more than halfway. Charge with nitrous oxide. Chill for about 1 hour, and shake well before using.

Ferran Adria via <http://fooddownunder.com>

Clear liquid by gelatin filtration

1000 g cloudy liquid or purée
5 g gelatin; ~3 sheets (0.5%)

Strain liquid to remove particles. Bring to simmer. Add bloomed gelatin. Let cool and freeze. Line a strainer with a cheese cloth or a coffee filter and place the strainer over a bowl. Place the frozen block in the strainer and allow 1-2 days for the clear liquid to drain out of the gelatin network.

Tip: Agar can also be used. See p. 10.

Adapted from Gerd Klöck



Photo by Martin Lersch

Coffee espuma with garlic and chocolate

4 cloves of garlic, baked
350 g strong coffee
30 g sugar
40 g chocolate (70% cocoa)
ground cardamom
3.4 g gelatin; 2 sheets (~0.58%)
150 g heavy cream (38% fat)

Bake garlic cloves whole for 30 min at 150 °C. Mix garlic cloves and coffee with blender or hand-held mixer. Add chocolate, a pinch of cardamom and heat while dissolving sugar. Stir in bloomed gelatin. Cool, add heavy cream, sift through fine mesh to remove remaining pieces of garlic and fill 0.5 L iSi gourmet whipper. Charge with 1 cream charger and leave in fridge over night. Serve with a drizzle of instant coffee.

Flavour: The first aroma noticed is coffee accompanied by a sweet taste on the tongue. This is followed by a faint chocolate aroma which then gives way for an aftertaste dominated by garlic. It's quite surprising and the aromas blend well together.

Martin Lersch, <http://blog.khymos.org/2007/04/22/>

Gazpacho sorbet

4.5 g gelatin* (~0.6 %)
15 g hot water
1 garlic clove
2.5 g salt
450 g ripe tomatoes, cored and quartered
1/2 large red bell pepper, coarsely chopped
40 g coarsely chopped sweet onion
1 piece Kirby cucumber, peeled and quartered
30 g Sherry vinegar
15 g orujo, grappa, or aquavit

6 g sugar
30 g mild extra-virgin olive oil

Soften gelatin in hot water 1 minute. Mash garlic to a paste with salt using a mortar and pestle (or mince and mash with a large knife). Blend garlic paste, tomatoes, bell pepper, onion, cucumber, vinegar, orujo, and sugar in a food processor until as smooth as possible. Add oil and gelatin mixture with motor running, then force purée through a sieve into a bowl, pressing firmly on solids. Discard solids. Chill until cold, about 1 hour, then freeze in ice cream maker. Transfer sorbet to an airtight container and put in freezer to harden.

Sergio López Domínguez via <http://www.epicurious.com>

Asparagus espuma

1000 g peeled white asparagus
8.5 g gelatin; 5 sheets (0.6% of final comp.)
salt
sugar
1 lemon
100 g heavy cream (33%)

Boil the asparagus in salt water with the sugar and a slice of lemon until done. Purée the asparagus with 300 g of asparagus juices in a mixer, and pass through a fine sieve. Season to taste. Soak gelatin in cold water. Heat 100 g of the asparagus purée to a temperature of 60 °C, stir in the pressed out gelatin, then add in the remaining mixture. Allow to cool thoroughly and stir in the cream. Pour into the 1 L whipper, charge with nitrous oxide, shake and leave to cool in fridge. The resulting consistency is firm and creamy.

Tip: To make a green asparagus Espuma, simply replace some of the white asparagus with blanched and puréed spinach.

iSi North America via <http://www.prairiemoon.biz>

Mango espuma

375 g ripe mangoes
50 g sugar
3.4 g gelatin; 2 sheets (0.62%)
125 g orange juice
(add rum to taste if desired)

Soak the gelatin in cold water. Boil diced mangoes, orange juice and sugar, purée and pass through a fine sieve. Heat 100 g of the purée to a temperature of 60 °C and stir in the squeezed out gelatin. Add the remaining purée and allow to cool. Beat with a whisk before pouring into a 0.5 L whipper. Charge with nitrous oxide and shake vigorously. Chill in the refrigerator for several hours. Shake the whipper vigorously upside-down before

dispensing. Serve with fresh or marinated mango dices.

<http://www.espumas.com/>

Cold yoghurt mousse

140 g yoghurt (plain)
140 g greek yoghurt
120 g cream, 35%
60 g sugar
0.5 g citric acid
3.0 g gelatin, 1 3/4 sheets (0.64%)

Bloom gelatin in cold water. Heat a quarter of the plain yoghurt gently with citric acid and half of the sugar in a pan and dissolve the gelatin. Add remaining yoghurt and leave to set in fridge. Semi-whip cream with rest of sugar. When yoghurt is half set, fold in semi-whipped cream. Leave in fridge for another 3 hours to properly set.

Ferran Adrià in [A day at el Bulli](#)

Cold coffee espuma

325 g cold espresso
125 g heavy cream (33% fat)
75 g sugar
3.4-4.3 g gelatin; 2-2½ sheets (~ 0.65-0.82%)

Soak gelatin sheets in cold water until soft. Heat 100 g of espresso to 60 °C and remove from heat. Dissolve sugar. Squeeze water from gelatin sheets well, add to hot espresso and stir to dissolve. Add remaining cold espresso and set aside to cool slightly. Before gelatin sets, add cream, then stir. Pour mixture into 0.5 L whipper, charge with nitrous oxide and shake well. Chill for several hours before dispensing. Keep refrigerated.

Ferran Adrià via <http://www.movable-feast.com/2006/09/espresso.html>

Elderflower mousse

130 g cream, >36%
80 g egg white
3.4 g gelatin; 2 sheets (0.67%)
75 g elderflower cordial/syrup
16 g sugar
200 g skyr (Icelandic strained yoghurt)

Whip egg whites and cream in separate bowls. Dissolve bloomed gelatin in a small portion of heated cordial with the sugar. Mix cordial and gelatin into skyr. Fold in cream and egg whites.

René Redzepi in [NOMA](#)

Saffron foam

440 g heavy cream
60 g whole milk

2 t saffron threads
170 g white wine
3.4 g gelatin; 2 sheets (0.75%)
salt
white pepper

Combine the white wine and saffron in a small sauce pot and simmer over medium heat until liquid is reduced to 60 mL. Add the heavy cream and milk and gently bring to a simmer. Meanwhile, bloom gelatin in cold water until soft, about 5 minutes, then squeeze gently to remove excess water and add to the cream mixture. Season with salt and white pepper and strain through a chinois. Chill to room temperature and fill 0.5 L whipper. Charge with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

<http://www.isinorthamerica.com>

Cheese cake with lemon

225 g digestive crackers
125 g butter
10 g gelatin; 6 sheets (~0.8% of cream mix)
220 g water
30 g lemon juice
lemon zest
110 g sugar
125 g powdered sugar
225 g cream cheese
vanilla pod
250 g sour cream
250 g heavy cream (38% fat)

Crumble crackers and mix with melted butter. Spread in a spring form (24 cm diameter). Add bloomed gelatin to boiled water, sugar and lemon juice. Set aside to cool. Mix cream cheese, powdered sugar and sour cream with seed from vanilla pod and lemon zest. Whip cream and fold into cream cheese mix. Once gelatin mix has cooled, but before it sets, fold it into the cream mix. Pour into spring form and cool before serving.

Adapted from Andreas Viestad

Cucumber yoghurt espuma

500 g salad cucumbers
500 g yoghurt (3.5% fat)
8.5 g gelatin; 5 sheets (0.85%)
dill
garlic
salt
white pepper

Wash the cucumbers and cut them into pieces without peeling them. Combine cucumber pieces, yoghurt and spices, purée in a blender and strain through a fine sieve. Soak gelatin in cold water. Place the squeezed out sheets into

a saucepan with a little bit of the mixture and, constantly stirring, dissolve the gelatin. Next, add the cucumber blend to the gelatin, pass through a fine sieve and pour this mixture into the 1 L whipper. Charge with nitrous oxide and shake. Chill in the refrigerator for several hours. Shake the whipper vigorously upside-down before dispensing.

<http://www.espumas.com/>

Raspberry espuma

900 g raspberries
110 g sugar (add to taste)
8.5 g gelatin; 5 sheets (0.85%)
(raspberry brandy)

Soak the gelatin in cold water. Boil raspberries with sugar, purée and pass through a fine sieve. Heat 200 g of the raspberry purée to 60 °C and stir in the pressed out gelatin. Add the remaining purée and leave to cool. Beat with a whisk before pouring into a 1 L whipper and charge with nitrous oxide.

iSi North America via <http://www.prairiemoon.biz>

Carbonated yuzu jelly

300 g water
25 g yuzu juice
50 g sugar
3.4 g gelatin; 2 sheets (0.9%)

Place water, yuzu and sugar in a heavy duty saucepan and bring to boil. Add bloomed gelatin to the hot mixture. Place in whipper and charge twice with carbon dioxide. Release a small amount of the carbon dioxide and place in the fridge overnight. Screw off the top the next morning and play (careful – it might be a good idea to release some more pressure before unscrewing the top!).

Ian Kleinman via <http://food102.blogspot.com>

Panna cotta

600 g heavy cream (~38% fat)
1 vanilla pod
45 g sugar
6.8 g gelatin; 4 sheets (~1%)

Flavoring

grated zest from 1 lemon or lime
or
100 g blue veined cheese
walnuts for serving

Split vanilla pod, scrape out seeds and simmer with cream, sugar and zest for 3-5 min. Add bloomed gelatin to cream mixture, pour into desired molds or cups and cool in refrigerator

for at least 4 hours. Serve with lime marinated strawberries or other fruit if desired.

<http://www.tine.no>

Cold sauce with green cardamom

1000 g water
50 g glucose
12 capsules of cardamom
3-4 cm fresh ginger, peeled and minced
zest of 1 lime

For thickening use one of the following

4 g agar (0.38%)
20 g pectin (1.9%)
10 g gelatin* (1.0%)

Bring water and glucose to boil and infuse cardamom, ginger for 20 min. Add desired thickening agent and stir until dissolved (if using agar or pectin, mix with 10 g sugar to aid dispersion). Strain and serve.

<http://www.chefsimon.com>



Photo by Linda Anciau (Clarified tomato juice with red alginate sphere, see reference below for complete instructions incl. alginate sphere)

unBloody Mary (gelatin filtration)

1000 g ripe tomatoes
lemon juice, to taste
3 stalks celery
120 g water
jalapeno hot sauce, to taste
120 mL lovage leaves
salt and pepper
2 scallions
dash Worcestershire sauce
10 g gelatin* pr. liter liquid (1% in final prep.)

Pass vegetables and herbs through a juicer or liquefy in a blender with the water. Add remaining ingredients, adjust seasoning to taste. Strain through a sieve, measure the

volume and transfer to a saucepan. Add 10 g powdered gelatin for each liter of liquid by sprinkling it over the surface. Let stand for 5 minutes, then whisk it in over medium high heat until base just begins to simmer and gelatin has completely melted. Remove from heat, let cool and transfer to a bowl and place in freezer overnight or until frozen solid. The next day, line a colander with cheesecloth, pop out the frozen base and place it in the prepared colander, set over a large bowl and transfer to the refrigerator to drain for 24 to 48 hours. When it appears that the base has fully drained, remove colander and discard the solids. When ready to serve, add 1 part vodka to 2 parts of clarified base.

Linda Anciau via <http://www.playingwithfireandwater.com/foodplay/2008/02/unbloody-mary.html>

Watermelon foam

500 g watermelon juice
5 g gelatin; 3 sheets (1.0%)

Heat half of the watermelon juice. Dissolve the gelatin sheets in the hot watermelon juice. Add the rest of the juice. Strain the juice and transfer to a 0.5 L whipper. Charge the whipper with nitrous oxide and refrigerate until chilled.

José Andrés

Red beet foam

1800 g red beets
250 g heavy cream
4.3 g gelatin; 2½ sheets (1.0% of final prep.)
salt
white pepper

Peel and juice the beets. This yields approx. 1 L of juice. Reduce beet juice to 180 g over medium heat. Bloom gelatin in cold water until soft, about 5 minutes, then squeeze gently to remove excess water and add to the warm beet juice. Gently heat heavy cream until tepid. Combine cream and beet reduction. Season with salt and white pepper then strain through a chinois. Chill to room temperature, fill 0.5 L whipper and charge with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

http://www.isinorthamerica.com/recipe/print/print_23.html

Piña colada espuma

600 g pineapple juice
350 g coconut milk
50 g brown rum

10 g gelatin; 6 sheets (1.0%)
or
1 g xanthan (0.1%)

Bloom gelatin. Heat a little of the pineapple juice and dissolve gelatin. Add remaining liquids. If using xanthan, it can be added directly to the liquids using a blender or immersion blender. Strain liquid, transfer to whipper and charge with nitrous oxide. Leave in fridge for some hours before serving. Serving tip: top pineapple juice with piña colada espuma.

From Fizz magazine via <http://www.cuisine-concept.de>

Stabilization of whipped cream

500 g heavy cream
5 g gelatin, powdered (1%)
15 g water

Bloom gelatin in water. Heat carefully to dissolve. Add to cream and whip.

<http://www.baking911.com>

Orange and grapefruit consommé

14 g gelatin, powdered (~1%)
30 g water
200 g unsweetened orange juice
450 g unsweetened grapefruit juice
2 grapefruits, peeled and cut into segments
few drops of Angostura bitters
mint leaves

Bloom gelatin in 30 g cold water. Heat carefully until gelatin is dissolved. Mix fruit juices in a bowl. Add gelatin solution, grapefruit (save some segments for garnish) and Angostura bitters and stir. Chill for 2 hours, until the consommé is very lightly gelled. Serve in soup plates, garnished with grapefruit segments and mint leaves.

<http://www.cookitsimply.com/recipe-0010-03229t.html>

Salmon mousse

200 g cooked salmon, chopped
150 g smoked salmon, chopped
100 g water
200 g sour cream
½ onion, chopped
½ lemon, juiced
1 t ground pink pepper
3 T dill, chopped
6.8-8.5 g gelatin; 4-5 sheets (1-1.2%)

Bring water to boil, add bloomed gelatin and stir to dissolve. Mix in remaining ingredients. Pour into pan and leave to set in refrigerator for at least 4 hours.

<http://www.matoppskrift.no/sider/oppkrift8191.asp>

Filled mozzarella balloons

6 g gelatin; 3.5 sheets (1.2%), bloomed

500 g tomato water
1000 g water
250 g salt
250 g mozzarella curd

Bring tomato water to simmer. Remove from heat and stir in squeezed gelatin sheets until dissolved. Strain through chinois and transfer to whipper and charge with nitrous oxide. Chill whipper in ice water, shaking frequently.

Heat water and salt to 71 °C, add mozzarella curd and heat for about 5 min or until soft. Tear small pieces (about 15 g) from curd, knead and stretch until elastic. Cover tip of whipper and gently inflate mozzarella balloon with tomato foam. Twist ends together to close the balloon. Transfer balloon to paper towel to dry.

Grant Achatz in Alinea



Photo by Stefanie Hope Pollack (Margarita jelly beans)

Homemade Jelly Beans

175 g water
260 g sugar
7 g gelatin* (1.2%)
120 g juice/cocktail
1.3 g salt
cornstarch for dusting

Coating
60 g water
155 g sugar
food coloring

Combine water, sugar and gelatin in a saucepan and bring to boil. Stir until all is completely dissolved. Continue heating until temperature reaches 110 °C. Remove syrup from heat and cool in cold water. Quickly stir in juice and salt (if using a mild juice: add lemon juice or citric acid for a more tangy flavor). Spray jelly bean mold with non-stick spray and

pour syrup into molds. Leave to set for 4-6 h. Pop beans out of the mold onto parchment paper. Dust with cornstarch to promote drying.

Coating: Mix water, sugar and food coloring in a jar. Add the jelly beans. Seal the jar, tilt and turn it gently by hand for 10-15 min. Remove the jelly beans from the liquid and leave the to dry and harden on parchment paper over night. Turn over to allow the other side to dry.

<http://www.cupcakeproject.com/2012/04/homemade-jelly-beans-you-pick-flavor.html>

White chocolate panna cotta

Panna Cotta

250 g cream, >35%
50 g white crème de cacao (20% ABV)
70 g sugar
7 g gelatin* (1.26%)
175 g milk

About 1.8% ABV in final prep.

Raspberry sauce

100 g sugar
200 g raspberries, fresh
30 g triple sec (40% ABV)
5 g lemon juice

Panna Cotta: Dissolve 70 g sugar in cream and crème de cacao over medium heat. Set aside. Sprinkle gelatin over milk and heat gently while stirring to dissolve. Stir into cream mixture. Pour into ramekins and leave to set in fridge for 4h. Place ramekins in hot water for about 10 sec to loosen panna cotta and invert onto plates. Serve with raspberry sauce.

Raspberry sauce: Combine ingredients (reserving 20% of the raspberries) and stir over low heat until sugar dissolves and berries are soft. Strain to remove seeds. Stir in remaining raspberries and refrigerate until ready to serve.

<http://www.cookingwithbooze.com>

Bavarian cream

3 eggs
70 g sugar
300 g heavy cream (~38% fat)
10 g gelatin; 6 sheets (1.3-1.6%)
50 g water
flavoring (see below)

Whisk eggs and sugar to eggnog. Whip cream and add eggnog. Bring water to boil and pour over bloomed gelatin. Mix gelatin solution with desired flavoring (see below). Carefully mix

flavoring with the cream mix. Cool in refrigerator for a couple of hours to set.

Suggested flavorings:

juice and peel from 1 orange or lemon
100 g canned pineapple
200 g jam or marmalade
200 mL fresh berries stirred with sugar
50 g sherry
50 g grated or melted chocolate

<http://www.tine.no>

90 years of aviation

Violette caviar

120 g violette
60 g lemon juice
60 g Parfait Amour
3.4 g gelatin; 2 sheets (1.4%)

Drink

75 g gin
15 g maraschino liqueur
15 g lemon juice

For violette caviar: Place all into a sauce pan and warm until gelatin is dissolved. Place into a squeeze bottle. Refrigerate until a thick sauce-like texture. Slowly drip violette sauce into a tall container of almost frozen canola oil. Strain from canola oil and rinse oil off the caviar with cold water.

For drink: Shake and strain into a cocktail glass. Serve along-side violette caviar

Jamie Boudreau via <http://smallscreennetwork.com>

Edible wrapper/film

400 g water
0.2 g glycerin (0.05%)
6 g powdered gelatin, 200 bloom (1.5%)

Place everything in saucepan and set aside until gelatin is fully bloomed. Heat the mixture, stirring constantly to dissolve the gelatin. Deposit 6 g of mixture onto a 9 cm petri dish (or similar flat bottomed container), swirling it to make sure the bottom is evenly coated. Cover lightly with parchment paper to prevent dust from settling on the film. Leave in a warm place for 20-25 hours, or until the film is completely dry and can be peeled off the petri dish. Place film between sheets of parchment paper and store in a dry place until needed. If layered, the films can be cut/sealed with a hot knife.

Heston Blumenthal in The Big Fat Duck Cookbook

Sweet lemon foam

200 g squeezed lemon juice
5 g gelatin; 3 sheets (1.6%)
5 g honey
100 g sugar

Bloom and melt the gelatin in the lemon juice by gentle heating. Add honey and sugar and stir to dissolve. While still warm whisk the solution at full speed. Cool the mixture by putting the bowl in ice water to let the gelatin foam set.

<http://www.inicon.net>

Olive oil gummy bears

25 g glucose
2.5 vanilla pods
80 g caster sugar
8.5 g gelatin; 5 sheets (1.7%)
100 g water
100 g isomalt
160 g olive oil (use best quality available)
5 g citric acid

Bloom gelatin. Heat water, sugar, glucose and isomalt to 90 °C, stirring continuously till all has dissolved. Mix in olive oil using blender or immersion blender. Stir in seeds from vanilla pods and gelatin (squeeze out water first). Pour into mold or tray and leave to set in fridge. Cut in pieces and cover with caster sugar and citric acid.

[Paco Roncero via http://www.chefkoch.de](http://www.chefkoch.de)

Fruit jelly

1000 g clear fruit juice, sweetened
17 g gelatin; 10 sheets (1.7%)

Bloom gelatin in 300 g juice. Bring remaining juice to boil. Add bloomed gelatin and juice and stir to dissolve gelatin. Leave to set in refrigerator for at least 4 hours, preferably over night.

Olive caviar

jar of black olives
4.3 g gelatin; 2½ sheets (1.8% of final prep.)

Open and wash a jar of black olives. Purée olives. Push olive purée through a chinois to make olive water. Take 240 g of olive “water” and place in a pot on medium heat. Add bloomed gelatin and stir to dissolve. Immediately remove from heat and refrigerate. Place mixture into a squeeze bottle. Place a container of vegetable oil in a freezer until almost frozen. Squeeze droplets of olive mixture from the squeeze bottle into the almost

frozen oil. When enough “caviar” is made, strain out of oil and rinse off with water.

[Jamie Boudreau via http://spiritsandcocktails.wordpress.com](http://spiritsandcocktails.wordpress.com)

Red wine jelly

500 g red wine
35 g sugar
10 g gelatin; 6 sheets (1.8%)
1 whole star anise

About 13% ABV in final prep

Let 200 g wine, sugar and anise simmer for 5-10 min. Add bloomed gelatin. Add remaining wine and divide between 6 wine glasses. Leave in refrigerator for at least 4 hours to set. Serve with whipped heavy cream and garnish with a star anise.

[Adapted from http://www.saveur.com](http://www.saveur.com)

Frozen champagne

280 g champagne
200 g elderberry syrup
100 g mineral water
20 g orange juice
20 g lemon juice
14 g gelatin; 8 sheets (2%)
60 g egg white

Bloom gelatin in orange juice and heat carefully until it dissolves. Add remaining ingredients, finishing off with the egg white. Add to whipper and use 2 nitrous oxide chargers. Cool for at least 2 hours. Dispense into liquid nitrogen and serve immediately.

[Henrik Schellhoss via http://kochmuetzen.net/koch-blog-16-161-488.de.html](http://kochmuetzen.net/koch-blog-16-161-488.de.html)

Ramos Gin Fizz Marshmallow

140 g gin
35 g lemon juice
35 g lime juice
1 bar spoon orange blossom water
14 g powdered gelatin (~2%)
290 g sugar
80 g water
2 large egg whites (~70 g)

For dusting
35 g sugar
5 g cornstarch

Spray a square pan with cooking spray and dust with the sugar/cornstarch mixture. Tap out the excess. Add gin, lemon and lime juice, orange blossom water and gelatin to a small saucepan. Let gelatin soften for five minutes, then heat over low heat until it dissolves. Set aside.

In another saucepan, combine sugar and water. Place over high heat with a thermometer attached. When the mixture reaches 118 °C, beat the egg whites at high speed until they form firm peaks. When the sugar syrup reaches 129 °C degrees, slowly whisk it into the warm gin-gelatin mixture, then pour the syrup into the egg whites in a thin stream while beating on high until they are barely warmer than room temperature. Pour into the square pan and smooth with a spatula. Cover with plastic wrap and let sit until it solidifies. Cut into about 35 Ramos Gin Fizz Marshmallows.

Eben Freeman in <http://www.voorhes.com/pdfs/SpiritGuidetoSpirits.pdf>

Heat stable gelatin gel and foam

flavored water base
gelatin 2-3%
transglutaminase 0.35-0.7%

Bloom gelatin and dissolve in water base. Cool. Add transglutaminase and leave to set for gel. For foam, pour mix into siphon before it sets, charge with nitrous oxide and leave in fridge over night. Dispense. Vary concentrations according to desired texture and stability.

Jorge Ruiz

Marshmallows

400 g sugar
240 g corn syrup
60 g water
21 g gelatin (2.5%), 225 bloom
120 g water
1.5 g salt
15 g vanilla extract

Bloom gelatin with 120 g water. Boil sugar, corn syrup and water until 120 °C. Add slowly to gelatin solution while mixing. Add salt. Turn up speed and whip until marshmallow has fluffed up. Add vanilla extract. Cool in greased pan for 3 hours. Cut and powder with sugar/starch.

*Michael Chu/Thomas Keller,
<http://www.cookingforengineers.com/recipe/106/Marshmallows>*

Pine nut marshmallows

500 g milk
18 g gelatin; 9 sheets (2.8%)
40 g virgin pine nut oil
75 g toasted pine nut powder
salt

Cool milk to 3 °C. Mix gelatin with remaining milk and heat to 40 °C to dissolve. Start to whip mixture. After 30 seconds, add all the cooled milk in one go and continue to whip for 3 min. Add the pine nut oil and keep whipping

for another 30 seconds. Spread out on sheet to a thickness of 2.5 cm. Refrigerate for at least 2 hours and cut into 2.5 cm cubes. Refrigerate in air tight container. For serving, lightly salt cubes and coat sides with toasted pine nut powder.

Ferran Adria in A day at el Bulli



Photo by Martin Lersch (Banana marshmallows with parsley, see link below for blog post with explanation)

Fruit marshmallows

65 g water
200 g sugar
10 g gelatin; 6 sheets (2.9%)
65 g fruit purée (mango, strawberry etc.)

Bring water and sugar to boil while stirring. Remove from heat when temperature reaches 110-115 °C. Add bloomed gelatin sheets and mashed bananas. Whip for 10 minutes (much longer than you think!). Grease a pan, sprinkle with powdered sugar and spread mixture in pan. When set, invert pan on a surface dusted with plenty of powdered sugar and starch. Cut up in desired pieces and coat every cut surface with powdered sugar and starch.

Martin Lersch, <http://blog.khymos.org/2007/05/20/banana-marshmallows-with-parsley-tgrwt-2/>



Photo by Allen Hemberger

Grape sponge

12 g gelatin; 7 sheets (3.1%), bloomed
375 g grape juice

Heat 100 g grape juice and whisk in bloomed gelatin until dissolved. Transfer to a metal bowl set over ice water. Add remaining grape juice and whisk vigorously until ribbons begin to form. Transfer to stand mixer with whisk attachment and whip on high speed until stiff peaks form. Use plastic pastry bag and dispense into molds lined with nonstick cooking spray. Freeze for 1 hour if desired.

Grant Achatz in *Alinea*

Jellied gin and tonic

Lime slices

1 lime
60 g simple syrup
1 t citric acid

Sugar-soda-acid mixture

1/4 t bicarbonate of soda
1/4 t confectioner's sugar
1/4 t citric acid

Jellied gin and tonic

2.5 g gelatin; 1½ sheets (3.3%)
25 g gin
50 g tonic water

Freeze lime and cut into chips with deli slicer. Coat slices in simple syrup and citric acid. Bake at 65 °C until crisp.

Mix bicarbonate of soda, sugar, and citric acid.

Soften sheet gelatin in cold water for two minutes. Warm gin and add gelatin and tonic water. Pour into a shallow baking pan lined with plastic wrap and refrigerate for two hours.

Cut into 1.5 cm cubes. Put cube onto lime chip, sprinkle on sugar-soda-acid mixture (the acid combines with the baking soda for a carbonated feeling on the tongue), and serve.

Eben Freeman via <http://www.wired.com>

Whisky gums

Part 1

15 g powdered gelatin, 200-225 bloom (5.1%)
35 g whisky

Part 2

100 g glucose syrup
75 g unrefined caster sugar
40 g whisky
1 g tartaric acid (0.34%)

Part 3

30 g whisky

About 14% ABV in final product

Blend ingredients for part 1, seal in a sous vide bag and place in 60 °C water bath for 30 min to fully soften gelatin. Combine ingredients for part 2 and boil to 124 °C (121 °C for slightly softer set). Remove from heat and stir in softened gelatin (part 1). When syrup has cooled to 100 °C stir in whisky from part 3. Quickly deposit mixture into moulds, then refrigerate, covered with parchment paper until gums have fully set. Remove moulds from fridge and allow to soften 30 min before serving.

Heston Blumenthal in *The Big Fat Duck Cookbook*

Wine gum

Base

50 g cold water
100 g sugar
70 g glucose
14 g gelatin* powder (5.6%)
50 g boiling water
A heavy-duty plastic icing bag

Pineapple wine gums

1/4 tsp. citric acid
0.5 g yellow coloring
1.5 g pineapple essence

Cola wine gums

1/4 tsp. citric acid
1 g red coloring
1.25 g cola essence

Strawberry wine gums

1/4 tsp. citric acid
1 g red coloring
1.25 g strawberry essence

Salt liquorice wine gums

2 g black coloring
1 t ammonium chloride (sal ammoniac)
5 g liquorice flavoring
0.5 anise oil

Mix cold water, sugar and glucose in a pan. Using a candy thermometer, heat until 145-150 °C depending on desired firmness. Cool. At 110 °C, remove thermometer and add gelatin, bloomed in 50 g water and brought to boil. Add coloring and flavoring. Blend thoroughly into the mixture, but do not whip because the coloring will become murky.

Place icing bag in a measuring cup or bowl and pour wine gum mixture the bag and tie a knot at the top. Avoid burns by holding the bag with a clean cloth. Cut a very small hole in the tip of the icing bag. Squeeze mixture onto an oiled cake pan or a silpat, little by little. After 10 to 12 hours the dried wine gums can be removed slowly and carefully.

The mixture can also be poured directly from the pot onto a sheet of baking paper to form one large wine gum. When the mixture has dried and can be removed from the baking paper, it can be cut into various shapes and sizes.

Dip the wine gums in sugar or glucose to prevent them from sticking together, or let them dry uncovered for 8-10 days. They will remain edible for around one month.

Helle Beisheim via <http://www.pingvin.com>



Pineapple flavored wine gums. Photo by Martin Lersch.

Wine gums

400 g water
1000 g sugar

100 g gelatin, 180 bloom (6.6%)
15 g citric acid
flavor
color

Boil sugar in 200 g water until dissolved. Bloom gelatin in remaining water. Heat to dissolve gelatin. Add gletain mix to sugar solution. Stir constantly. Add citric acid, flavor and color to taste. Spread on silpat or tray. Leave to set foover night. Cut into bite sized pieces with scissors. Coat with granulated sugar. Store in airtight box.

<http://husmorlektor.blogspot.no/2013/08/hjemmelagde-seigmenn.html>

Wine gum

125 g water
200 g sugar
250 g glucose
50 g gelatin* (7.9%)
1.5 g citric acid
1.5 g strawberry essence
1 g red food coloring (20 drops)
vegetable oil for greasing

Bloom gelatin in 75 g of water and heat while stirring on a *bain marie* till gelatin dissolves. Keep gelatin warm to prevent it from setting. In a 2 L pan bring 50 g water, 200 g sugar, 250 g glucose to 135 °C. Cool to 100 °C. Add citric acid, gelatin solution, flavor and color. Mix. Scum of foam. When cooled to 70 °C, pour into greased molds or onto a silpat (0.5-1 cm thick). Dust with powdered sugar or glucose. After 30 min the gum can be cut or shaped.

<http://www.urtegaarden.dk>

Kientzheim butter foam

20 g water
4 g gelatin
clarified butter
pinch of salt

Bloom and dissolve gelatin in water. Add a pinch of salt. Start whisking and add clarified butter slowly. Whisking on an ice bath promotes setting of the foam. If desired 20 g egg white can be substituted for the water and gelatin.

Hervé This via <http://inicon.net>

Further recipes with gelatin can be found in the section “Multi-hydrocolloid recipes” on page 93.



Gellan

Tips and tricks

- Presence of sodium and in particular calcium inhibits proper hydration. Addition of a sequestrant such as sodium citrate binds calcium and helps hydration.

Name	<i>gellan (E418) low acyl (LA)</i>	<i>gellan (E418) high acyl (HA)</i>
Origin	polysaccharide obtained by fermentation of <i>Sphingomonas elodea</i>	polysaccharide obtained by fermentation of <i>Sphingomonas elodea</i>
Properties, texture	<i>thermoirreversible</i> , hard, brittle gel; sodium/potassium ions give thermoreversible gels	thermoreversible, soft, elastic gel; thickener if not heated
Clarity	transparent	opaque
Dispersion	cold water; d. is improved (allowing add. to hot solutions) by mixing with sugar (3-5x), glycerol, alcohol or oils (3-5x); hard water promotes d.	cold water; d. is improved (allowing add. to hot solutions) by mixing with sugar (3-5x), glycerol, alcohol or oils (3-5x); hard water promotes d.
Hydration (dissolution)	90-95 °C; keep pH > 3.9; add sugar after hydration; inhibited in presence of sodium and calcium, but 0.1-0.3% sodium citrate helps	85-95 °C; can be hydrated at pH < 4; less sensitive to ions; add sugar after hydration
pH	4-10	3-10
Setting	10-60 °C, rapid (minutes)	70-80 °C
Melting	does not melt	70-80 °C
Promoter	gelling promoted by calcium, magnesium, sodium, potassium and acids	gelling is not sensitive to ions
Inhibitor	will not hydrate at pH < 3.9 or with sodium/calcium salts present	
Tolerates		salts, acidic foods
Viscosity of solution	low	high
Typical conc.	0.4-0.7% for gels (self supporting from 0.05%); [0.03-2.6%]*	0.4-0.7% for gels (self supporting from 0.2%); [0.03-2.6%]*
Synergies		
Syneresis	no (if left untouched)	no

* Concentrations in [square brackets] show range exemplified in this collection.

Fluid gel for beverages

Part 1

112 g sucrose
0.60 g tri sodium citrate dihydrate
0.28 g low acyl gellan (0.027% in final prep.)
0.20 g sodium benzoate
862 g deionized water

Part 2

5.00 g citric acid
0.25 g calcium lactate (0.025% in final prep.)
15 g deionized water

Blend sucrose, tri sodium citrate dihydrate, gellan and sodium benzoate and disperse in the deionized water of Part 1. Heat the dispersion to 70–80 °C. Dissolve the citric acid and calcium lactate in the deionized water of Part 2 and add to the hot gum solution. Cool to below 15 °C undisturbed. Gently agitate the sample to form a fluid gel.

CRC Handbook of hydrocolloids

Pulp suspension beverage (fluid gel)

338 g water
100 g fruit juice
60 g sugar
0.25 high acyl gellan (0.05%)
0.25 g tri sodium citrate dihydrate
0.9 g citric acid anhydrous
0.5 g potassium citrate

Blend gellan with tri sodium citrate dihydrate and disperse in the water. Heat the dispersion to 90 °C to hydrate the gum. At 90 °C add the remaining dry ingredients and the fruit juice. Cool to room temperature whilst mixing to form the fluid gel.

CRC Handbook of hydrocolloids

Hot tea fluid gel

Tea infusion

900 g low calcium water
20 g Earl Gray tea leaves

Part 1

860 g tea infusion
80 g caster sugar
0.6 g low acyl gellan (0.063%)
0.6 g sodium citrate (0.063%)

Part 2

0.25 g calcium chloride (0.026%)
1 g malic acid (0.11%)
5 g tea infusion

Let tea leaves infuse for 1 hour in ice-cold water. For part 1, dry blend sugar, gellan and sodium citrate. Transfer tea infusion to

saucepan, whisk sugar mix into water and bring to a simmer to dissolve ingredients. Meanwhile mix ingredients for part 2 and set aside. Once part 1 has come to a simmer, whisk in part 2 to set the gel. Pour into a clean container, cool on an ice bath. Refrigerate for 24 hours, pass through a fine sieve to break up the gel (creating the fluid gel) and serve.

Note: Heston Blumenthal serves this together with a cold tea fluid gel in the same cup. The increased viscosity prevents mixing of the cold and warm side.

Heston Blumenthal in The Big Fat Duck Cookbook

Banana-cocoa raviolis

Banana-cocoa ravioli base

800 g sugar
480 g glucose
120 g chocolate powder
600 g water

Raviolis

1 kg banana purée
237 g base
137 g water
1.5 g low acyl gellan (0.11%)

Banana-cocoa ravioli base: Take the sugar and glucose to a medium caramel and slowly whisk in the water and chocolate. Cool.

Raviolis: Freeze banana purée into tubes and cut into 1 inch-slices. Bring ravioli base with water to a boil and add the gellan. Cool to 40 °C and quickly dip the frozen banana slices. Allow to thaw.

Sam Mason via <http://www.star chefs.com>

Bake-stable fruit preparation

210 g apples
160.8 g sucrose
8 g modified waxy maize starch (THERMFLO)
0.32 g low acyl gellan (0.08%)
0.8 g citric acid solution (50% w/w)
0.88 g tri sodium citrate dihydrate

Pre-blend the dry ingredients, add to the apple and heat with stirring to boiling. Remove from heat, add the citric acid solution, mix well and deposit. Leave to gel before use. Shear, and use as required.

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Fruit juice jelly

250 g water
250 g fruit juice
90 g sugar
2.4 g citric acid, anhydrous

1.8 g tri sodium citrate dihydrate
0.9 g low acyl gellan (0.15%)

Pre-blend all the dry ingredients. Heat the water to boiling and dissolve the dry ingredients in the hot water. Add the fruit juice, mix and chill. The gel sets at approximately 40–45 °C and the use of chilled fruit juice with dry-mix desserts ensures a rapid set.

CRC Handbook of hydrocolloids

Reduced sugar jam using HA/LA blend

450 g frozen strawberries
283.5 g sugar
260 g water
2.5 g gellan* (0.25%)
0.5 g tri sodium citrate dihydrate
1 g potassium sorbate
2.5 g citric acid solution (50% w/w)

* Mix high acyl (HA) and low acyl (LA) gellan for desired texture. HA gives a soft and spreadable jam. LA gives a firmer texture.

Dry blend the gellan gum, tri sodium citrate dihydrate and potassium sorbate with the sugar and disperse into the water. Add the fruit and heat to boiling. Cook for 1–2 minutes to ensure hydration of the gellan gum. Check the soluble solids. Remove from the heat and add the citric acid solution. Fill into jars and cap immediately.

CRC Handbook of hydrocolloids



Photo by Alexander Talbot

Yoghurt spheres (reverse spherification)

yoghurt

Setting bath
500 g water
1.5-2.5 g low acyl gellan (0.3-0.5%)

0.25 g sodium hexametaphosphate (0.05%)

First dissolve the sodium hexametaphosphate in the water, then the gellan. Take spoonfuls of yoghurt and drop the carefully into the setting bath. Leave for a couple of minutes and rinse the spheres with water. Can be served hot or cold as the Ca-gellan gel is thermoirreversible. Less gellan gives a thinner skin.

Aki Kamoza and H. Alexander Talbot in

http://blog.ideasinfood.com/ideas_in_food/2008/12/encapsulation.html

Apple purée gel

Apple purée
20 apples, cored, peeled and chopped
130 g sugar
1 vanilla bean
750 g white wine

Apple purée gel
810 g apple purée
203 g water, cold
203 g white wine, cold
2.6 g high acyl gellan (0.21%)
1.9 g low acyl gellan (0.16%)
1 g maltodextrin (0.08%)

In large sauté pan, cook apples with sugar, vanilla bean, and white wine over medium heat until liquid becomes syrupy. Discard vanilla bean, then purée apples until smooth. Heat apple purée in a pot until warm.

Blend water and wine with high and low acyl gellan and maltodextrin for 2 minutes with hand held electric blender. Heat in sauce pot until it is thick then becomes loose again. Working quickly, add wine mixture to apple purée and mix well using hand held blender then pour into a plastic container lined with plastic wrap, pressing wrap down over top. Chill for one hour and cut into desired shapes. Warm in an oven or microwave, sprinkle top with sugar then caramelize using torch.

Sam Mason via <http://www.star chefs.com>

Almond fluid gel

800 g skimmed milk
300 g roast almonds
3 bay leaves
30 drops almond essence
18 g sugar
7.5 g salt
5 g gellan gum (0.44%)

Heat all ingredients except the gellan gum and roughly blend with the hand blender. Leave to infuse for 10 minutes. Pass through a fine

mesh sieve, discarding the almond, and then return to the boil. Using a hand blender, blitz in the gellan gum until dissolved and remove from heat. Place in fridge and blend repeatedly whilst cooling until smooth.

Heston Blumenthal via <http://www.nespresso.com>

Onion purée

onions
low acyl gellan 0.45%

<http://seanbrock.wordpress.com/2008/01/07/onion-purée/>

Amaretto jelly

3 g gellan gum (0.46%)
150 g water
300 g Amaretto
200 g sugar

Hydrate the gellan gum in the water. In a small pan heat the amaretto and sugar. Combine both mixtures and cool. Pour into a half sheet pan and allow to set. Cut into cubes.

Tom Wellings via <http://www.starchefs.com>

Pumpkin tuiles

500 g pumpkin purée
25 g apple juice
75 g water
40 g sugar
3 g gellan (0.46%)
pinch of nutmeg and cinnamon

Mix all ingredients under high shear. Bring to full boil. Pour into container and let set. Dice gel and blend it into a smooth fluid gel. Spread onto silpat. Dehydrate slowly in oven. While warm, remove from oven and shape the tuiles. They will crisp up as they cool.

David Barzelay, http://www.eatfoo.com/archives/2011/01/pre-meal_snacks.php

Spherification with gellan

1 g gellan (0.5%)
200 g water (or flavored liquid)

Setting bath
2 g calcium lactate
100 g water

Disperse gellan in water with hand held mixer. Allow to hydrate in refrigerator overnight. Drip or pour into the calcium solution. Leave until set. Remove and rinse.

<http://www.inicon.net>

Pomegranate and vodka fluid gel

1 g low acyl gellan (0.5%)
100 g pomegranate juice
100 g vodka

Heat pomegranate juice to 65 °C. Add gellan, blitz with immersion blender. Continue mixing by hand until cool and partially set. Add vodka and blitz with immersion blender.

Larry at <http://chiantiblue.blogspot.com>

Mint gel

250 g water
50 g glucose
200 g sugar
2.5 g low acyl gellan (0.5%)
1 g peppermint oil

In a saucepan, combine all ingredients and blend for 1 min with immersion blender. Bring to a rolling boil over high heat. Remove from heat, pour into desired mold or shape and leave to set in fridge for 2 h or until set. Serve as is or chop gel into irregular shards.

Grant Achatz in Alinea

Chocolate jelly cubes (firmer/shorter texture)

300 g low calcium or deionized water
25 g invert sugar (trimoline)
18 g cocoa
1 g table salt
2 g low acyl gellan (0.58%)
1 g sodium citrate (0.29%)

Combine ingredients in a sauce pan and bring to boil. Pass mixture through a chinois into a container and leave to set in a refrigerator. Turn out jelly and cut into cubes.

Heston Blumenthal in The Big Fat Duck Cookbook

Mango spheres

125 g mango juice
0.8 g low acyl gellan (0.64%)
0.2 g sodium hydroxymetaphosphate (0.16%)

Setting bath

500 g water
30 g calcium gluconate (5.0%)
0.4 g ascorbic acid (0.066%)
75 g granulated sugar

Pour mango juice into a blender, and with the blender on, sprinkle gellan and sodium hydroxymetaphosphate to disperse them properly. Strain through a fine meshed strainer. Prepare the setting bath by dissolving calcium gluconate, ascorbic acid and sugar in 500 g of water.

Thomas Keller in Under Pressure



Photo by Chad Galiano

Warm tomato jelly

735 g tomatoes, oven roasted
18 g clear agave nectar
5 g fresh basil
1.5 g crushed black pepper
2 g sea salt

low acyl gellan (0.7%)

Purée and strain the mixture, weigh and calculate required amount of gellan. Add gellan and mix with a hand blender, bring it to a boil for 1 minute, pour and allow to set. The gel will set while still warm. At this point, purée the gel in a blender.

<http://chadzilla.typepad.com/chadzilla/2008/01/you-gellan.html>

Buttermilk fluid gel

190 g water

310 g buttermilk
1 g sodium citrate (0.2%)
0.5 g sodium hexametaphosphate (0.1%)
3.5 g low acyl gellan (0.7%)

Sodium hexametaphosphate and sodium citrate are used for calcium sequestration. Shear the sequestrants into the buttermilk. Shear the gellan into the water. Then shear the water and buttermilk together. Heat the mixture to at least 200F in a saucepan, stirring constantly once bubbles appear around the outside of the pan. Immediately pour the hot mixture into a shallow dish and refrigerate until fully gelled. Cut the gel into inch cubes and puree them in a blender. Push the resulting fluid gel through a chinois or tamis and refrigerate for up to two weeks.

David Barzelay, http://www.eatfoo.com/archives/2010/02/sunchoke_buttermilk_bbq_sauce.php

Raisin gel

500 g raisins
500 g water
1 g sodium citrate (0.2%)
0.75 g high acyl gellan (0.15%)
3 g low acyl gellan (0.6%)

Bring water to boil and pour over raisins. Leave to steep over night. Drain through chinois. Transfer raisins to blender and blend for 3 min or until smooth. Pass through chinois. In a small saucepan, bring 500 g raisin purée to a boil. Transfer to a blender, and with the blender running at high speed add sodium citrate, high acyl gellan and low acyl gellan. Blend for another minute. Pour onto flat tray to form a layer 3 mm thick. Let cool until set. Cut into small squares and serve.

Grant Achatz in Alinea

Carrot lolly

100 g carrot juice
10 g icing sugar
10 g maltodextrin DE19
1 g low acyl gellan gum (0.83%)
orange zest as needed

Preheat the oven to 100 °C. Blend all the above ingredients and bring to the boil, continue to boil for 2 minutes. Pour into a container and cool over ice rapidly. Once this mixture has cooled it will have a hard consistency, which is then blended into a smooth paste. Cut out of cardboard an oblong template 2 cm x 3 cm. Line a baking sheet with a non-stick mat. Using the template, spread the mix over the sheet. Sprinkle some grated orange zest over the lollies. Place a toothpick or lolly stick into the mix half way up the tuile and half sticking out of the mix. Bake in the preheated oven for 2.5 hours.

Heston Blumenthal via <http://www.nespresso.com>

Jelly sweets

159 g sucrose
159 g glucose syrup (42DE)
120 g water
5 g citric acid anhydrous
5 g tri sodium citrate dihydrate
3.75 g low acyl gellan gum (0.83%)
0.2 g calcium hydrogen orthophosphate
flavor and color as required

Blend gellan gum and calcium hydrogen orthophosphate with 1 g of tri sodium citrate dihydrate and 40 g of sucrose and disperse in the water. Heat to boiling to hydrate the gellan gum then add the remainder of the sugar while continuing to boil. Add pre-warmed glucose syrup while maintaining the temperature above 90 °C. Cook the liquor to 80–82% total solids then cool to 90 °C. Dissolve the citric acid and remainder of the tri sodium citrate dihydrate, color and flavor in 20 g of water and stir into the liquor. Deposit at 76–78% total solids into starch molds. Stove to final solids as required.

CRC Handbook of hydrocolloids

Chocolate jelly discs (smooth/elastic texture)

250 g low calcium or deionized water
25 g trimoline
14 g cocoa powder
1 g table salt
3 g low acyl gellan (1.0%)
1 g sodium citrate (0.34%)

Combine ingredients in a Thermomix and heat until mixture reaches 95 °C. Pass through

chinois directly onto a chopping board covered with clingfilm. Tilt board to spread mixture as evenly as possible (about 1 mm), cover with another sheet of clingfilm and leave to set. Cut into discs of desired size. Store between layers of parchment paper.

Heston Blumenthal in The Big Fat Duck Cookbook

Maple gel

50 g maple syrup
250 g cold water
3 g gellan (1.0%)

Hydrate the gellan in cold water. Boil the maple syrup. Blend together and chill.

Sam Mason

Olive oil gelatin

350 g water
6 g gellan (1.2%)
1.5 g mono-/diglycerides (0.3%)
150 g extra virgin olive oil
2 g salt

Disperse gellan in water and bring to boil. Add emulsifier (one recipe actually omits this), olive oil and while mixing vigorously at 90 °C. Pour into flat tray and allow to gel. Cut into desired pieces.

Nova Kuirejo via <http://www.gourmantis.de>

Bourbon whiskey gel

600 g bourbon whiskey
7 g gellan (1.2%), *Kelcogel JJ*

Note: Kelcogel JJ is a blend of low acyl and high acyl gellan

In a saucepan, disperse gellan into whiskey with immersion blender. Bring to simmer and remove from heat. Pour into shallow pan and leave to set at room temperature. Cut into desired shape for serving.

Grant Achatz in Alinea

Apple noodles

95 g green apple juice
5 g glucose
1.2 g low acyl gellan (1.2%)

Juice about 4 green apples. Let the mixture set for 5 minutes. Scrape off all of the brown solids from the top. Weigh out the Apple juice and place the gellan on top. Blend with a hand mixer. Place in a saucepan with the glucose. Heat the mixture until it boils for 1 minute. Take a large syringe and fill it with the Apple mixture. Place a plastic tubing on the end and push the

juice through. Place in ice cold water for 1 minute. Push the noodle through using the syringe.

Ian Kleinman via <http://food102.blogspot.com>

Grape fluid gel

720 g white grape juice
12 g low acyl gellan (1.5%)
80 g muscat wine

Whisk gellan into grape juice and carefully bring to a boil. Pour liquid through a fine sieve into a jug and cool to 35 °C. Periodically, blitz the gel with an immersion blender. When the gel has cooled, add the wine and blend again. Pass through a fine sieve and re-refrigerate until needed.

Heston Blumenthal in The Big Fat Duck Cookbook

Hot potatoe ice cubes

200 g mealy potatoes
600 g water
salt
pepper
6 g gellan (1.6% in final prep.)

Boil peeled potatoes in water until soft. Measure out 375 g of the water, add salt and pepper to taste and mix in gellan. Pour into ice cube tray and leave to set. Heat in pan with butter and vegetable stock before serving.

Rolf Caviezel in Molekulare Küche

Verjus jelly

180 g verjus
200 g white grape juice
0.8 g sodium citrate (0.21%)
6.4 g low acyl gellan (1.7%)

Combine verjus, grape juice and sodium citrate in Thermomix and heat carefully to 90 °C with medium blender speed. Add gellan and blend for 1 min. Pour through fine sieve into a container and leave to set. Invert onto cutting board and cut jelly into desired shape.

Heston Blumenthal in The Big Fat Duck Cookbook

Saffron tagliatelle

250 g unsalted consommé
10 saffron threads
4.8 g high acyl gellan (1.9%)

Combine the three ingredients and bring to a boil. Allow to gel in a flat tray. Cut into 0.5 mm thick strips to make tagliatelle.

<http://www.texturasebulli.com>

Consommé macaroni

250 g beef and chicken stock
6.5 g gellan (2.6%)

Mix gellan with stock and blend. Bring to a boil and transfer to a container. Allow to gel and slice with a mandolin into 0.15 cm thick rectangles. Roll each rectangle with the help of a pvc-rod (0.3 cm in diameter) to make macaroni.

<http://www.texturasebulli.com>

Further recipes with gellan can be found in the section “Multi-hydrocolloid recipes” on page 93.



Guar gum

Tips and tricks

- In many recipes guar gum can be used interchangeably with xanthan gum
- Guar has a high water binding capacity (4 times greater than that of locust bean gum)
- Guar gum is often used together with xanthan in gluten free recipes to improve elasticity of doughs (see recipe for gluten free flour in the section "Multi-hydrocolloid recipes")
- Guar gum has almost 8 times the thickening power of corn starch and about 16 times the thickening power of flour.
- To a gluten free flour mixture without gums add 0.5% guar when used for cookies; 1.0% when used for cakes, muffins or quick bread; and 2.0% when the flour is to be used for bread/pizza

Name	guar gum (E412)
Origin	polysaccharide extracted from the seeds of the legume <i>Cyamopsis tetragonolobus</i>
Properties, texture	very stable, quick acting thickener, suitable for suspending particles
Clarity	transparent
Dispersion	cold water, d. is improved by mixing with sugar (3-5x) or <u>small</u> amounts of alcohol
Hydration (dissolution)	cold or hot water
pH	4-10
Setting	
Melting	
Promoter	
Inhibitor	low pH, alcohol
Tolerates	salt and sugar
Viscosity of solution	high in cold low in hot
Typical conc.	0.2-0.5% (very sticky solutions above 1%); [0.14-0.67%]*
Synergies	locust bean gum, xanthan
Syneresis	

* Concentrations in [square brackets] show range exemplified in this collection.

Banana ice cream

1000 g very cold water
120 g pecans, walnuts or cashews, chopped
2 large ripe bananas
170 g honey
2-3 g cinnamon
2.4 g guar gum (~0.14%)

Whirl pecans in blender until ground very fine. Gradually add 750 g very cold water. Blend on high until pecan mixture is very smooth. Add bananas, honey, cinnamon and guar gum. Blend until mixture is very smooth. Pour approximately half of the mixture into a 2 L ice cream maker. Blend 250 g cold water with mixture left in blender container and pour into ice cream maker. Stir to mix. Freeze according to manufacturer's instructions.

Marilyn Goannini via <http://www.bobsredmill.com>

Red raspberry freeze drink

500 g low fat milk, rice milk or soy milk
240 g frozen raspberries
120 g frozen apple juice concentrate
10 ice cubes
5 g vanilla extract
1.6 g guar gum (~0.17%)

Place all ingredients in blender and blend on high speed for 1 to 2 minutes.

Clair & Rita Bingham via <http://www.bobsredmill.com>

Tonka bean ice cream

230 g invert sugar (trimoline)
230 g sucranant (evaporated cane sugar)
1200 g cream
1200 g milk
1 tonka bean
8 g guar gum (0.28%)

Over medium heat, dissolve the sugars in the milk and cream. Add the tonka bean, bring to a boil, and reduce the heat. Add the guar gum to the mixture and blend with an immersion blender. Chill the ice cream overnight and spin for service with a Pacojet.

Elizabeth Falkner via <http://www.star chefs.com>

Strawberry gelato

1000 g strawberry puree, strained, with some seeds added back to mixture
1000 g whole milk
480 g sugar
80 g dextrose
10 g guar gum (0.38%)
malic acid
lemon juice
salt

Combine puree and milk. Temper in sugar, dextrose, and guar gum. Blend with an immersion blender. Allow to rest in the fridge for about 8 h. Adjust for acidity with the malic acid, lemon juice, and salt. Spin in a batch freezer only (do not use Pacojet).

Brooks Headley via <http://www.star chefs.com>



Photo by Allen Hemberger

Applewood ice cream

200 g apple-wood sawdust
1000 g whole milk
100 g heavy cream
75 g sugar
50 g egg yolk
25 g glucose
3 g guar gum (0.46%)

Toast sawdust for 20 min at 180 °C. Bring milk to boil and pour over sawdust. Leave to steep in refrigerator over night.

Bring 400 g infused milk and cream to a simmer. In a bowl, whisk together sugar and egg yolk. Slowly whisk cream mixture into yolk mixture to temper. Return combined mixtures to saucepan. Over medium-low heat, whisk until mixture is thick enough to coat back of spoon. Remove from heat and add glucose. Transfer to blender, add guar gum and blend on high speed for 3 min or until smooth. Freeze and process with pacojet.

Grant Achatz in *Alinea*

Fruit sauce

140 g ripe berries or chopped fruit
50 g sugar or 85 g honey
40-60 g water
1.6 g guar gum (0.67%)
1.3 g fresh lemon juice

Bring fruit, sugar and water to boil. Remove from heat and cool for 10-20 min. Add more sugar if desired. Stir in the gum and mix with a stand blender or an immersion blender. Stir in the lemon juice and strain. Adjust taste with more lemon juice and consistency with water.

*) Alternatively use 0.9 g xanthan (0.38%)

Elizabeth Falkner in Demolition desserts

Gluten free flour

525 g rice flour, brown
60 g potato starch
115 g tapioca starch
220 g sweet rice flour
60 g cornstarch

Recommended amount of guar varies:

For bread/pizza: 20 g guar gum (2.0%)

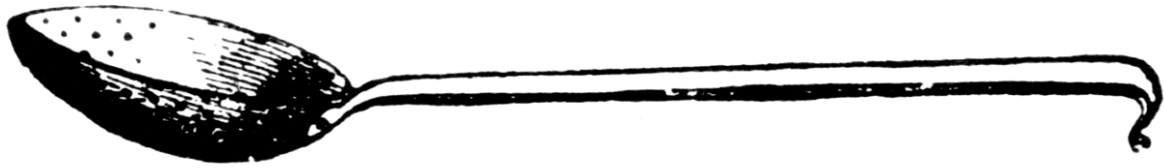
For cakes/quick bread: 10 g guar gum (1.0%)

For cookies: 5 g guar gum (0.5%)

Mix and use as a replacement for wheat flour.
The recommended amount of guar gum depends on the intended use of the flour.

<https://cookingglutenfree.com/>

Further recipes with guar gum can be found in the section “Multi-hydrocolloid recipes” on page 93 .



Gum arabic

Photo of raw gum arabic



Photo by Michael A. Nestrud

Marshmallows

2 egg whites (~70 g)
15 g marsh mallow roots
500 g gum arabic (22%)
500 g sugar
1250 g water
color (optional)
15 g orange blossom extract
20 g cornstarch

Wash the roots (peel fresh roots) and slice into small pieces. Whisk egg whites hard. Bring the pieces of root to boil in the water. Leave to simmer for 30 min. Strain through strainer, coffee filter or towel. Pour the gum arabic into the hot water. Under mild heat stir with a wooden spoon to dissolve completely. Continue to stir. Disperse the sugar in the solution and evaporate till the liquid is syrupy. Add in the egg whites and flavoring. Continue

to evaporate while whisking. Add any coloring now. Whisk in. Sift the starch over a tray or a piece of baking paper or foil. Pour the paste over the starch. Leave to set several hours. Unmold or remove from container and cut into pieces or strings.

Variation: Replace 250 g water and 50 g sugar by 150 g flavored cordial (mint, violet, poppy, raspberry...)

<http://www.gastronomie.kalys.com>

Hard gums

12.7 kg gum arabic (36%)
11.3 kg water
6.8 kg sugar
1.8 kg glucose syrup
2.26 kg water
0.45-0.68 kg glycerol
flavor and acids as desired

Soak gum arabic in 11.3 kg water with gentle warming and stirring until gum is dissolved. Strain to remove particles and foreign matter. Dissolve sugar and glucose syrup in 2.26 kg water and boil to 124 °C. Pour syrup mixture into gum solution and gently mix. Skim off any scum that rises upon standing. Deposit the clear solution in starch (dried to 4-5% moisture). Leave for 6-10 days at 49 °C. Brush of starch. Glaze/polish as desired.

B. W. Minifie in Chocolate, Cocoa and Confectionary

Soft gums and pastilles

4.1 kg sugar
4.1 kg glucose
3.1 kg fruit concentrate or pulp
water
citric acid
3.1 kg gum arabic (56%)
3.1 kg water
0.45 kg gelatin, bloomed

Dissolve sugar and glucose in fruit juice concentrate or pulp. Add water and citric acid as desired. Boil to 121 °C. Dissolve gum arabic in 3.1 kg water. Bloom gelatin and dissolve in gum solution by heating. Add gum/gelatin solution to syrup and mix well. Pour into dry starch. Leave in a hot room until desired texture is obtained. Remove starch, steam and coat with sugar.

B. W. Minifie in Chocolate, Cocoa and Confectionary

Candied rose petals

1 T gum arabic
1 T warm water (or rose water)
20 rose petals
30 g powdered sugar

Gently rinse petals and pat them dry. Dissolve gum in water until smooth. Strain to remove any remaining lumps. With a brush, paint both sides of the petals with the gum mixture. Sprinkle with superfine powdered sugar. Leave to air dry. When dry, store in air tight container for up to 3 months. Variation: rose petals can be replaced by violets, borage or dianthus.

Kitty Morse in Edible flowers



Isomalt

Apple and vanilla tuile

1000 g granny smith apples – peeled and cored
200 g water
1 vanilla pod
200 g isomalt (14%)
2 lemons, juiced

Peel, core and chop apples into small pieces and place in a saucepan. Add water, scraped seeds of the vanilla pod and lemon juice. Cover pan and cook on low heat until apple is very soft. Remove from the heat and allow to cool. Pureé apple and pass through a fine sieve into a pan. Add isomalt and bring to a boil, stirring constantly. Spread a thin layer of the pureé onto a silpat and dry in a cool oven at 80-95 °C until the tuile is crisp (when cooled to room temperature). This usually takes 2-6 hours. Tuiles can be moulded when warm and should be stored in a cool dry area in an airtight container, with some silica gel crystals.

<http://www.shaker-uk.com> via <http://zh-cn.facebook.com/topic.php?uid=2383569954&topic=3217>

Apple vinegar meringue

15 g egg white powder
130 g water
10 g apple balsamic vinegar
50 g sugar
50 g isomalt (19%)
7.5 g dried verbena

Dissolve egg white in 100 g water. Combine remaining water, vinegar, sugar and isomalt and heat in pan to 121 °C to yield a caramel. Whisk egg white mixture to soft peaks. Whisk caramel into egg whites. Add verbena. Whisk

until bowl is cool. Spread/pipe meringue onto tray and dry for 12 h at 55 °C.

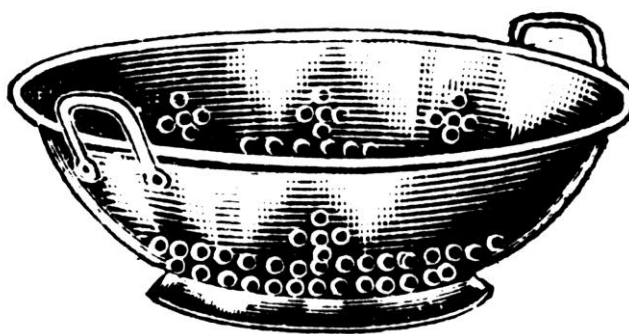
René Redzepi in NOMA

Pepper tuiles

200 g isomalt (50%)
200 glucose syrup 42DE
2 peppercorns

Combine isomalt and glucose in a small pan and heat to 158 °C. Pour the hot caramel onto parchment paper or a silicone mat. Leave to cool. When cold, break into small pieces and blend in a food processor with peppercorns to a fine powder. Preheat oven to 150 °C. Transfer powder to a fine sieve and dust surface of silicone mat with a 1 mm thick layer. Place in oven until powder melts. Remove from oven and leave to cool. Break into suitably sized pieces. Store tuiles in a dry, airtight container (preferably with packets of silica to keep air humidity low).

Heston Blumenthal in The Big Fat Duck Cookbook



Konjac

Tips and tricks

- Konjac is sold under several different names including konjac flour, konjac mannan and konjac glucomannan.
- Under alkaline conditions konjac forms a thermoirreversible gel well known in Japan as *konnyaku* (gel) or *shirataki* (noodles).
- Cornstarch can be replaced in recipes by a smaller amount of konjac flour

Name	<i>konjac glucomannan (E425)</i>
Origin	polysaccharide extracted from the tuber <i>Lasioideae Amorphophallus</i>
Properties, texture	shear-thinning viscous sol. with fatty mouth feel; thermoreversible elastic gels w. xanthan/kappa carrageenan; <i>thermoirreversible</i> gels at pH 9-10
Clarity	transparent
Dispersion	cold water; d. can be improved by mixing with sugar or flour (3-5x).
Hydration (dissolution)	cold water with continuous stirring for at least 2h
pH	~3-10
Setting	gelling: pH >9 followed by heating > 80 °C
Melting	w. xanthan: yes, alkaline gels: no
Promoter	xanthan, kappa carrageenan
Inhibitor	viscosity decreases with decreasing pH; gelling occurs at higher pH.
Tolerates	salt, acidic foods
Viscosity of solution	low temperature: high high temperature: lower
Typical conc.	0.1-0.3% for viscous solutions; [0.39-1.1%]*
Synergies	xanthan, kappa carrageenan, locust bean gum
Syneresis	

* Concentrations in [square brackets] show range exemplified in this collection.

Konjac dondurma

- 1600 g whole milk
- 410 g sugar
- 8 g konjac (Nutricol GP312 used) (0.39%)
- 2 g mastic (optional)

Slowly whisk konjac into milk and set aside for 30 min to thicken. Heat to 50 °C in a 4L pot and whisk in sugar and mastic. Boil for 15 min while constantly whisking. Beat mixture in stand mixer with paddle for 30 min until cool. Slowly add liquid nitrogen, 100 g at a time in 1-2 min intervals. Ice cream reaches its optimal texture at -12 °C. Chewiness/stretchiness is increased by further beating or mixing with dough hook. Ice cream be frozen in an ice cream maker followed by beating by hand to increase chewiness/stretchiness.

*Arielle Johnson, Kent Kirschbaum and Anne E. McBride
in The Kitchen as Laboratory*

Alkaline konjac gel

- 6 g konjac flour (~1%)
- 500 g water
- ¼ t pickling lime (food grade lime, Ca(OH)₂)
- 75 g water

Bring 500 g water and konjac flour to boil stirring continuously. Keep boiling for about 3 min. In a separate pot dissolve lime in 75 g water. Add it to the boiling solution and continue stirring for about 5 minutes without taking it off the flame. Upon cooling a thermoirreversible gel is formed. It is known in Japanese as *konnyaku* (gel) or *shirataki* (noodles) depending on the shape.

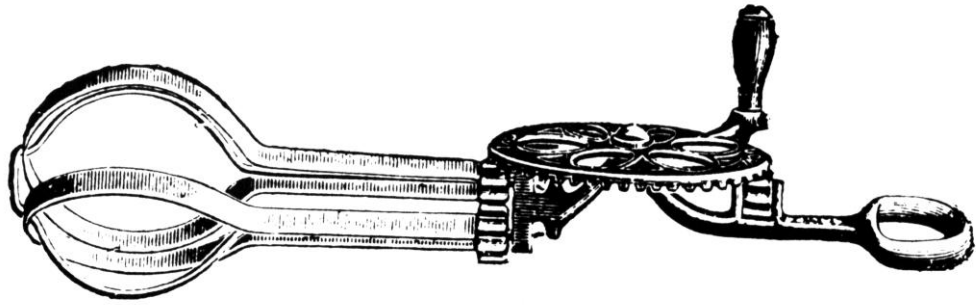
<http://www.konjacfoods.com>

Konjac dondurma (chewy ice cream)

3 g konjac flour (1.1%)
70 g milk
80 g cream
2 egg yolks (~40 g)
50 g sugar
20 g honey
vanilla extract

Pour milk in saucepan and stir in konjac flour. Add cream and heat until gooey and smooth. Use immersion blender if necessary. Do not boil the mixture. Mix egg yolks and sugar in a separate bowl, add to the saucepan and blend until smooth. Add vanilla extract. Pour into a container and freeze for 2 hours, take it out and mix well. Freeze again, and mix again.

*<http://cookpad.com/mykitchen/recipe/267889> via
<http://www.chowhound.com/topics/484961>*



Lecithin

Technically not a hydrocolloid, but it is included here for completeness regarding texture modifiers. Lecithin is a phospholipid and most frequently encountered in egg yolks. Commercially available lecithin is normally produced from soya beans.

Tips and tricks

- lecithin has good emulsifying properties
- lecithin enhances elasticity of flour based doughs
- when using lecithin for airs and foams, use a wide flat container to allow the air to collect
- very little lecithin is needed for foaming, the exact amount depends on proportion of water and oil in mix; adding too much will destabilize the foam

Emulsified vinaigrette

50 g vinegar or lemon juice
100 g olive oil
herbs & spices, mustard, garlic, onion etc.
0.3 g lecithin (0.2%)
0.15-0.60 g xanthan (0.1-0.4%)

Mix everything with an immersion blender. If desired, thicken with xanthan.

Martin Lersch



Photo by Robert Gaffney

Lime air

225 g lime juice
275 g water
1.5 g lecithin (0.3%)

Combine the three ingredients and use a hand-held mixer on the surface of the liquid; allow to stabilize for one minute and collect the air that has formed on top.

<http://www.texturasebulli.com>

Frozen parmesan air

Parmesan solution

500 g grated parmesan
450 g water

Parmesan air

250 g parmesan solution
1.3 g lecithin (0.52%)

Mix the parmesan with the water and gradually heat to 80 °C. Steep for 30 minutes and strain. Add 1.3 g of lecithin for every 250 g of parmesan solution obtained. Use a hand-held mixer on the surface of the liquid, allow to stabilize for one minute and collect the air that has formed on top. Freeze the air in a container of choice.

<http://www.texturasebulli.com>

Peachy soy ice cream

700 g soy milk
350 mL fresh or frozen peaches, sliced
100-200 g sugar (to taste)
50 g soy oil (optional)
6.9 g lecithin (0.56%)
4.4 g vanilla flavoring or 1 whole vanilla bean
pinch of salt

If using a whole vanilla bean, split it down the sides and halve it lengthwise. Scrape out the insides and use the inner vanilla bean scrapings for flavoring (Do not use the bean casing). Blend all the ingredients together in a blender until smooth and creamy. If you prefer chunks of peaches, chop the peaches separately and fold into the soymilk mixture just before freezing. Freeze according to your ice cream maker instructions.

<http://www.recipezaar.com/123833>

Soy sauce air

300 g soy sauce
200 g water
3 g lecithin (0.6%)

Mix all the ingredients with the help of a hand blender and let it rest for a few minutes. Blend once again with the hand blender, bringing in as much air as possible into the mix, to build a foam layer on top of it. Let it rest for 1 minute and pick up the foam with help of a kitchen skimmer.

<http://souschef.co.nz/Emulsifiers-Gellifiers.pdf>

Tea air

1000 g milk
200 g muscovado sugar
20 g lapsang soochong
10 g lecithin (0.83%)

Bring milk and sugar to a boil, infuse tea four minutes. Strain, add lecithin, and froth with emulsifying blade of immersion blender.

<http://willpowder.net>

Orange air with olive oil

300 g orange juice
15 g rose water
200 mL olive oil
5 g lecithin (0.96%)

Heat rose water with a portion of the orange juice. Add the remaining juice, olive oil and lecithin. Pour into a wide, flat container which allows foam to collect on the sides. Foam with an immersion blender held on the surface of the liquid. Freeze air with liquid nitrogen and serve immediately.

[Heiko Antoniewicz](#)

Apple strudel

6 apples, thinly sliced
155 g currents or chopped raisins
165 g blanched almonds
75 g chopped dates
1 t vanilla
1 t cardamom

For pastry

180 g whole wheat flour
120 g cold water
2 t oil
6.9 g lecithin (2.2%)
pinch of salt

Mix flour and salt together, add oil and lecithin; mix well. Add water, handling as little as possible. Roll pastry out very thin on a large

smooth slightly floured kitchen towel (stretch pastry).

Combine all ingredients for filling. Spread the apple filling on pastry to about 5 cm of one end of pastry and all over the rest. Lift one end of the towel so it begins to roll. Roll it onto a cookie sheet and tuck ends under. Bake at 160-180 °C for 1 hour. Slice like a jelly roll and serve with vanilla ice cream.

<http://www.cooks.com>

Bread machine dough enhancer

230 mL lecithin granules
1 T vitamin C powder
1 T ground ginger

Mix ingredients and store in a tightly closed glass jar. Use the same amount of enhancer as the yeast. The ginger boosts the yeast, and makes it act more swiftly. The ascorbic acid (vitamin C), strengthens the gluten. The lecithin granules aids the oil in causing the strands of gluten to slip against each other more easily.

<http://www.recipezaar.com/89744>

Further recipes with lecithin can be found in the section “Multi-hydrocolloid recipes” on page 93 .



Locust bean gum

Tips and tricks

- In frozen products locust bean gum retards ice crystal growth which improves the mouth feel, especially after several thaw-freeze cycles
- Addition of 0.2% locust bean gum renders bakery fillings in pumpkin pies and fruit tart fillings bake stable and less prone to boil out

Name	<i>locust (carob) bean gum (E410)</i>
Origin	polysaccharide extracted from the seeds of the legume <i>Ceratonia siliqua</i>
Properties, texture	thickener, often used in ice cream; elastic gel in 1:1 ratio with xanthan
Clarity	
Dispersion	cold water; d. can be improved by mixing with sugar (3-5x).
Hydration (dissolution)	> 90 °C
pH	4-10
Setting	
Melting	
Promoter	will only gel in presence of agar, kappa carrageenan or xanthan
Inhibitor	
Tolerates	
Viscosity of solution	low temperature: high highest viscosity obtained > 60 °C
Typical conc.	0.1-1.0%; [0.32-0.9%]*
Synergies	xanthan, kappa carrageenan
Syneresis	

* Concentrations in [square brackets] show range exemplified in this collection.

Lemon sorbet

500 g water
550 g caster sugar
100 g glucose
5-6 g locust bean gum (0.32-0.38%)
500 g lemon juice
citric acid

Bring water, sugar, glucose and lemon juice to a boil. Boil until 15° Baume. Add locust bean gum while stirring. Strain to remove lumps and cool in a refrigerator. Transfer to a low container and freeze. When frozen, transfer to a food processor and churn to introduce air (the color changes from yellow to white). Return to freezer. Serve.

<http://www.chefsimon.com>

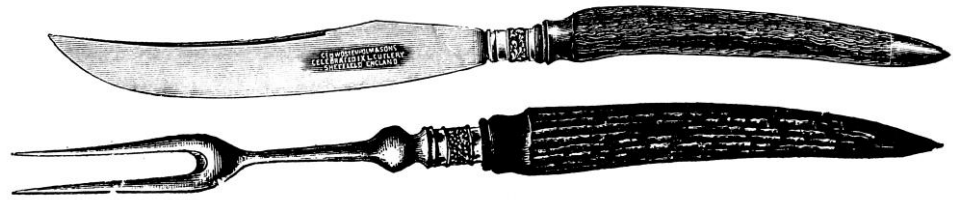
Super foamy milkshake

2 g locust bean gum (0.9%)
10 g inulin
10 g sweet whey powder
200 g skimmed milk (0.1 % fat)
flavor, syrup and sweetener as desired

Add locust bean gum, inulin powder and sweet whey powder to milk in a blender or mix in a bowl with an electric mixer. When choosing flavors, consider that fats/oils will make the foam collapse.

<http://en.wikibooks.org/wiki/Cookbook:Milkshake>

Further recipes with locust bean gum can be found in the section “Multi-hydrocolloid recipes” on page 93 .



Maltodextrin

Tips and tricks

- Several commercially available hydrocolloids are preblended with maltodextrin. This helps dispersion.



Photo by Linda Ancil

Roasted flour nuggets

40 g all purpose flour
8 g confectioners sugar
0.5 g salt
13 g tapioca maltodextrin (14%)
30 g unsalted butter, melted

Note: Roasting alters the starch and gluten, and the flour loses much of its elasticity and yields a sandy texture.

Preheat oven to 160 °C. Spread flour in an even layer on a baking sheet and roast in oven for about 45 minutes, stirring often until fragrant and golden. Cool completely. Toasted flour can be made ahead and kept in a sealed container. Preheat oven to 180 °C. Place the flour, sugar, salt and maltodextrin in a bowl and toss to combine. Slowly drizzle in melted butter while tossing with a fork. Remove rounded nuggets as they form and place on a baking sheet. Bake for 10-12 minutes and allow to cool completely before handling.

<http://www.playingwithfireandwater.com/foodplay/2008/07/blueberry-pie.html>

Brown butter pebbles

250 g brown butter fat (77%)
~75 g tapioca maltodextrin (23%)
5 g salt, finely ground

Strain the brown butter fat of solids. While still warm, mix it with the tapioca maltodextrin as if making a powder. Season with salt. Add tapioca maltodextrin to the point where the paste can easily be rolled into balls that will hold together but not stick too much to your hands. Place them on parchment paper on a sheet pan, without touching other balls. Toast for 3-5 minutes at 190 °C. Let them cool completely then hold them in an airtight container until you want to use them.

David Barzelay, http://www.eatfoo.com/archives/2010/04/morels_brown_butter_lemon_almo.php

Olive oil powder

80 g olive oil
25 g tapioca maltodextrin (24%)

3 g salt

Whisk together oil, maltodextrin and salt to form a powder. Reserve in airtight container.

Grant Achatz in Alinea



Photo by Allen Hemberger

Dry caramel

Caramel base

375 g sugar
350 g sugar
500 g heavy cream
100 g butter

Dry caramel

210 g caramel base
65 g tapioca maltodextrin (24%)

Caramel base: Heat sugar, glucose, cream and butter over medium heat to 110 °C. Pour onto sheet tray lined with silicone mat. Let cool to room temperature.

Dry caramel: Combine caramel base and maltodextrin in food processor and process until caramel base is completely absorbed.

Grant Achatz in Alinea

White chocolate powder

80 g tapioca maltodextrin (40% of final composition)
120 g melted white chocolate

Place starch in Robot Coupe and add melted white chocolate. Spin machine and scrape side and bottom with spatula. Add starch as needed to create desired texture. For a fluffier chocolate powder, pass through tamis.

Adrian Vasquez via <http://www.star chefs.com>



The Nutella powder pictured was made with a 25:75 ratio of tapioca maltodextrin and Nutella.

Photo by Ivan Shaw

Nutella powder

80 g tapioca maltodextrin (40%)
120 g Nutella (60%)

Combine ingredients in a food processor. Process until the mixture has the texture of soil. Pass mixture through a tamis or fine-meshed sieve to lighten its texture. Store in a cool dry place until ready to serve.

<http://hungryinhogtown.typepad.com>

Powdered cheese

100 g semi-hard cheese, grated
30 g water
0.4 g sodium citrate
200 g tapioca maltodextrin (61%)

Preheat oven to 80-100 °C. Mix cheese, water and sodium citrate. Heat until completely melted. Stir to obtain even mixture. Transfer cheese mixture to food processor and work in 200 g tapioca maltodextrin to form a paste. Spread a thin layer on a silpat and bake until dry and brittle (2-3 h). Process cheese mixture in a food processor (or clean coffee grinder) to a fine powder. Add more tapioca maltodextrin if necessary (~15 g).

Maxime Bilet and Scott Heimendinger, via <http://jetcitygastrophysics.com/2011/02/11/the-most-pretentious-mac-cheese-ever/>

Bitter almond oil crumbs

12 g virgin almond oil
10 g green almond oil of prune
40 g maltodextrin (65% of final composition)

Mix the two oils and reserve. Add the oil mixture slowly to the maltodextrin, mixing constantly with a hand blender until individual crumbs begin to appear. Set aside at room temperature. Heat the crumbs in a frying pan until they begin to take on a round shape and light crunchy coating.

<http://www.texturasebulli.com>



Photo by Ahmet Ayvaz

Bacon powder

60 mL tapioca maltodextrin (N-Zorbit M)
120 mL rendered bacon fat

Add most of the maltodextrin to a bowl and drizzle in the bacon fat, scraping the sides of the bowl with a spatula and mixing well. Add more maltodextrin until desired texture is achieved.

Morou via <http://baconshow.blogspot.com>

Sour mix recipe

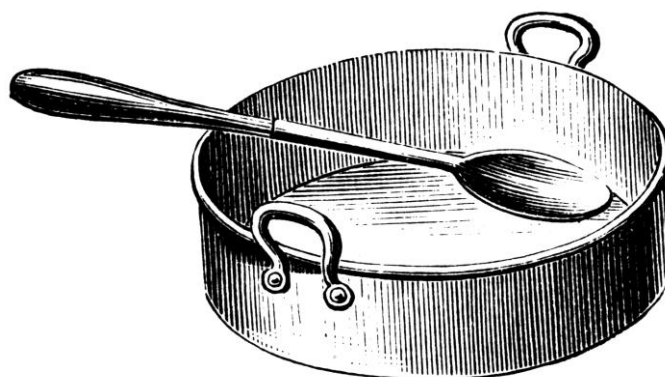
310 g sugar
85 g corn syrup
120 mL maltodextrin
120 g fresh lemon juice
120 g fresh lime juice
20 g lime zest
8 g dehydrated egg white (optional)
12 g citric acid
480 g water

Mix water, sugar, maltodextrin and zest in a pot and gently heat until all the sugars have dissolved. Turn off the heat and add the

remaining ingredients, stirring until dissolved. Strain the mix into a 1 liter bottle. Maltodextrin increases the viscosity of the sour mix, and if egg whites are skipped, it also provides some foaming capability.

<http://www.theartofdrink.com>

For more recipes, please refer to the keyword and ingredient index.



Methyl cellulose

Tips and tricks

- A large range of methyl cellulose products are available, for instance with different gelling temperatures. Consult specialized text books or the manufacturer for details for your particular application.
- Since methyl cellulose gels when heated it is often used for shape retention in products that tend to fall apart when heated
- Methyl cellulose can be used to prevent boil out of fruit fillings in bakery
- A range of cellulose derivatives are available in addition to methyl cellulose including CMC (carboxymethyl cellulose), HPC (hydroxypropyl cellulose) and HPMC (hydroxypropyl cellulose) to mention a few. Users of these are advised to contact the supplier for recipes and detailed instructions for their use.

Name	<i>methyl cellulose (E461)</i>
Origin	a modified polysaccharide derived from cellulose rich plants.
Texture	thermoreversible soft elastic gel when heated; helps form and stabilize foams when cold
Clarity	
Dispersion	hot or cold water, use slow speed to avoid foaming; mix with small amount of hot water to avoid lumps and stir into the rest of the cold water
Hydration (dissolution)	cold water, leave over night; add salt after complete hydration
pH	2-13
Setting	gels when heated to 50-60 °C
Melting	melts below the setting temperature
Promoter	salt lowers setting temperature
Inhibitor	alcohol rises setting temperature
Tolerates	acids, bases
Viscosity of solution	low when cold, high when hot
Typical concentration	1-2% for gels; [0.26-3.4%]*
Synergies	
Syneresis	yes

* Concentrations in [square brackets] show range exemplified in this collection.

Cream cheese noodles

370 g cream cheese
160 g water
1.3 g methyl cellulose (0.26%)

In saucepan, heat water to 85 °C and vigorously whisk in methyl cellulose. Add mixture to cream cheese and stir well to combine. Place mixture over ice bath and whisk until cooled to 10 °C. Store at or below 10 °C for 2 hours to allow complete hydration. Transfer to squeeze bottle. Bring two liters of water to simmer and pipe in cream cheese mixture to form noodles. Drain noodles as soon as they become firm (takes about 30 seconds).

Wylie Dufresne in Art Culinaire, spring 2006

Olive oil soba noodles

2 g methyl cellulose (0.70%)
80 g water (room tempered)
1 g salt
200 g olive oil (room tempered)

Dissolve methyl cellulose in water. Leave over night so air bubbles can escape. Add salt and olive oil slowly, like when making mayonnaise. Use a good olive oil – preferably a mild, fruity one rather than a bitter one (Valerrama Hojiblanca). Use a whisk rather than an immersion blender when mixing. Transfer mixture to syringe (or equivalent) and extrude into hot, clear liquids/soups.

Joachim Eisenberger via <http://www.bosfood.de>

Tender broad bean balls

Methyl cellulose mix
100 g water
3 g methyl cellulose

For broad bean balls
65 g shelled tender broad beans
20 g methyl cellulose mix (0.7% in final comp.)

Mix the two ingredients at room temperature in the blender to obtain a lump-free mixture. Strain and leave to sit in the refrigerator for 24 h. Mix the shelled tender broad beans with the methyl cellulose mixture. Make 8 balls of 8.5 g each. Keep in the refrigerator. Put the balls in salted water which has been kept hot at 90 °C and leave to cook for 1 min.

<http://www.texturaselbulli.com>

Parmesan pasta

70 g water
2 g methylcellulose SGA 150 (0.74%)
200 g grated Parmesan

Blend water and methylcellulose together with an immersion blender and set in the refrigerator for at least 4 hours to hydrate. Add the solution to grated Parmesan a little at a time—just enough to form a dough—and shape as desired. The easiest way to handle them is to roll them into little snakes and then cut them into gnocchi. Poach in simmering water until they float, then remove with a slotted spoon and place in bowls of hot consommé.

Linda Anctil via <http://www.chronogram.com>



Photo by Eddie Shepherd

Tempura batter

250 g water
8 g methylcellulose (0.75%)
350 g vodka
200 g water
250 g flour (or rice flour)
pinch salt
pinch chilli powder

Blend methylcellulose into 250 g of the water using a hand blender. Whisk vodka into flour. Season with salt and chilli powder. Add methylcellulose mixture into the flour and whisk in the remaining 200 g of water. Whisk batter until smooth and pour through a sieve. Transfer 500 g of the batter to a cream whipper and charge twice with carbon dioxide (soda chargers). Give whipper a good shake and leave to chill in fridge for 2 hours or more. Dispense tempura into large mixing bowl. Dip ingredients to be fried into a little flour then into the batter before gently placing them in a deep fat fryer (at 190 °C). Only fry a few tempuras at a time. The tempura will cook in less than two minutes.

Eddie Shepherd via <http://www.veggiechef.co.uk/Blog/files/tag-tempura.html>

Cellulose stabilized foam

100 g broth or juice
1-1.5 g methyl cellulose (1-1.5%)

Disperse methyl cellulose and chill overnight.
Whisk at high speed or foam with a siphon.

<http://www.inicon.net>

Hot mozzarella sheets

Mozzarella base

560 g buffalo mozzarella
70 g mozzarella water
15 g olive oil
1 g salt

Mozzarella sheets

646 g mozzarella base
161.5 g water
10.1 g methyl cellulose (1.25%), *Methocel A15C*

Base: Blend ingredients until smooth to make a mozzarella base.

Sheets: Bring water to a boil and disperse the methyl cellulose in the simmering water. When the methyl cellulose is incorporated add the water mixture to the mozzarella base and shear until the mixture is smooth and shiny. Place the mozzarella mixture in a bowl over an ice bath and chill till cold. Spread the mozzarella base in thin sheets on a non-stick surface and bake in a low oven until the mixture gels. Remove the hot mozzarella and use sheets for draping.

Kamozawa and Talbot via <http://ideasinfood.typepad.com>



Photo by Jeff Potter

Marshmallow

230 g water
90 g sugar
4.5 g methyl cellulose (1.4%), *E15*
1/2 t vanilla
confectioners sugar

Bring water and sugar to a boil. Let cool. Add methylcellulose and vanilla. Blend with immersion blender. Cover and chill for 2 hours or until thickened. Transfer to a mixing bowl and beat at high speed until fluffy, 2-3 minutes. Spread out on a silpat or mold and bake at 150 °C for 5-8 minutes or until set. Unmold or cut into desired shape. Sprinkle with confectioners sugar and apply a blowtorch or place under broiler until browned. Serve hot. Notice that these marshmallows will melt when cooled!

<http://www.playingwithfireandwater.com>



Photo by Linda Anctil

Corn pudding

400 g corn juice, extracted with a juicer
160 g cream cheese
20 g cheddar powder
8.5 g methyl cellulose (1.4%), *Methocel SGA150*
salt, to taste

Place 1/2 of the corn juice and the cream cheese in a saucepan and heat over medium heat until cream cheese is melted. Remove from heat and add the remaining juice, the cheddar powder and methyl cellulose. Blend well with an immersion blender, cover and chill for at least 4 hours to hydrate. When ready to bake, preheat the oven to 120 °C. and stir in the salt. Fill molds and bake for 10-20 minutes, depending on the capacity of molds. Unmold and serve immediately or hold in a 90 °C oven for up to 20 minutes.

<http://www.playingwithfireandwater.com/foodplay/2008/06/corn-pudding.html>



Photo by Daniel Campagna (substituted carrots for potatoes)

Reconstructed potato

160 g hot potato puree
75 g milk, cream, or buttermilk
15 g butter
salt
100 g water
5 g methyl cellulose (1.4%), *Methocel SGA150*

To make potato puree: Peel potatoes and cut into chunks. Drop into boiling, salted water and cook until very tender. Drain and pass through a ricer, tamis or sieve 2-3 times or until a very smooth texture is achieved. This is best made just before proceeding with recipe, while still hot.

Combine hot potato puree with milk, butter, and salt, stirring vigorously until butter melts.

Add methocel to water and blend it in with an immersion blender. Combine gel with potato mixture, stirring until well blended. Cover and chill overnight in refrigerator. The next day, preheat oven to 120 °C. Fill molds with potato mixture and bake for 8-10 minutes, or until firm. Remove from oven and unmold. If desired, proceed as described in the reference to coat potatoes with raclette cheese.

<http://www.playingwithfireandwater.com/foodplay/2008/08/raclette-potato.html>



Photo by Alexander Talbot

Hot vanilla ice cream

306 g whole milk yogurt
230 g cream cheese
80 g agave nectar
154 g water
1 Bourbon vanilla bean scraped
pinch of sea salt
11.55 g methyl cellulose (1.5 %), *Methocel SGA 150*

Blend yogurt, cream cheese, agave nectar, vanilla seeds and salt until smooth, but do not aerate. Disperse methyl cellulose in boiling hot water while whisking. Once dispersed, add it to the blender and purée until mixture is homogenized, again avoid aeration. Pour into bowl over an ice bath to chill and leave to rest for at least an hour, preferably over night.

Heat a pot of water and shut off the heat when it boils. Scoop the ice cream base, wipe the edges of the ice cream scoop, and immerse the scoop and its contents into the hot water. When the ice cream sets, dislodge it from the scoop. The ice cream should poach for about one minute for small scoops and longer for larger scoops. You may have to turn the heat back on to keep the water hot. Once the ice cream is set, remove the scoops, drain briefly on a paper towel and place into serving dishes and garnish. As the mixture chills the ice cream will “melt”, blending with the garnishes like an actual cold ice cream sundae.

Kamozawa and Talbot via <http://ideasinfood.typepad.com>

Thin film (brittle, melting)

100 g water
1.5 g sugar
1.5 g methyl cellulose (1.5%)

Mix the powder of methyl cellulose with sugar. Heat up 1/3 of the water until the first bubble of boiling. Pour the powder of methyl cellulose and sugar in rain while moving. Put it in a mixer or in a blender to homogenize the solution. Add the remaining water in the mixture, continue to mix the solution for 30 min. Take 10 g of solution, pour it in a Petri dish (flat dish with diameter of 10 cm). Let the solution dry at room temperature for 48 hours. The thickness of the film is approximately 0.1 mm.

Adapted from <http://www.inicon.net>



Photo by Linda Anctil

Gouda fries

Methyl cellulose solution
75 g water
3 g methyl cellulose, SGA 150 (3.8%)

Cheese mixture
112 g aged gouda, grated
40 g rice flour
64 g methyl cellulose solution
(1.6% methyl cellulose in final comp.)

Mix methyl cellulose and water with an immersion blender. Chill >4h to allow methyl cellulose to hydrate. Mix grated cheese and rice flour in a bowl. Drizzle 64 g of methyl cellulose solution and mix to obtain a uniform dough. Roll to 1 cm thickness between two sheets of plastic wrap. Cut into 1 x 1 x 8 cm batonnets. Brown evenly on all sides in a lightly greased nonstick skillet.

*Linda Anctil,
<http://www.playingwithfireandwater.com/foodplay/2010/10/gouda-fries.html>*

Thick film (like plastic/leather)

100 g water (or broth, juice etc.)
2 g methyl cellulose (2%)
3 g glycerol

Disperse methyl cellulose in water and chill over night. On the next day add glycerol and stir carefully to avoid foaming. Pour 1 to 1.5 mm high on a silicone mat, mold or tray and leave to dry at room temperature for 2 days. Remove and cut/shape as desired.

Adapted from <http://www.inicon.net>

Basic recipe for hot melting jelly

2 g methyl cellulose (2%)
100 g water (or flavored liquid)

Disperse methyl cellulose in cold water. Leave in fridge over night for hydration. Portion out and heat in a water bath or in a microwave oven to set. The gel melts upon cooling.

<http://www.inicon.net>

Soya burgers

soy protein 21%
vegetable fat 15%
starch 2%
potato flour 2%
methyl cellulose 2%, *Benece1 M043*
dried onion 1.5%
salt 1%
seasonings and flavors 0.5%
water to 100%

Methyl cellulose gels when heated. This gives shape retention. Since the gelling is thermoreversible, it is not noticed in the final product.

CRC handbook of hydrocolloids



Photo by Daniel Zaccariello (who substituted prune juice for carrot juice)

Crispy carrot foam

250 g carrot juice
50 g water
50 g sugar
8 g methyl cellulose (2.2%), *Methocel F50*

Bring carrot juice, water and sugar to a boil. Remove from heat, pour into bowl and refrigerate until chilled. Add methyl cellulose to 250 g of the chilled carrot juice and blend with immersion blender. Transfer to stand mixer with whisk attachment. Whip on high speed for 10 min or until stiff peaks form. Pour onto silicone mat and spread out evenly. Transfer mat to dehydrator and dry at 55 °C for 5 h or until crisp. Reserve in airtight container.

Grant Achatz in Alinea

Hot Bailey's ice cream

100 g espresso, cold
50 g milk
50 g Bailey's
10 g sugar
7 g methyl cellulose (3.2%)

Mix all ingredients together and leave in fridge overnight for proper hydration. Fill an ice cube freezing bag with the coffee mix. Heat the bag in water at 40-60 °C for 8 min. Cut out "ice cream" cubes and serve immediately.

Rolf Caviezel in Molekulare Küche

Parsley spaghetti with porcini soup

For the spaghetti
parsley
400 g water
1 pinch of salt
24 g olive oil

15 g methyl cellulose (3.4%), *Metil from Texturas* was used

For the soup

500 g beef stock
150 g porcini
100 g lean meat for clarification
70 g cubed root vegetables
1 egg white (~35 g)
1 sprig rosemary and thyme
1 T soy sauce

Blitz parsley with water with an immersion blender. Add methyl cellulose at slow speed (to avoid incorporation of bubbles). Add salt and olive oil while still blending at slow speed. Leave over night in fridge. For serving: fill syringe and inject into hot soup at the table.

Heiko Antoniewicz

Further recipes with methyl cellulose can be found in the section “Multi-hydrocolloid recipes” on page 93.



Pectin

Tips and tricks

- Pectin is very sensitive to pH, sugar content and cations. Furthermore a range of pectins with varying degrees of methoxylation are available. Please refer to textbooks for more details.
- Consider that the natural pectin content of fruit varies. Low pectin fruit include strawberry, peach, raspberry, pineapple. Medium pectin fruit: blackberry, apricot. High pectin fruit: apple, gooseberry, plum, quince, redcurrant, blackcurrant.
- I've decided not to include recipes were one relies on the pectin which is naturally present such as membrillo, fruit cheese, jellies, jams, marmalades.
- Low methoxyl pectin gels in presence of calcium ions and can be used for spherification just like sodium alginate.
- If the type of pectin is not specified it is most likely a HM pectin which gels at low pH in the presence of high sugar concentration
- Special amidated pectins are also available. These behave like LM pectin, but are more tolerant to excess calcium. Furthermore amidated LM pectin will gel after being heated whereas normal LM pectin remains more liquid if heated and cooled again.

Name	<i>pectin (E440) low methoxyl (LM)</i>	<i>pectin (E440) high methoxyl (HM)</i>
Origin	polysaccharide derived from citrus peel and apple pomace.	polysaccharide derived from citrus peel and apple pomace.
Texture	thermoreversible gels	thermoirreversible gels
Clarity	clear, transparent	clear, transparent
Dispersion	cold water; d. can be improved by mixing with sugar (3-5x)	cold water; d. can be improved by mixing with sugar (3-5x)
Hydration (dissolution)	cold or hot water	cold or hot water; will not dissolve if > 25% sugar
pH	2.5-5.5	2.5-4
Setting		40-85 °C (depending on pH and degree of methoxylation)
Melting	yes	no
Promoter	requires calcium ions for gelling; can gel in presence of milk (0.6-0.9% pectin required)	requires acidity (pH < 3.5) and high sugar contents for gelling (60-80% soluble solids, mainly sugar)
Inhibitor	high sugar concentrations, low pH, alcohol	
Tolerates		
Viscosity of solution	low	low
Typical concentration	[0.15-3.1%]*	[0.15-6.3%]*
Synergies		
Syneresis	yes	yes

* Concentrations in [square brackets] show range exemplified in this collection.

Soft set orange marmalade

1.0 g high methoxyl pectin, rapid set (0.1%)
0.5 g low methoxyl pectin (0.05%)
10 g sugar
100 g water
200 g orange pulp and peel
640 g sugar
150 g water
1.5 mL citric acid monohydrate (50% w/v)

Dry mix pectin and 10 g sugar and disperse in 50 g water with high speed mixer. Brings raspberries with remaining water and sugar to boil. Add pectin solution and boil down to 1015 g. Cool to 85 °C and deposit into jars. Keep pH in the range 3.0-3.2. Add citric acid if necessary.

CRC handbook of hydrocolloids

Traditional raspberry jam

2.2 g high methoxyl pectin, rapid set (0.2%)
10 g sugar
50 g water
450 g raspberries
610 g sugar
50 g water

Dry mix pectin and 10 g sugar and disperse in 50 g water with high speed mixer. Brings raspberries with remaining water and sugar to boil. Add pectin solution and boil down to 1015 g. Cool to 85 °C and deposit into jars. Keep pH in the range 3.0-3.2. Add citric acid if necessary.

CRC handbook of hydrocolloids

Tuile craquante

150 g confectioner's sugar
2 g pectin (0.53%)
8 g all purpose flour
120 g unsalted butter
50 g glucose syrup
50 g water

Sift together sugar, pectin, and flour. In a saucepan, combine butter and glucose and melt over low heat. Whisk in sifted ingredients, then water. Increase heat to medium. Stirring constantly, bring just to a boil. Remove from heat and allow to cool. After an ample resting period, spread onto a Silpat lined sheet pan and bake in a convection oven until golden at 180 °C. Remove from oven, allow to rest a moment, and shape as desired. Store in airtight container with desiccant.

*Michael Laiskonis via
<http://michaellaiskonis.typepad.com/main/2008/04/transitions.html>,
adapted from Frederic Bau*

Fruit sorbet

70% water
22% sugar
10% fruit
0.6% high methoxyl pectin
flavor, color

All ingredients are mixed and heated to dissolve dry ingredients. Adjust pH to about 3 with a 50 w/w% citric acid solution. Add fruit, flavor and color. Freeze and aerate, for instance with a Pacojet.

*Adapted from Y. H. Hui in
Handbook of Food Science, Technology, and Engineering, Vol. 3*

Paté fruit

250 g fruit purée
6 g apple pectin (1.0%)
25 g sugar
80 g glucose
2 g invert sugar (trimoline)
230 g sugar

Boil purée. Add glucose and invert sugar, boil again. Add pectin and 25 g sugar, boil again. Add remaining sugar and cook to 108 °C. Pour into molds with a silt pad. Cut or unmold and dip in sugar.

Ian Kleinman via <http://food102.blogspot.com>

Green tea sour mousse

2000 g water
375 g fresh lime juice
350 g sugar
32 g pectin (1.1%)
60 g green tea
50 g egg white
25 g vodka
2.5 g malic acid

Mix together water and lime juice. Mix the sugar and pectin together dry, then blend into the water and lime juice. Bring this solution to a boil and simmer for five minutes. Let cool completely. Infuse the green tea in the cold solution for two hours and then strain through fine muslin.

Take this base mix and combine with the egg white, vodka, and malic acid. Pour into a whipper and charge with nitrous oxide.

To serve, spray a small amount of foam into a soup spoon, knock the foam off the spoon into a Dewar filled with liquid nitrogen. Turn the mousse over in the liquid nitrogen for around 10 to 15 seconds until the entire surface has been frozen. Serve.

Heston Blumenthal via <http://www.rsc.org>

Apple candy

500 g apple cider
200 g glucose
600 g sugar
15 g high methoxyl pectin (1.1%)
7 g citric acid

Warm cider and glucose over medium heat to dissolve glucose. In a bowl, whisk together 50 g of sugar, pectin and citric acid. Add to saucepan and bring to boil, whisking constantly. Add remaining 550 g sugar and heat to 107 °C. Pour into pan sprayed with nonstick cooking spray. Let cool until set and cut into 6 mm dice.

Grant Achatz in Alinea

Liquorice candy (wheat flour based)

Liquorice and anise extract
20 cm liquorice root, crushed
2 T anise, whole
1000 g water

For candy
350 g extract
260 g blackstrap molasses
50 g oil
10.3 g pectin or gelatin (1.2%)
190 g flour

Extract: Boil down to 400-500 mL. Strain.

Candy: Bring extract, molasses and oil to boil. Add pectin. Boil hard for at least 1 min. Then add flour all at once. Lower heat and stir constantly until batter forms a mass and pulls away from the sides of the pot. Extrude the dough through a pastry bag or pat/roll the dough and cut to shape. Leave licorice to dry and cure, turning every few hours to let it dry evenly. It takes at least a day to firm up.

E.J. Martin via <http://www.liquorice.org>



Photo by Allen Hemberger

Raspberry sheets

500 g raspberry juice
15 g rose water
7 g amidated LM pectin (1.3%)

Combine raspberry juice and rose water in saucepan and blend in pectin with immersion blender. Bring to boil, stirring constantly and boil for 30 s. Remove from heat, let rest for 5-10 min and skim away foam. Reheat, stirring constantly, until just liquid. Pour onto acetate sheet sprayed with nonstick cooking spray. Raise acetate sheet into a U and raise and lower ends until mixture coats evenly. Place sheet in dehydrator and dehydrate at 40 °C for 4 hours or until sheet can be removed from acetate in one piece. If desired, rip sheets into random sized pieces, transfer to second acetate sheet sprayed with nonstick cooking spray. Dehydrate at 50 °C for 4 h or until crisp. Remove from tray to cold surface to harden.

Grant Achatz in Alinea

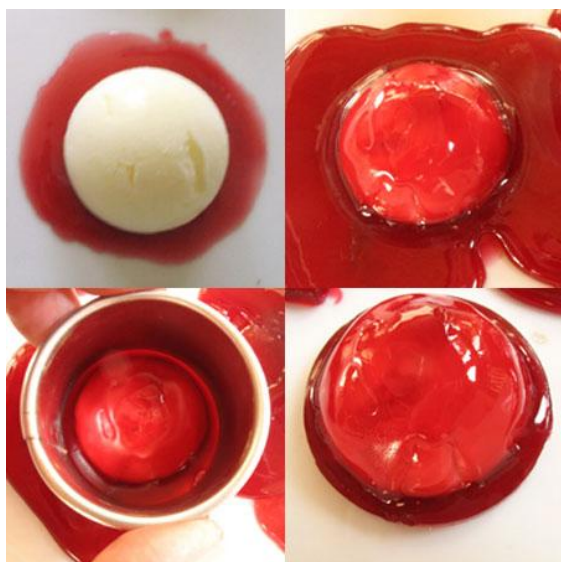


Photo by Linda Anctil

Blackberry yogurt ravioli

greek yogurt
150 g clear blackberry juice
35 g sugar
3 g amidated LM pectin (1.6%)

Note: Blackberries contain 29 mg calcium/100 g fruit which is sufficient to gel amidated LM pectin.

Pack yogurt into small, silicone hemisphere molds and freeze just until firm.

Combine sugar with pectin in a bowl and mix thoroughly. Place juice (preferably clarified/strained) in a pan and bring to boil. Add sugar-pectin and stir vigorously 1-2 minutes while cooking to dissolve. Return to boil and remove from heat. Keep a pan of simmering water on the stove to keep the pectin warm and fluid. Drop Tablespoonfuls of hot pectin solution onto a ceramic or glass plate, forming discs, and allow to gel. Set pan in simmering water while proceeding. When discs are firm, unmold yogurt hemispheres and place one on each of the discs. Pour the remaining warm pectin evenly over the yogurt to completely encase. When gelled, cut away the excess gel with a round cutter that is slightly larger than the hemisphere. Chill.

<http://www.playingwithfireandwater.com/foodplay/2008/08/blackberry-rose-cashew.html>

Cold sauce with green cardamom

1000 g water
50 g glucose
12 capsules of cardamom
3-4 cm fresh ginger, peeled and minced
zest of 1 lime

For thickening use one of the following
4 g agar (0.38%)
20 g pectin (1.9%)
10 g gelatin (1.0%)

Bring water and glucose to boil and infuse cardamom, ginger for 20 min. Add desired thickening agent and stir until dissolved (if using agar or pectin, mix with 10 g sugar to aid dispersion). Strain and serve.

<http://www.chefsimon.com>

Sliced Chocolate

435 g water
250 g dark chocolate
135 g milk chocolate
2 g salt
8.2 g calcium gluconate (1%)
16.4 g amidated LM pectin (2%)

Place water, chocolate, salt and calcium gluconate in a pot and bring to simmer. When temperature reaches 90 °C, pour into a blender. Turn it on low, then increase speed to form vortex. With the blender running, carefully remove the lid and sprinkle in the pectin. Run the machine for about five minutes, and then pour the mixture into a plastic-lined dish. Let it cool, undisturbed, at room temperature for 30 minutes. Place in the refrigerator and chill for at least four more hours until completely cool and set. Once the chocolate is cold you can slice it and serve immediately, or cover it with plastic wrap and keep refrigerated until you're ready to serve it.

Aki Kamozaawa and H. Alexander Talbot via
<http://www.popsci.com/diy/article/2008-07/pectin-not-just-jelly>

Fruit Terrine

1 honeydew melon
1 pineapple

Calcium solution for impregnation
500 g water
2.5 g calcium lactate gluconate (0.5%)

Pectin solution for glueing fruit together
500 g water
15 g low methoxyl pectin (3.0%)

Cut fruit into thick squares of equal size, each about 1.5 cm thick. Dissolve calcium salt in water. Vacuum-seal fruit with calcium solution in a bag. Leave fruit to impregnate for 5 min. Open bag and pat fruit dry. Disperse pectin in water heated to 95 °C with blender/immersion blender. Let cool. Brush pectin solution on one piece of fruit and lay another piece on top. Vacuum-seal to hold pieces together. Leave to rest in fridge overnight over night. Open bag

and slice fruit terrine to desired size/shape and serve.

*Aki Kamozawa and H. Alexander Talbot via
<http://www.popsci.com/diy/article/2008-07/pectin-not-just-jelly>*

Wine jelly

850 g wine (red or white)
120 g fresh lemon juice
56 g high methoxyl pectin (3.1%)
850 g white sugar

Combine wine, lemon juice, and pectin in a large saucepot. Bring to a boil, stirring frequently. Add sugar, stirring until dissolved. Return to a rolling boil. Boil hard 1 minute, stirring constantly. Remove from heat. Skim foam off top, if necessary. Ladle hot jelly into hot, sterilized jars.

<http://allrecipes.com>

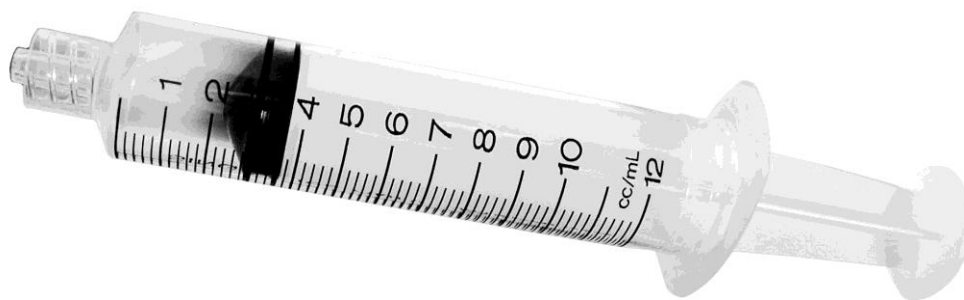
Lemon gum drops

185 g lemon juice, freshly squeezed
50 g high methoxyl pectin (6.3%)
2.2 g baking soda
340 g light corn syrup
210 g sugar (granulated)

Combine lemon juice, pectin and baking soda. Bring to boil, then keep on low heat. In a separate pan, combine sugar and corn syrup and boil until it reaches 138 °C (soft crack stage). Slowly pour hot syrup into hot juice mix, stirring constantly. When combined, add food coloring. Leave for 2 min and skim off foam from surface. Pour mix into 26 x 13 cm pan lined with aluminum foil and sprayed with cooking spray. Leave to set over night. Cut into squares and roll gum drops in sugar.

<http://whatscookingamerica.net/Candy/HomemadeGumDrops.htm>

Further recipes with pectin can be found in the section “Multi-hydrocolloid recipes” on page 93 .



Sodium alginate

Tips and tricks

- To get rid of air bubbles after dispersion and hydration, leave alginate solution in fridge over night, pour it through a fine meshed sieve or subject the solution to a vacuum.
- To avoid precipitation of alginic acid (occurs if pH < 3.65), adjust the pH as follows to reach pH 5:

Starting pH	Tri sodium citrate to add, g/L
2	2.7
2.5	0.85
3	0.27
3.5	0.082

- Lemon juice is around pH 2.4; Orange juice, apple juice, red wine etc. are all about pH 3.5. An extensive table of food pH is available from <http://bit.ly/Kalmqt> (Archived page from FDA)
- For fluorescent spheres when exposed to UV light, use tonic water (which contains quinine) or riboflavin (Vitamin B2)
- Calcium rich foods such as dairy products are well suited for reverse spherification
- Consider that ion induced spherification is also possible with gellan, kappa carrageenan, iota carrageenan and pectin. Spherification with frozen oil can be done using agar, gelatin and gellan.
- For internal gelling it is necessary to slow down the gelling. To achieve this an insoluble calcium source such as calcium sulphate or calcium carbonate is used.

These allow a controlled release of the calcium upon lowering of pH. Consult specialized texts or manufacturer for further details.

- Calcium alginate gels are heat stable up to more than 150 °C
- Low levels (0.1-0.5%) can be used to stabilize ice cream

Name	sodium alginate (E401)
Origin	polysaccharide extracted from brown algae.
Texture	<i>thermoirreversible</i> gel in presence of calcium ions; shear-thinning thickener in absence of calcium
Clarity	clear, transparent
Dispersion	cold water; d. can be improved by mixing with sugar (3-5x); add. of acidic liquids may cause precipitation of alginic acid
Hydration (dissolution)	cold or hot water; if cold, allow to hydrate for a couple of hours
pH	2.8-10
Setting	independent of temp.
Melting	no (but prolonged heating at low/high pH will destabilize gel)
Promoter	requires calcium for gelling
Inhibitor	precipitates as alginic acid at pH < 4 (is corrected by add. of sodium citrate); gels at too high ion/salt concentrations
Tolerates	up to ~50% ethanol (d. and hydrate in water before addition of alcohol)
Viscosity of solution	low in neutral water, high at lower pH (< 5.5)
Typical concentration	0.5-1% for normal spherification; [0.3-5%]*
Synergies	
Syneresis	yes

* Concentrations in [square brackets] show range exemplified in this collection.

Spherical tea ravioli

475 g water
16 g Earl Grey tea
25 g sugar
50 g lemon juice
1.5 g sodium alginate (0.3%)

Setting bath

500 g water
3.25 g calcium chloride (0.65%)

Mix 400 g of water, the tea and 20 g of sugar while cold and steep in the refrigerator for 24 hours. Strain. Combine the lemon juice with 5 g of sugar and freeze in an ice tray. Blend the sodium alginate with 75 g water. Dilute the calcium chloride in 500 g water. Mix the tea infusion with the sodium alginate base and allow to rest. Place in the freezer to chill but do not allow it to freeze.

Place a lemon cube in a 3 cm dosing spoon and fill the rest of it with the tea base. Place in the calcium chloride bath for 30 seconds. Rinse the ravioli in cold water.

<http://www.texturaselbuli.com>

Spherical mango ravioli

250 g water
1.3 g sodium citrate
1.8 g sodium alginate (0.36%)
250 g mango purée

Setting bath

1000 g water
5 g calcium chloride (0.5%)

Blend the sodium citrate with 250 g of water, add the sodium alginate and blend once more. Bring to a boil, allow to cool and mix with the mango purée. Blend 1000 g of water with calcium chloride. Pour the contents of a dosing spoon full of the mango and sodium alginate mixture into this calcium chloride bath, leave for 2 minutes and wash in cold water. Repeat until all of the ravioli are made.

<http://www.texturaselbuli.com>

Liquid pea ravioli

260 g frozen peas
325 g water
5 large mint leaves
3 g sodium alginate (0.5%)

Setting bath

1500 g cold water
10 g calcium chloride (0.67%)

In a bowl, dissolve calcium chloride in water. Store bowl in the fridge.

Cook frozen peas in a small amount of water for four minutes, adding mint leaves for the last five seconds of cooking. Drain, then shock immediately in a cold water bath for three minutes.

Mix water and sodium alginate with immersion blender until the sodium alginate has dissolved. Bring to a boil over high heat, stirring constantly. Remove from heat and allow to cool to room temperature. When cooled, blend with pea mixture using an immersion blender until the mixture is smooth.

Remove chilled calcium chloride solution from fridge. Scoop pea mixture into a tablespoon measure in the shape of a half-sphere. Set the bottom of the tablespoon measure against the surface of the calcium chloride mixture, then pour the mixture in with a gentle turn of the wrist. Leave ravioli in the calcium chloride mixture for two minutes. Gently remove the ravioli from the calcium chloride bath using fingers or a slotted spoon. Place in another bowl filled with cold water or rinse gently under running water. Top with a couple of grains of sea salt and serve immediately.

<http://hungryinhogtown.typepad.com>



Photo by Christopher Loessl

Mozzarella spheres (reverse spherification)

250 g buffalo mozzarella
150 g heavy cream
5 g calcium lactate (~1%)
2 tamarillos or tomatos, juiced

Setting bath

1 L water
5 g sodium alginate (0.5%)

Mix mozzarella with cream and calcium lactate. Fill bowl with water and add sodium alginate.

Stir until dissolved. Transfer mozzarella mix to alginate bath. Allow 2 min for setting. Inject spheres with tamarillo/tomato juice. Serve.

Dietmar Hölscher via <http://www.eispreis.de>

Yoghurt beads (reverse spherification)

200 g yoghurt
90 g double cream
30 g sugar
2 drops of pine extract

Setting bath

1000 g water
5 g sodium alginate (0.5%)

For the yoghurt beads; mix all the ingredients. Make a sodium alginate bath (reverse spherification) by mixing the water with the sodium alginate. Fill syringes with the yoghurt mixtures. Inject the mixture into the sodium alginate bath so you get beads (2 cm diameter). Leave the beads into the bath for 2 minutes. Rinse in water and leave into the water until use.

Sang Hoon Degeimbre via <http://foodfordesign.blogspot.com>

Spherical olives (reverse spherification)

400 g olive juice
2.5 g calcium chloride (0.625%)
1.5 g xanthan (0.375%)
olive oil
garlic
thyme
orange/lemon peel
pepper

Setting bath

7.5 g sodium alginate (0.5%)
1.5 L water

Mix sodium alginate and water. Keep in fridge over night to allow bubbles to escape.

Prepare olive juice by filtering puréed olives through a chinois cloth. Mix with calcium chloride. Sprinkle xanthan and mix with a hand held mixer (not an immersion blender) until desired consistency.

Gently head olive oil with garlic, thyme, citrus peel and pepper. Cool and store in tight container.

With a small spoon, transfer the thickened olive juice to the sodium alginate bath for setting. Rinse with water, let drip of and transfer to aromatized olive oil.

Paco Roncero via <http://www.chefkoch.de>

Spherical croquettes (reverse spherification)

250 g croquette base without flour
6 g calcium gluconate/calcium lactate (2.4%)
0.8 g xanthan (0.32%)

Setting bath

1000 g water
5 g sodium alginate (0.5%)

Blend the sodium alginate into the water until it dissolves. Leave in the fridge 12 h to eliminate excess air.

Dilute the calcium gluconate/calcium lactate mix in the croquette base, then mix in the xanthan with a hand blender to avoid lumps. Reserve in the fridge. Heat the croquette base until it regains a more liquid texture. Fill a 2.5 cm-diameter dosing spoon with the croquette base and pour it into the sodium alginate and water solution. Give the resulting sphere an elongated shape with the aid of 2 spoons so that it looks like a traditional croquette. Leave the croquettes in the sodium alginate solution for 3 min, turn them over and cook for a further 1 min. Once this time has elapsed, strain with a draining spoon and place them in hot water (60 °C) for 3 min. Remove from the water taking care not to break them. Dry the croquettes thoroughly and coat them in fried breadcrumb powder. Serve hot.

<http://www.texturaselbuli.com>

Spherical mussels (reverse spherification)

100 g mussel water
0.5 g xanthan (0.5%)
2.5 g calcium gluconate/calcium lactate (2.5%)
20 clean rock mussels

Setting bath

1000 g water
5 g sodium alginate (0.5%)

For storage

200 g seawater
200 g water

Completely dissolve the sodium alginate in the water using a blender. Leave in the fridge for 12 h to eliminate excess air.

Dilute the calcium gluconate/calcium lactate in the mussel water with the aid of a hand blender. Add the xanthan and blend again until obtaining a fine texture. Vacuum pack mussel mixture to remove excess air and reserve in the fridge.

Place a mussel into a 2.5 cm-diameter dosing spoon together with 4 g of the spherical mussel

base. Pour the contents of the spoon into the sodium alginate solution. It is extremely important that the spheres do not touch, as they will stick together. Cook the spherical mussels in the sodium alginate solution for 5 min. Strain the spheres with a draining spoon without breaking them and rinse in cold water. Drain the spherical mussels and keep them covered with the water and seawater mixture in the fridge.

Place the spherical mussels in hot water (60 °C) for 3 min. Remove them from the water taking care not to break them and place them in a spoon or on the corresponding plate. Serve hot.

<http://www.texturaselbulli.com>

Veal bone marrow (reverse spherification)

20 g reduced red wine
200 g meat stock
0.4 g xanthan (0.33%)
4.5 g calcium gluconate/lactate (3.75%)
salt

Setting bath

1000 g water
5 g sodium alginate (0.5%)

Mix 100 g of the meat stock with the reduced red wine and add salt to taste. Dissolve the calcium gluconate/calcium lactate into the mixture. Use a hand blender to dissolve the xanthan and vacuum pack the solution to eliminate excess air. Set aside.

Completely dissolve the sodium alginate in the water using a blender. Reserve in the fridge for 12 h to eliminate excess air.

Fill a 2 cm-diameter dosing spoon with the mixture of the meat stock, reduction and calcium gluconate/calcium lactate.

Pour the contents of the spoon into the sodium alginate bath, forming spheres. It is extremely important that they do not touch, as they will stick together. Cook the spheres in the sodium alginate mixture for 5 min.

Strain the spheres without breaking them using a draining spoon and rinse them in cold water. Strain again and keep them covered with the other 100 g of meat stock. This inverted sphere is perfect as a sauce to accompany meat, in this case veal marrow.

<http://www.texturaselbulli.com>

Spheric green olives (reverse spherification)

500 g green olives, depitted

Olive mix

200 g green olive juice (see below)
0.75 g xanthan (0.38%)
1.25 g calcium chloride (0.63%)

Setting bath

1500 g water
7.5 g sodium alginate (0.5%)

Crush olive pulp with immersion blender. Strain through a superbag pressing with the hands. Disperse sodium alginate in water with immersion blender and leave over night to hydrate and allow air bubbles to escape. Dissolve calcium chloride in olive juice. Sprinkle xanthan on surface and disperse with immersion blender.

To prepare olive spheres, fill 5 mL spherical spoon with olive mix and carefully pour the content into the sodium alginate solution to form spheric olive. Leave for 2-3 min, remove and rinse with water. Leave to drain and submerge them in aromatized olive oil (garlic, lemon peel, orange peel, thyme, rosemary, pepper).

<http://souschef.co.nz/Spherification.pdf>



Caviar made with blueberry juice. Small drops obtained by using a needle attached to the syringe. Photo by Martin Lersch

Melon cantaloupe caviar

250 g cantaloupe juice
2 g sodium alginate (0.8%)

Setting bath

500 g water
2.5 g calcium chloride (0.5%)

Mix sodium alginate with 1/3 of the melon juice and blend. Mix in remaining 2/3, strain and set aside. Dissolve the calcium chloride in the water. Fill syringe with the melon and sodium alginate mixture. Expel it drop by drop into the calcium chloride solution. Remove after 1 minute, strain and rinse the resulting caviar in cold water.

<http://www.texturaselbulli.com>

Kir moleculaire

80 g black currant juice
20 g crème de cassis
20 g lemon syrup
1 g sodium alginate (0.8%)
champagne

Setting bath

2.5 g calcium chloride (0.5%)
500 g water

Mix fruit juices and sodium alginate. Leave over night to get rid of air bubbles. Use plastic syringe and drip alginate solution into setting bath. Leave in setting bath at least 30 seconds. Rinse spheres with water, transfer them to a champagne glass and fill glass with champagne.

Adapted from recipe by H. Antoniewicz & A. Ariens-Derix

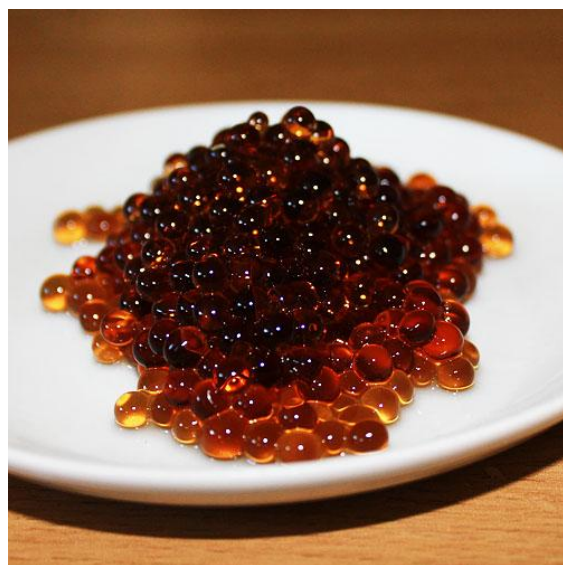


Photo by Christian Boldsen Knudsen

Cola caviar

100 g cola
0.9 g sodium alginate (0.9%)
0.2 g sodium citrate (0.2%)

Setting bath

200 g water
2.0 g calcium chloride (1.0%)

Heat soda to boil. Turn heat down. Dissolve sodium citrate and disperse the sodium alginate into the solution. Stir well, turn heat off. Once at room temperature let the solution drip into the setting bath. Collect the spheres and rinse with water.

Christian Boldsen Knudsen

Restructured onions

40 g onion
1.1-1.3 g sodium alginate (~1%)
14 g starch
1 pinch salt
12 g sugar, maltitol or glucose syrup
50-80 g water (low in calcium)
0.2 g sodium citrate

Setting bath

16 g calcium chloride (8%)
200 g water

Blend the onion under water adding starch and sodium alginate. If tap water is rich in calcium, add some sodium citrate before you add the sodium alginate.

Use a ice cream scooper or a syringe to transfer mix to setting bath. You might also try filling a tray after spraying some setting bath solution. Collect restructured shapes from the setting bath in a strainer or with special spoon

Rinse well under running water and place in a tray to dry off. For firm shapes rest samples in the setting bath at least 10 minutes.

<http://www.gastronomie.kalys.com>

Cola caviar

1 g sodium alginate (1.0%)
100 g cola or other soda drink
(konjac or xanthan)

For setting bath

8-10 g calcium chloride/calcium lactate (8-10%)
100 g water

Heat soda to boil. Turn heat down. Mix the sodium alginate in. Stir well, turn heat off. Once at room temperature let the solution drip into the setting bath. The dripping speed depends on the viscosity of the solution. For a more viscous solution, use some thickener, e.g. 0.1-0.3% konjac or xanthan. Collect the spheres with a tea strainer, a sieve or a perforated spoon. Rinse with water.

<http://www.gastronomie.kalys.com>

Thin film

100 g water or fruit juice
1 g sodium alginate (1.0%)

Setting solution for spraying

100 g water
5 g calcium lactate (5%)

Prepare 1% sodium alginate solution with water or fruit juice. Pour onto flat dish, baking platter or similar. Prepare calcium lactate solution and spray onto alginate film. Allow several minutes for setting. Small/thin films can be turned around and sprayed from the other side for faster setting. Short heating in the microwave after spraying (to evaporate calcium solution) gives greater flexibility and strength.

Adapted from <http://www.inicon.net>

Sodium alginate cubes

20 g sugar or maltitol
10 g dextrin
170 g fruit juice
3 g sodium alginate (1.5%)
5 g lemon juice
1-2 g calcium citrate, calcium lactate or calcium chloride (0.5-1.0%)

For coating

50 g baking cooking chocolate
10 g butter or double cream

Optional

1 egg white (~35 g)
1 pinch of xanthan

Blend half of the fruit juice with the lemon juice, dextrin and calcium source. Blend sodium alginate with remaining juice. Pour the first mix into the other and blend a few seconds. Leave to set for half an hour (setting should be almost immediate and visible within minutes). Cut into cubes.

The cubes are heat stable and resist cooling and heating. They may be used in an ice cream if cut into small pieces or to top mousse and drinks

Coating the cubes: Melt the chocolate over a hot pan (or in a double boiler) and blend in with the butter or double cream

Pick up the sodium alginate cubes on cocktail sticks and dip into melted chocolate sauce. Place on a grid rack (strainer) and leave to set in a cool place or the fridge

Variation: If you add an egg white and a pinch of xanthan to the calcium solution and then

beat it before mixing into the sodium alginate solution, you will obtain a lighter gelled product.

<http://www.gastronomie.kalys.com>

Carbonated mojito spheres (reverse spherification)

mojito
alcohol
xanthan gum
calcium chloride (4-6%)

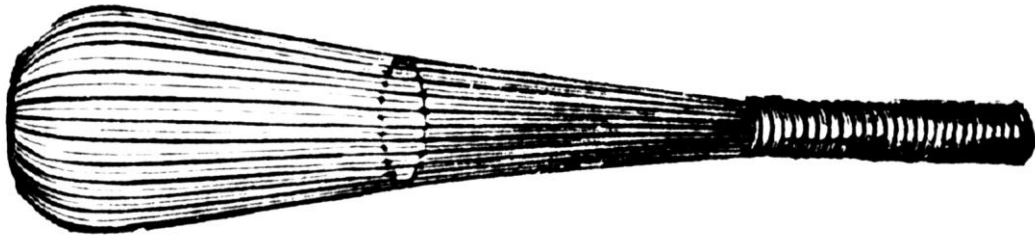
Setting bath

water
sodium alginate (5%)
sodium citrate (2%)

Leave spheres in setting bath. Transfer spheres to iSi bottle, cover spheres with small amount of mojito and charge with one charge of carbon dioxide. Leave for three hours and serve immediately after opening. Garnish with lime zest and mint leaf.

ChefT, Cafe Atlantico via <http://forums.egullet.org>

Further recipes with sodium alginate can be found in the section "Multi-hydrocolloid recipes" on page 93 .



Xanthan

Tips and tricks

- Add xanthan to reduce syneresis (water drainage), even in cold preparations
- Xanthan is shear thinning: liquids are viscous when at rest, but become more fluid when stirred or sprayed.
- The high at-rest viscosity gives excellent cling properties, for instance in tempura batters.
- Stabilizes emulsions.
- To keep water from leaking out of vegetable purées, add a touch of xanthan gum
- Often used to keep particles suspended (e.g. herbs, spices etc.)
- Xanthan reduces starch retrogradation in bread and baked products.
- In ice cream xanthan (~0.2%) prevents ice crystal formation during thawing cycles
- Xanthan can help stabilize whipped cream and mousses
- Xanthan added to gluten free products prevents crumbling and binds the product. For best effects use with guar gum in a 2:1 ratio (x:g).

Name	xanthan (E415)
Origin	polysaccharide obtained by fermentation of <i>Xanthomonas campestris</i>
Texture	high viscosity, shear-thinning; thermoreversible soft elastic gels w. locust bean gum or konjac
Clarity	clear, mostly transparent
Dispersion	cold or hot water; d. can be improved by mixing with sugar (10x) or glycerol, alcohol or vegetable oil.
Hydration (dissolution)	cold or hot water; does not hydrate at high sugar concentrations (>65%).
pH	1-13
Setting	
Melting	
Promoter	
Inhibitor	
Tolerates	acids/bases, salts, heating, enzymes, up to 60% ethanol
Viscosity of solution	high (independent of temperature)
Typical concentration	0.25% thin running sauce, 0.7-1.5% thick sauces, 0.5-0.8% foams; [0.07-1%]
Synergies	guar, locust bean gum, konjac, tara
Syneresis	



Photo by Martin Lersch

Banana milkshake

500 g skimmed milk (0.1% fat)
0.5 g xanthan (0.07%)
10-15 g sugar
1 banana
vanilla
5-10 ice cubes

Grind xanthan and sugar. In a blender, mix milk while adding xanthan and sugar. Add banana, vanilla and ice cubes. Xanthan gives a richer mouth feel.

Martin Lersch

Fake cappuccino foam

500 g cream liquor
0.4 g xanthan (0.08%)

Blend, strain and transfer to whipper. Charge with nitrous oxide. Refrigerate.

Mix coffee liquor, ice and vodka/brandy in a shaker. Top with fake cappuccino foam and chocolate shavings.

Adapted from recipe by H. Antoniewicz & A. Ariens-Derix

Tempura batter

1 egg
100 g flour
250 g ice cold water
0.35-0.5 g xanthan (0.1-0.15%)

Beat egg in a bowl. Add ice water in the bowl. Be sure to use very cold water. Add sifted flour and xanthan in the bowl and mix. Xanthan improves adhesion properties of batter, i.e. for onion rings and shrimps.

<http://japanesefood.about.com> and *CRC handbook of hydrocolloids*

Piña colada espuma

600 g pineapple juice
350 g coconut milk
50 g brown rum
1 g xanthan (0.1%) **or** 10 g gelatin (1.0%)

Bloom gelatin. Heat a little of the pineapple juice and dissolve gelatin. Add remaining liquids. If using xanthan, it can be added directly to the liquids using a blender or immersion blender. Strain liquid, transfer to whipper and charge with nitrous oxide. Leave in fridge for some hours before serving.

From Fizz magazine via <http://www.cuisine-concept.de>

Field poppy ice cream

800 g plain yoghurt, stirred
1 g xanthan (0.1%)
10 g icing sugar
red color
10 g poppy flavored cordial

For cordial:

100 g water
100 g sugar
1 pinch citric acid or 2.5 g lemon juice

Cordial: boil all ingredients and cool down

Ice cream: pour yoghurt into mixing bowl. Stir. Mix xanthan with icing sugar and add home made cordial. Disperse xanthan and sugar with blender. Pour the cordial into the yoghurt and whisk. Add color and flavoring to taste. Add some poppy seeds. Churn.

Variation: xanthan can be replaced by locust bean gum.

Chef Simon via <http://www.gastronomie.kalys.com>

Dill granita

500 g water
200 g dill
40 g apple balsamic vinegar
1.0 g xanthan (0.13%)
salt to taste

Process water, dill and vinegar in a Thermomix for 2 min. Drain liquid. Season with salt. Blend xanthan into a small amount of liquid with a immersion blender. Mix into main batch. Freeze in a wide container. Scrape with fork.

René Redzepi in NOMA

Orange ice cream

250 g reduced orange juice
250 g cream
100 g sugar
8 g glucose

1/2 vanilla pod
1.5 g xanthan (0.15%)
8 egg yolks (~160 g)
200 g crème fraîche

Bring orange juice, cream, half of the sugar, glucose and the vanilla pod to boil. In a separate pan, whisk egg yolks with remaining sugar. Add orange juice mix and heat to 80 °C. Disperse xanthan into mixture and work in the crème fraîche. Cool and freeze, preferably with a pacojet.

Heiko Antoniewicz and Klaus Dahlbeck in Verwegen kochen

Olive oil sponge cake

15 g wheat flour
50 g sugar
4 large eggs (240 g)
100 g extra virgin olive oil
0.7 g xanthan (0.17%)

Combine flour, sugar, eggs and oil. While whisking, sprinkle on xanthan. Continue mixing until dough becomes thick and homogenous. Fill 1L siphon/whipper and charge with 2 cream chargers. Leave dough to rest for 15 min. Shake well. Fill muffin cups 1/2-3/4 full and bake for 15 min at 180 °C.

Cristina de Lorenzo and Sergio Laguarda in The Kitchen as Laboratory

Iberian ham cream

50 g Iberian ham broth
30 g Iberian ham fat
0.2 g xanthan (0.25%)

Mix the 3 ingredients with an immersion blender or a turmix to obtain a creamy emulsion with no lumps. Keep in the refrigerator. Serve with oyster.

<http://www.texturaselbulli.com>



Photo by Martin Lersch

Foamy strawberries with balsamic vinegar

200 g strawberries
0.5 g fresh coriander leaves
30 g sugar
14 g balsamic vinegar
150 g water
1 g xanthan (0.25%)

Purée strawberries, coriander, sugar and balsamic vinegar with immersion blender. In a separate container, mix water and xanthan using the same blender and add to the strawberry mix. The immersion blender can be used to whip in some air, but for an even more airy texture, filter off the strawberry stones with a fine mesh strainer or cheese cloth and transfer to an ISI whipper and charge twice with nitric oxide. For a warm foam, heat the whipper in a water bath at 60-70 °C (only recommended with ISI gourmet or thermo whippers which are designed for higher temperatures). Goes well with vanilla ice cream.

Martin Lersch in http://blog.khymos.org/2007/06/17/tgrwt-3-foamy-strawberries-with-coriander/White_sangria_in_suspension

White sangría in suspension

500 g white sangría mix
1.4 g xanthan (0.28%)

Put the sangría in a bowl with xanthan and blend with a turmix. Strain and vacuum pack the whole mixture to extract the bubbles trapped in the interior.

The consistency obtained will enable us to maintain elements such as herbs, fruit or spherical caviar in suspension.

<http://www.texturaselbulli.com>

Strawberry ice cream

500 g unsweetened soymilk
3.4 g xanthan (0.32%)
230 g honey
320 g strawberries

Add xanthan to 200 g soymilk while mixing with immersion blender. Add remaining soymilk, honey and strawberries. Blend until smooth. Freeze in a flat metal pan. After 1 hour, return mixture to blender and process until creamy. Freeze again. Repeat again after 1 hour.

<http://dairyfreecooking.about.com>

Coco cola

400 g coconut juice
60 g sugar
160 g spray dried coconut
2.5 g xanthan gum (0.4%)

Warm 100 g coconut juice to dissolve sugar, followed by dried coconut, last xanthan. Bring to a boil, strain, allow to cool to 45-50 °C mix with remaining xanthan. Strain, fill soda siphon (or whipper) and charge with carbon dioxide.

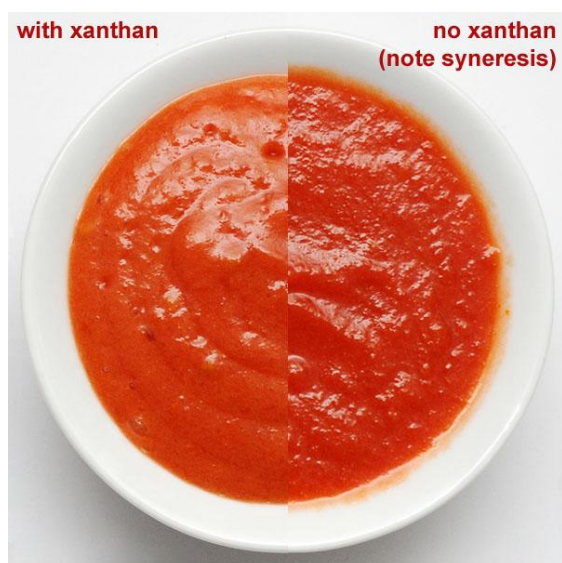
<http://willpowder.net>

Fruit pureé mayonnaise

200 g fruit pureé
150 g olive oil
2 g mono-/diglycerides (0.6%)
1.5 g xanthan (0.4%)

Mix fruit purée, olive oil and mono/diglycerides well with immersion blender. Add xanthan and mix more.

Adapted from Nova Kuirejo via <http://www.nova-kuirejo.de>



Picture by Martin Lersch

No-syneresis puréed tomatoes

100 g tomatoes, canned and chopped
0.5 g xanthan (0.5%)

Blend xanthan into tomatoes with a hand held immersion blender.

Martin Lersch

Gluten free flour mix

320 g rice flour, white
100 g cornstarch
35 g tapioca flour
3.4 g xanthan (0.7%)

Blend and use in any recipe calling for flour.

<http://www.recipezaar.com/214986>



Photo by Jessica Petersen

Marshmallows with xanthan

60 g water
pinch of cream of tartar
255 g sugar, granulated
255 g light corn syrup
½ vanilla bean
85 g egg whites
5 g xanthan (0.76%)

Ground xanthan with a tablespoon of sugar. Set aside. Heat water, cream of tartar, remaining sugar, corn syrup and vanilla to 120 °C. Discard vanilla bean. Whisk egg whites for about 2 min until still soft. Continue whipping egg whites at slow speed while adding syrup slowly. Sprinkle xanthan mix while still whipping. Turn speed up and continue mixing for 2-3 min or until meringue pulls away from sides. Sprinkle a pan or baking sheet generously with cornstarch and spread out the meringue. Sprinkle top with cornstarch, cover with plastic and leave to set for 4 hours

in a refrigerator. Cut marshmallows into desired shapes and dip cut surfaces in cornstarch.

Elizabeth Falkner in Demolition Desserts

Balsamic vinegar syrup

100 g balsamic vinegar
10 g sugar
0.9 g xanthan (0.82%)

Grind sugar and xanthan. Add to vinegar while mixing with immersion blender. Avoid incorporation of air bubbles as these only slowly escape.

Martin Lersch

Balsamic vinegar dressing

30 g balsamic vinegar
20 g honey
0.85 g xanthan (0.85%)
50 g extra virgin olive oil
salt

Mix in blender until smooth.

<http://www.recipezaar.com/242717>

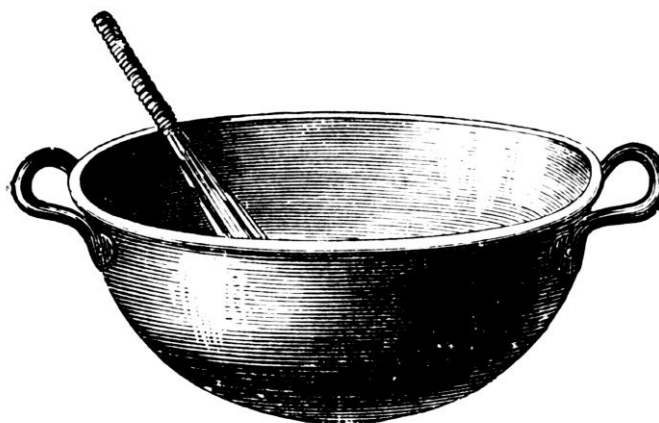
Carrot pillow

80 g carrot juice
120 g egg white
70 g egg yolk
20 g flour
3 g xanthan (1.0%)
salt
pepper

Disperse xanthan in carrot juice and mix in egg white, egg yolk and flour. Add salt and pepper to taste. Strain and transfer to 0.5 L whipper. Charge twice with nitrous oxide. Leave to rest for 30 min. Butter plastic cups, cut two holes in the bottom and fill half way up with the carrot mix. Cook for ~30 s in a microwave. Experiment with time and power setting until desired end result is achieved.

Rolf Caviezel in Molekulare Küche

Further recipes with xanthan can be found in the section “Multi-hydrocolloid recipes” on page 93.



Multi-hydrocolloid recipes

This section contains recipes where two or more hydrocolloids are used in combination. Note that many hydrocolloids display significant synergies when combined. In some cases additive effects are seen, i.e. that $1+1 = 3$. Other synergies significantly change the texture of the resulting gel. Some examples are listed in the table on p. 113. A complete treatment of hydrocolloid synergies however is well beyond the scope of this text. The reader looking for more a more systematic and scientific treatment of hydrocolloid synergies is referred to the scientific texts mentioned on p. 124.

All recipes in this can be found through the texture index. A plus sign after the hydrocolloid name in the index on p. 127 means it is used in combination with other hydrocolloids. Therefore, each recipe is listed multiple times under the heading of every hydrocolloid it contains.

The total amount of hydrocolloid is given in % in the title of the recipe and ranges from 0.1-8.8% (+ a 100% sorbet stabilizer mix). The recipes are sorted in order of increasing amount of hydrocolloid.



Photo by Daniel Campagna

Cream cheese noodles (0.1%)

354 g cream cheese, room tempered
240 g water
0.54 g agar (0.09%)
0.06 g locust bean gum (0.01%)

Mix cream cheese and water in a medium bowl. Add agar and locust bean gum. Mix well. Mixture should be consistency of heavy cream, if to thick, thin out with a little more water. Transfer to medium saucepan and heat to 90 °C while stirring. Simmer for 2-3 min to fully hydrate. Pour onto a silpat and spread in a thin, even layer. Chill in refrigerator. Once set, cut into desired size noodles.

Daniel Campagna

Standard ice cream (0.17%)

water 64.4%
sucrose 12%
skimmed milk powder 12%
butter fat 8%
glucose syrup 3%
mono-/diglycerides 0.3%
locust bean gum (Carob) 0.15%
vanilla flavor 0.1%
color 0.05%
kappa carrageenan 0.02%

Add all ingredients to cold water and heat with stirring to 85 °C. Melt butter fat in hot water. Cool. Freeze in an ice cream maker.

<http://www.cybercolloids.net>

Soft chocolate gel (0.18%)

530 g cream
500 g chocolate (64% cocoa), chopped
120 g sugar
600 g water
1.6 g locust bean gum (0.09%)
1.6 g carrageenan (0.09%)

Scald the cream and pour it over the chocolate and sugar. Whisk to combine. Set aside. In another bowl, add the water, locust bean gum and carrageenan. Use a hand blender to combine thoroughly. Boil the mixture. Whisk the hot gel and chocolate mixture together. Pour it into an 20 x 20 cm pan lined with plastic. Refrigerate for at least two hours to set.

Sam Mason via <http://www.sugoodsweets.com>

Freeform crème brûlée (0.25%)

360 g egg yolks
180 g sugar
3.3 g agar agar (0.2%)
300 g milk (3.25% fat)
750 g cream (36% fat)
1 vanilla bean
4 g gelatine mix (~0.75 g gelatin, corresponds to 0.05% gelatin in final mix)

Gelatin mix
14 g gelatin powder
60 g water

Bloom gelatin powder in water, melt and reserve. Combine agar with 50% of sugar, and remaining sugar with egg yolks. Bring milk, cream, vanilla bean and agar mix to the boil, and simmer for 5 min to ensure complete hydration of the agar. Add yolks and remaining sugar, and cook to 80 °C, stirring with a rubber spatula to minimize incorporation of air. Remove from heat, add 4 g of reserved gelatin mix, strain and portion into molds. Refrigerate

and caramelize to order. The added agar and gelatine prevent melting of the freeform creme brulee during caramelization.

Adam Chandler, <http://achocolateadventure.wordpress.com/>

Mint jelly, sauce and foam (~0.3%)

500 g water
mint (dried or fresh leaves)
1 grain sea salt
2.5 g sugar
0.5 g konjac (0.1%)
1 g carrageenan (0.2%)

Prepare a herbal tea or infusion of herbs. Add sugar and grain of salt. Infuse for 10-15 minutes. Add konjac and carrageenan. Bring to boil. Mix and keep on boil a couple of minutes. Strain into ramekins or bowls. Jelly can be used as it is. To make sauce (fluid gel), blitz the gel in a blender after cutting into smaller pieces.

Variation: Adding a pinch of xanthan to the gel with a glass of water helps whisk the jelly into a foamy solution.

<http://www.gastronomie.kalys.com>

Raspberry pearls (cold oil technique) (0.35%)

250 g raspberry purée (10% sugar)
50 g granulated sugar
1.0 g agar agar (0.25%)
0.4 g locust bean gum (0.1%)
100 g water

Gently warm raspberry purée and reserve. Combine sugar, agar agar and locust bean gum, and disperse into water. Transfer to a small sauce pan. Bring this mixture just to a boil, reduce heat and simmer for 2-3 minutes. Remove from heat and incorporate into the warm raspberry base using an immersion blender. Drop the mixture into cold vegetable oil, allowing 5-10 minutes to fully set. Transfer pearls to cool water to rinse, and then drain.

Michael Laiskonis via
http://michaellaiskonis.typepad.com/main/files/raspberry_pearls.pdf

Pliable chocolate ganache (0.35%)

375 g chocolate (72%)
1.7 g gelatin; 1 sheet (0.12%), bloomed
50 g water
100 g sorbitol
3 g agar (0.20%)
50 g glucose
900 g heavy cream
2 g salt

Place chocolate in large bowl. In a medium saucepan, bring water, sorbitol and agar to boil, whisking constantly. Squeeze out water of bloomed gelatin sheet and add with glucose to saucepan. Bring to boil again. Add cream and salt and stir to combine. Strain half of hot mixture through chinois over chocolate and stir continuously until chocolate melts completely. Add remaining cream mixture and stir to combine. Pour ganache into sheet tray lined with acetate. Leave to set for 1 hour in fridge. Cut into strips of desired size, twist them and serve.

Grant Achatz in Alinea

Lemon sorbet (0.36%)

Sorbet stabilizer mix

275 g gelatin powder (29%)
175 g CMC (carboxymethyl cellulose) (19%)
250 g locust bean gum (26%)
250 g guar gum (26%)

Sorbet base

1400 g lemon juice
250 g glucose
1310 g sugar
18 g sorbet stabilizer mix (0.36%)
2030 g water

Sorbet stabilizer mix: Mix powders.

Sorbet: Bring liquids to 40 °C. Mix powders. While whisking, add powders to liquid. Bring mixture to 85 °C to fully hydrate stabilizers. Chill to 4 °C and let base mature for 6 hours. Churn and transfer to a -10 °C freezer.

Francisco J. Migoya in Frozen Desserts

Chocolate ganache (0.44%)

260 g dark chocolate (70%), chopped
310 g heavy cream
200 g water
1.5 g agar agar (0.19%)
20 g glucose syrup
1 g salt
2 g (1 sheet) gelatin, bloomed (0.25%)

Add agar agar, glucose and salt to water and bring to boil while stirring. Leave to simmer for 2-3 min. In a separate pan carefully heat cream. Once it has boiled, remove from heat and gradually incorporate into the chocolate. Follow with the agar agar mixture. Add the gelatin and transfer to a flexible silicone mold. Freeze for at least 2 hours.

Michael Laiskonis via
<http://michaellaiskonis.typepad.com/main/2008/03/bread-and-choco.html>

Vinaigrette-style salad dressing (0.45%)

7% spirit vinegar 12.5%
sugar 9.5%
salt 3.2%
iota carrageenan 0.3%
xanthan 0.15%
chopped spice pieces 1.0%
color
preservative
water to 100%

Mix and serve.

CRC Handbook of hydrocolloids

Marshmallow foam (0.4-0.6%)

250 g bottled water
1.5 g xanthan gum (0.2-0.3%)
1.5 g methyl cellulose (0.2-0.3%), F50
dash of vanilla
dash of salt
250-400 g confectioner's (powdered) sugar

Disperse methyl cellulose in 125 g water and leave over night in refrigerator to allow complete hydration. Mix xanthan with some of the powdered sugar (to avoid lumping) and disperse in 125 g with immersion blender. Combine methyl cellulose and xanthan mix in the bowl of a large mixer (7 L) with a whisk. Add vanilla and salt and turn speed to medium. Once soft peaks form, add sugar a little at a time. Notice how the foam becomes more dense and elastic (texture is something in between marshmallow fluff and canned vanilla frosting). Foam can be spooned out for serving. The foam can be caramelized just like "real" marshmallows.

Adapted from <http://chef531.wordpress.com/2008/03/10/marshmallows/>

Sugar reduced meringue (0.49%)

200 g egg whites
200 g sugar
1 cinnamon/cassia stick
1.2 g guar gum (0.29%)
0.8 g iota carrageenan (0.19%)

Infuse egg whites and 170 g sugar with cinnamon/cassia gently over water bath for 30 min. Blend and strain. Mix/grind hydrocolloids into 30 g sugar and whisk into egg whites. Warm to 55 °C on bain mairie, always whisking. Transfer to stand mixer and whip until cool. Reserve frozen. Re-whip as necessary. Pipe into desired shape and freeze in liquid nitrogen. Caramelize with blow torch.

<http://www.willpowder.net/guaringueSuisseRaja.html>

Dessert jelly (0.5%)

water 80%
sugar 15%
citric acid 2.5%
tripotassium citrate 2%
carrageenan 0.25%
locust bean gum 0.25%
color and flavor as required

Mix gums with sugar and disperse into hot water. Stir until fully dissolved. Cool to set.

<http://www.cybercolloids.net>

Fig cylinders (0.53%)

Caramelized fig purée
65 g granulated sugar
200 g fig pulp
25 g water
zest of one orange
50 g cinnamon jalapeño syrup

Fig cylinders
50 g orange juice
75 g water
0.8 g high acyl gellan (0.21%)
0.7 g low acyl gellan (0.19%)
0.5 g tapioca maltodextrin (0.13%)
250 g caramelized fig purée

Caramelized fig purée: In a non-reactive sauté pan, caramelize sugar over high heat. Just as sugar begins to color, add fig pulp, and water. Stir to combine. Lower heat to medium and continue cooking until liquid is absorbed. Stir in syrup and remove from heat. Purée with an immersion blender and reserve warm.

Fig cylinders: Combine orange juice, water, gellans, and maltodextrin and blend well with an immersion blender, about two minutes. Transfer mixture to a small sauce pan and heat just until boiling. Quickly combine with the reserved fig purée and once again mix with an immersion blender. Into five prepared cylinders (20 mm diameter by 145 mm length), pipe the mixture, tapping the forms to reduce the chance of air pockets. Allow to chill and set before removing from forms and slicing.

Michael Laiskonis via
<http://michaellaiskonis.typepad.com/main/2008/07/reconfigure.html>

Tomato olive oil flan (0.53%)

140 g water
2 g agar (0.22%)
0.8 g locust bean gum (0.09%)
2 g xanthan (0.22%)
600 g roast tomato purée
2 g sea salt
150 g extra virgin olive oil

6 g glycerin flakes (0.67%)*
* *Mono-/diglycerides*

Split about 8 tomatoes in half and roast. Remove skins, purée, and strain. Feel free to incorporate any non-oil based flavorings to the tomato at this point (herbs, dry seasonings, vodka, koji aji, etc.). Using a Thermomix, spin water at speed 5 for 2 minutes at 0°C while dispersing agar, locust bean gum, and xanthan and shear. Reset the Thermomix to spin at speed 4 for 5 minutes at 82°C. After 2 minutes have passed, add in the tomato purée. After another 2 minutes, slowly stream in the olive oil (which has previously been heated and had the glycerine dissolved into it). Shut the heat off, and allow to blend another minute. Immediately pour the emulsion into molds and allow to set. Remove from molds.

Chad Galiano in
<http://chadzilla.typepad.com/files/tomato-olive-oil-flan.pdf>



Photo by Eddie Shepherd

Beetroot meringue (0.53%)

1.5% methyl cellulose base
45 g water
0.675 g methyl cellulose (1.5%, 0.19% of total composition); F50 or Metil

45 g methyl cellulose base
260 g beetroot juice
1.2 g xanthan (0.34%)
40 g isomalt
10 g sugar
seasonings to taste

1.5% methyl cellulose base: Disperse methyl cellulose in hot water with immersion blender. Cool. Leave in fridge over night to allow proper hydration of the methyl cellulose. It may be advisable to make a larger batch of the methyl cellulose base.

Meringue: Blend methyl cellulose base, beetroot juice and xanthan with immersion blender. Transfer to bowl. While whipping, add isomalt and sugar. Whip until soft peaks form (may take some time). Pipe onto silpat. Dehydrate at 57 °C for 10-12 hours until crispy.

Eddie Shepherd via
<http://www.veggiechef.co.uk/Blog/files/meringue.html>

Loukoums chew (Turkish delight) (0.53%)

100 g sugar
150 g fruit juice
110 g glucose syrup
15 g lemon juice
2 g of agar and tara in a 70:30 ratio (0.53%)

For molds
30 g vegetable oil

For coating
1 T glucose
1 t gum arabic
25 g water

Disperse agar and tara in two thirds of fruit juice. Heat to boil and set aside to cool. Don't let the solution set! Dry blend the remaining powders. Pour into a saucepan, add remaining juice and heat to boil while stirring well. Once all is blended, remove from fire and mix from time to time. Put agar and tara solution on heat to melt then pour onto other solution. Add lemon juice. Flavor or color may be added to taste. Mix well and pour into molds or onto mold's greased surface. Leave solution to dry for at least 4 hours or even overnight. Cut into pieces.

Dissolve the Gum Arabic in the water. Dip the pieces into the solution using a clean needle then sprinkle sugar onto them. Leave in a warm and aerated place to dry off for a few days.

For variation, replace agar/tara by other combinations of gums :

1-2 g agar/tara, 70:30 ratio
1-2.5 g carrageenan/tara, 70:30 ratio
3-5 g xanthan/tara, 50:50 ratio
0.5-1 g konjac/carrageenan, 20:80 ratio
1-4 g konjac/carrageenan, 60:40 ratio

<http://www.gastronomie.kalys.com>

Passion fruit sabayon (0.63%)

350 g passion fruit purée
160 g sugar
vanilla pod, seeds
2 g xanthan (0.36%)
50 g water
1.5 g methyl cellulose (0.27%)

passion fruit seeds

Grind xanthan with some sugar and disperse together with methyl cellulose in water. Leave to hydrate over night. Blend passion fruit purée, sugar and hydrocolloid mix. Transfer to serving sized dish. Heat in microwave at 600 W for 20 seconds. Garnish with passion fruit seeds.

Heiko Antoniewicz and Klaus Dahlbeck in *Verwegen kochen*

Flexible foie gras (0.65%)

xanthan:konjac (30:70 ratio) 0.65%
foie gras terrine
egg yolk
water

Melt foie gras terrine into liquefied fat, mix in xanthan and konjac, and then a small amount of water and an egg yolk. Spread the mixture on a sheet, chill, cut into strands and tied into knots.

Wylie Dufresne via <http://www.iht.com>

Fake salep dondurma (0.8%)

24 g Darjeeling tea leaves
500 g cold milk
500 g cold cream
5 g low acyl gellan (0.4%)
3 g salt
5 g guar gum* (0.4%)
150 g granulated sugar
2 scraped vanilla beans
3 egg yolks, beaten (~60 g)
2 g calcium lactate gluconate (0.16%)

*) Preferably a "flavor free" guar gum

Combine milk, cream, and tea leaves. Infuse mixture in a vacuum bag at full vacuum plus 30 seconds. Allow to steep for 1 hour or more till flavor is developed. Strain tea from milk/cream mixture and add gellan, salt, and guar. Whisk vigorously to disperse gellan and hydrate guar. Bring mixture to a boil while stirring and simmer for 1 minute to hydrate gellan. Remove from heat. Add sugar and vanilla and stir. When mixture drops to 83 or 82 °C add the egg yolks and stir. When the temperature drops to 70 °C mix in the calcium and stir. Put mixture in an ice bath to set. When mixture is completely set, blend in a high-speed mixer till creamy. Freeze with liquid nitrogen in a Kitchen-Aid mixer fixed with a paddle attachment. Beat until the ice cream gets stringy and stretchy. To make creamy ice cream without the Salep feel omit the guar gum and increase the gellan to 7 grams.

Dave Arnold, <http://www.cookingissues.com/2010/03/20/fake-fryable-brulee-able-salep-dondurma-ice-cream-a-legal-recipe/>

Hot transparent savory mousse (0.8%)

600 g water
4.2 g carrageenan (0.7%)
0.4 g konjac (0.07%)
3 g maltitol
0.2 g xanthan (0.03%)
1 soup cube or 80 g meat juices or juices
from a meat dish with a bouquet garni

Mix all dry ingredients (except xanthan) and add liquids. Heat all ingredients to close to boiling point (80 °C) for a few minutes. Use power blender to avoid lumps. Strain if using herbs. Leave solution to set. Blitz the gel in a mixer with the pinch of xanthan. The gel will yield some water so you don't have to add any.

Strain through a mesh size suitable for the nozzle and pour into dispenser. Use 1 to 2 gas canisters following makers guidelines.

This mousse will be quite heat resistant and can be served hot or warm (40-50 °C max.).

By changing slightly the amounts of xanthan, you can easily modify viscosity and texture to get the best mousse.

<http://www.gastronomie.kalys.com>



Photo by Chad Galliano

Soft gel noodles (0.85%)

200 g flavored water base, soup or broth
0.8 g agar (0.4%)
0.5 g locust bean gum (0.25%)
0.4 g xanthan (0.2%)

Disperse hydrocolloids in cold water with immersion blender. For easier dispersion the hydrocolloids can be grinded with some sugar in a mortar prior to dispersion. Bring to boil. Fill straws or tubes with hot solution and leave to set in a cold water bath. Eject the noodles and

heat under a lamp. The noodles are soft, palatable and heat resistant, but there is some syneresis.

Chad Galliano via
<http://chadzilla.typepad.com/chadzilla/2008/11/soft-gel-noodles.html>

Coffee jelly (0.88%)

500 g brewed coffee
60 g sugar
3 g xanthan (0.53%)
2 g locust bean gum (0.35%)

Combine, stir with a whisk and heat until completely dissolved. Pour into molds and leave to set in fridge. Cut into pieces and serve with whipped cream.

Amos Nussinovitch and Madoka Hirashima in *Cooking Innovations*

Martini sorbet (0.9%)

240 g vermouth
3.5 g agar (0.7%)
240 g gin
0.9 g xanthan (0.2%)

Place vermouth and agar in a pot on high heat. Stir until all of the agar has dissolved. Take off of heat. Add gin and xanthan and stir until completely dissolved. Place in freezer until frozen with the texture of a sorbet. Serve with olive caviar (see recipe in the "Gelatin" section).

Jamie Boudreau via <http://spiritsandcocktails.wordpress.com>

Mint pudding (1.0%)

700 g water
6 g agar (0.5%)
200 g glucose
200 g sugar
100 g mint leaves
6 g xanthan (0.5%)
2 g calcium ascorbate

Bring water and agar to a boil, whisking constantly. Add glucose and sugar and return to boil. Transfer to blender, add mint and blend on high speed for 3 min. Strain through chinois and refrigerate for about 2 hours or until set. Transfer to blender and blend until broken up. With blender running on high speed, add xanthan and calcium ascorbate and blend until smooth and creamy. Transfer to squeeze bottle and refrigerate.

Grant Achatz in *Alinea*

Caviar using cold oil technique (1.1%)

375 g vegetable or fruit juice, strained
sugar to taste
3.7 g agar (1%)
0.4 g locust bean gum (0.1%)
2 L bottle of rapeseed/canola oil

Put oil in freezer over night. Mix all the powders together and whisk into the juice as it comes to the boil. Remove from the heat. Pour cold oil into a narrow but deep bowl. Allow juice to cool slightly. Sieve to remove any gumminess, transfer to squeeze bottle and drip mix into oil. The droplets solidify upon contact with the cold oil, forming spheres that sink to the bottom. To collect spheres, pour oil through sieve. Submerge in cold water to remove excess oil.

Sam Mason

Citrus air (1.12%)

120 g lime juice
80 g lemon juice
8 g sugar
2 g salt
2 g lecithin (0.94%)
0.4 g xanthan (0.18%)

Combine and blend until completely dissolved. Use mixer/whipper on surface to generate foam. Allow to drain 2 min before serving. The added viscosity from xanthan helps stabilize the air.

Marc Veyrat via *Modernist Cuisine*

Sour mix with a twist (1.15%)

300 g water
100 g lemon juice
100 g lime juice
3 g salt
6.5 g methyl cellulose (1.0%), Methocel F150
1.0 g xanthan (0.15%)
150 g simple syrup

Combine water, lemon juice, lime juice and salt in a blender. Turn the blender on low and gradually increase the speed to medium. Sprinkle in the methyl cellulose and xanthan and shear in the blender for 30 seconds until the powders are full dispersed. Chill the mixture to 10 °C. Stir in the simple syrup. The sour mix can be whipped to soft peaks using a stand mixer fitted with a whisk or an immersion blender with a whisk attachment. Incorporate the whipped sour mix into your favorite drink recipe.

Aki Kamozaawa and H. Alexander Talbot via
http://www.ideasinfood.com/ideas_in_food/2008/07/sour-mix-with-a-twist.html



Photo by Eddie Shepherd (Strawberry Marshmallows with crushed freeze died strawberry folded through the marshmallow base)

Vegan marshmallows (1.19%)

1.5% methyl cellulose base
50 g water
0.75 g methyl cellulose (1.5%, 0.12% of total composition); F50 or Metil.

Marshmallow base

50 g of 1.5% methyl cellulose base
100 g caster sugar
60 g water
1.0 g xanthan (0.16%)
2 g vanilla extract
0.2 g rose water

Syrup

200 g sugar
60 g water
150 g water
3.5 g kappa carrageenan (0.56%)
2.2 g locust bean gum (0.35%) *

*) or 4.5 g Biozoon Brand Locuzoon

1.5% methyl cellulose base: Disperse methyl cellulose in hot water with immersion blender. Cool. Leave in fridge over night to allow proper hydration of the methyl cellulose. It may be advisable to make a larger batch of the methyl cellulose base.

Marshmallow base: Grind xanthan into sugar. Whip methyl cellulose with remaining water while slowly adding sugar, xanthan and flavors. Whip until stiff peaks form.

Syrup: Combine sugar and water (60 g) in a pan and heat until the mixture reaches 125 °C (hard ball stage). Then slowly whisk in the remaining water (150 g). Add carrageenan and locust bean gum portion wise into the hot syrup. Stir for 2 min.

To make marshmallows, add hot syrup to the marshmallow base while continuously whipping it. Pour into a baking dish dusted with icing sugar and cornstarch. Chill for at least 1 hour. Carefully slice and coat all sides with a 50/50 mix of icing sugar and cornstarch.

Eddie Shepherd via
<http://www.veggiechef.co.uk/Blog/files/marshmallow.html>

Flavored agar cream (1.2%)

1.5 g agar (0.7%)
120 g liquid cream (or full fat milk)
30 g milk
1 t angelica liqueur
30 g absinthe cordial
1 g xanthan (0.5%)
40 g water

Heat dairy ingredients with agar till boiling then after a couple of minutes cut off the heat. Pour into a large bowl and leave to set in refrigerator for 1-2 hours. Turn gel out and cut in pieces. Fill blender and blitz into cream.

Add liqueur, cordial, pinch of xanthan and water (a teaspoon at a time to check texture). Whisk to beat in as much air as possible.

<http://www.gastronomie.kalys.com>



Photo by Chad Galiano

Lemon whip (1.25%)

lemonade
salt (to taste)
xanthan (amount not given)
methyl cellulose (1.25%), SG A16

Weigh out fresh lemonade and add salt to taste. Thicken with xanthan to almost the consistency of heavy cream. Whisk in methyl

cellulose. Whip at high speed for 15 min. There is a 4-fold increase in volume.

Chad Galiano via <http://chadzilla.typepad.com>

Fluid gel (basic recipe) (1.29%)

185 g liquid flavor base
2 g agar (1.1%)
0.35 g xanthan (0.19%)

Blend agar and xanthan into base. Place in a saucepan and bring to a boil. Allow to cool until solidified. Place solid gel in a blender and blend until creamy.

<http://www.playingwithfireandwater.com>

Dessert jelly (1.76%)

500 g water
90 g sugar
10.2 g gelatin (1.7%), type B, 240 Bloom
2.3 g citric acid anhydrous
1.6 g tri sodium citrate dihydrate
0.35 g low acyl gellan (0.06%)
color and flavor as required

Blend all the dry ingredients. Heat the water to boiling and dissolve blend into the hot water by stirring for 1–2 minutes. Deposit and chill.

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Ravioli filled with mango mousse (1.8%)

1 ripe mango
200 g mango purée
3.5 g gelatin (~0.9%)
2 shoots of a young pine (the very tender, fresh leaves)
3.5 g of methyl cellulose (~0.9%)
lemon juice
rose leaves

Cut the mango into fine (maximum 1 mm) sheets. Mix the mango purée with the shoots of the pine (cut into fine pieces). Divide the mango purée into two parts. The first part is heated to 40 °C and mixed with the gelatin. The second part is kept cool and mixed with the methylcellulose. Beat the 2 parts together into a light foam. Fold the mango sheets into 4 to form like little cornets. Fill the cornets with the mango foam. Dress the cornets on a plate together with the yoghurt beads (see recipe in "Sodium alginate" section), some mango coulis, leaves of roses and shoots of pine.

Sang Hoon Degeimbre via <http://foodfordesign.blogspot.com>



Photo by David Barzelay

Frozen lime meringue (1.91%)

150 g lime juice
110 g lemongrass-infused water
40 g sugar
4 g salt
3.8 g versawhip (1.25%)
2 g xanthan gum (.66%)

Bring a couple hundred grams of water to a boil with a bunch of lemongrass, then turn off the heat and let steep for 20 minutes. Strain. Measure out 110 g of this lemongrass stock. Combine all ingredients in a 1 L container and blend with an immersion blender to disperse and hydrate xanthan and versawhip. Transfer everything to a stand mixer with the whisk attachment, and whisk until foam has reached maximum volume and glossiness. Transfer contents to a plastic piping bag and pipe shapes on a Silpat on a sheet pan. Leave in freezer until fully frozen (about 4 hours in a normal consumer freezer). Transfer to an airtight freeze-able container (an offset spatula is helpful) and use within two days.

David Barzelay, http://www.eatfoo.com/archives/2009/11/lime_thai_flavors_lazy_bear_20.php

Cucumber sorbet (1.98%)

Cucumber juice
5 cucumbers, halved w/seeds removed
13 g verbena leaves

Sorbet
550 g strained juice
20 g lemon juice
70 g stock syrup (50:50 water:sugar)
1 g salt
5.1 g gelatin; 3 sheets (0.77%)
6 g maltodextrin (0.91%)
2 g xanthan (0.30%)

Cucumber juice: Chop cucumbers and process with verbena leaves for 10 s in Thermomix. Leave for 5 min and strain.

Sorbet: Dissolved bloomed gelatin in a little of the cucumber juice by gentle heating. Whisk in maltodextrin and xanthan. Stir into remaining juice and freeze in Pacojet containers.

René Redzepi in NOMA

Hummus gnocchi (2.0%)

300 g smooth hummus, room tempered
75 g water
3.75 g methyl cellulose (1%) SGA150
3.75 g gelatin (1%), bloomed

Bring the water to a boil, remove from the heat and whisk in the methocel to disperse it. Add the drained bloomed gelatin to the methocel water, then mix this mixture into the hummus. Once the two mixtures are fully combined, cool the mixture completely in an ice bath. When the mixture is ice cold, place it in a pastry bag with a one centimeter tip. Bring a pot of water to a boil, season with salt and turn down the heat so the water just simmers. Squeeze the hummus mixture into the water, cutting of two centimeter sections with a knife. The gnocchi will float and be firm to the touch when they are set. The gnocchi must be used warm.

Kamozawa and Talbot via <http://ideasinfood.typepad.com>

Green tea noodles (2.4%)

120 g strong green tea
1 g agar (0.8%)
2 g gellan (1.6%)
3 g sugar
vegetable stock

Bring green tea to boil, whisk in agar, gellan and sugar. Bring to boil again. Pour onto silpat or tray laid out with plastic foil. Leave to set and cut into noodles. Heat noodles in vegetable stock and serve. The agar serves to make the noodles more elastic upon heating.

Rolf Caviezel in Molekulare Küche

Gluten free flour (2.4%)

2.4 g xanthan (1.6%)
1.2 g guar gum (0.8%)
75 g soy flour
75 g rice, potato or corn flour

Mix and use as normal flour.

Adapted from *The Kitchen Hand* by Anthony Telford

Milk pudding (2.5-4.2%)

1000 g milk

100-200 g sugar
2-3 g carrageenan (1.7-2.5%)
1-2 g guar gum (0.8-1.7%)
pinch of potassium salt
flavor as desired (e.g. orange, limette)

Mix hydrocolloids with sugar. Add to milk and heat to 70 °C. Add flavor. Pour into mold or individual ramekins (lined with caramelized sugar if desired) and leave to set.

<http://www.chefsimon.com>

Warm chocolate coffee mousse (2.7%)

Methyl cellulose base

100 g milk
100 g muscovado sugar
100 g cocoa seeds, roasted
100 g granulated coffee
7 g methyl cellulose (1%)

Gelatin base

300 g milk
12 g gelatin (1.7%)

Methyl cellulose base: Bring 100 g milk to boil with sugar and add cocoa seeds and coffee. Strain. Purée the infusion with methylcellulose following instructions for hydration. Bring to 80-90 °C, then rapidly chill to 4 °C.

Gelatin base: Warm the remaining 300 g milk to dissolve gelatin and reserve at 35 °C.

Begin whipping methylcellulose base in mixer, slowly adding gelatin base and making a stable mousse. Freeze in molds, unmold, and warm to order in the salamander.

Will Goldfarb via <http://www.star chefs.com>



Photo by Vilson Vedana

Soft chocolate gel (3.15%)

240 g water
240 g heavy cream
120 g bittersweet chocolate (60% cocoa)
50 g granulated sugar
1 g iota carrageenan (0.15%)
20 g low methoxyl pectin (3%)

Disperse carrageenan into cold water. Heat cream carefully in a pan and add sugar, stirring to dissolve. Pour the hot cream over chocolate to melt. Stir a little. Add dispersed carrageenan and whisk gently to avoid formation of bubbles. Bring the mixture to boil and whisk in the pectin. Let boil for about 30 seconds until it starts to thicken and immediately pour through a fine meshed sieve to get rid of bubbles. Pour into 20 x 20 cm pan lined with plastic wrap. Let cool a little and cover with plastic wrap. Allow to set in a fridge for a couple of hours. Slice in long thin strips, twist and place them on plates for serving.

David Barzelay <http://www.eatfoo.com>, adapted from Alex Stupak

Vegan marshmallows (3.16%)

Base mix

140 g sugar
10 g cornstarch (1.4%)
12 g powdered agar (1.7%)
50 g palm sugar, granulated
15 g glucose powder (optional)
350 g water
10 g vanilla essence or extract

Fluff

20 g soy protein isolate *)
3 g baking soda
1.5 g tartaric acid
4 g salt

0.4 g xanthan, guar gum or acacia gum
(0.057%)
90 g cold water

** Use unflavoured soy protein isolate, not hydrolysed soy protein or flavoured soy drink powder.*

Combine dry ingredients for base mix in a sauce pan. Whisk in water and bring to boil. Cook at a rolling simmer for 15 minutes stirring from time to time. Remove saucepan from the heat and add vanilla essence. Set aside.

Sift dry ingredients for fluff mix, add water and beat until increased in volume and fluffy-ish (about 10 minutes). While still beating, add the base mix - first carefully 1 table spoon at the time. After 3-4 table spoons the rest can be poured in a steady stream (should take no longer than 2 minutes - otherwise agar mix can start to gel). Continue beating until mixture is warmer than lukewarm and the volume has increased further. Spread into a 20 x 30 cm greased pan dusted with cornstarch (or potato starch). Cover with parchment paper and leave to set (about an hour). Dust generously with cornstarch and cut into cubes. Coat all sides with cornstarch (cocoa powder or desiccated coconut can also be used at this point) to prevent them from sticking together.

Jeanette Sutton via <http://www.meatandeggfree.com/vegan-marshmallows.html>

Lemon marshmallows (3.2%)

Gelling mix

14.6 g gelatin (2.9%)
1.6 g slow set HM or amido pectin (0.3%)
8.1 g sugar
61.0 g water

Sugar mass

159.6 g sugar
171.8 g glucose syrup
12.2 g sorbitol
56.9 g water
10.6 g citric acid
2.0 g color
1.5 g lemon flavor

Gelling mix: Mix gelatin and pectin with sugar and dissolve in water at 80 °C and keep for 30 min.

Sugar mass: Cook sugar, glucose syrup and sorbitol in water to 126 °C (= hard ball stage). Cool to 80-100 °C, add citric acid, lemon flavor and color and whip until fluffy.

Adapted from patent application WO2009021968

Soy sauce gelled foam (3.24%)

6 g gelatin (160 bloom); 2 1/2 sheets (3%)
100 g water
100 g soy sauce
0.5 g xanthan (0.24%)

Hydrate gelatin in water, heat to dissolve and cool. Before gelatin sets, combine with soy sauce and xanthan and whip in freezer chilled bowl until dense foam is formed (15 min). Cast in non-stick mold if desired and freeze 2 min. Chill in fridge for >2h before serving. Cut into shapes as desired.

Ferran Adrià via Modemist Cuisine

Chocolate flan (3.4%)

water 74.1%
sugar 10%
skimmed milk powder 10%
cornstarch 3%
10% alkalized cocoa 2.5%
kappa carrageenan 0.4%

Mix all ingredients. Add chocolate flavor and color as required.

<http://www.cybercolloids.net>



Photo by Claus Ableiter (Tortenguss used to fixate strawberries)

Tortenguss (German cake glaze) (3.8%)

water or fruit juice 91%
sugar 5%
starch 3%
kappa carrageenan 0.8%
potassium citrate 0.2%

Mix all ingredients together, stir with heating until you reach a low simmer. Simmer for one minute. Add color and flavor as required.

<http://www.cybercolloids.net>



Photo by Linda Anctil

Tangerine fruit curd (4.0%)

200 g sweetened tangerine juice
6 g gelatin (3.0 %)
2 g methyl cellulose (1.0 %), F50

Bloom gelatin. Carefully heat a portion of the juice and dissolve gelatin in it. Add remaining juice and leave gel to set. Whip it and add methyl cellulose to increase viscosity.

Linda Anctil in
<http://www.playingwithfireandwater.com/foodplay/2009/01/tangerine-gingerbread-coconut-black-sesame.html>

Olive oil gummy worms (8.8%)

20 g gelatin (200 bloom); 10 sheets (4.4%)
40 g water
20 g gum arabic (4.4%)
100 g isomalt
25 g glucose syrup DE40
55 g honey
110 g water
75 g olive oil
1 g vanilla seeds
0.1 g thyme essential oil

Hydrate gelatin in 40 g water at 60 °C for 30 min. In separate pan combine and heat gum arabic, isomalt, glucose syrup, honey and water to boil. Whisk in gelatin mixture. Whisk in olive oil. Add flavorings. Cast in to worm-shaped molds. Leave to set in fridge for >4h. Remove from molds.

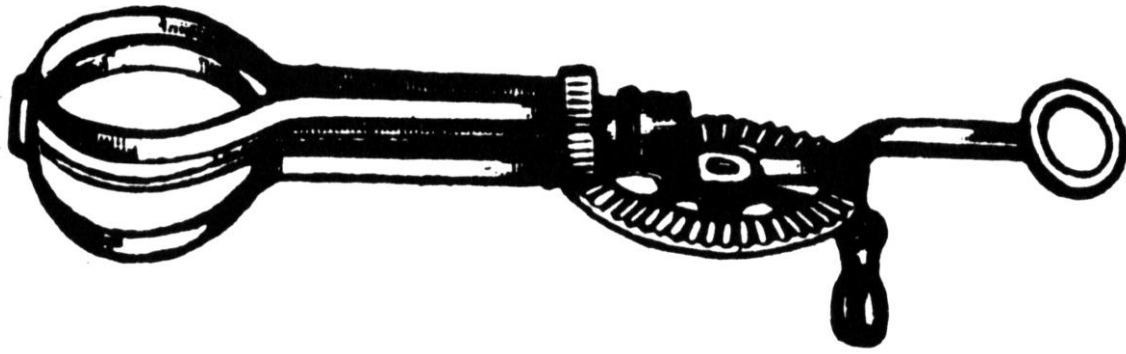
Modemist Cuisine

Sorbet stabilizer mix (100%)

275 g gelatin powder (29%)
175 g CMC (carboxymethyl cellulose) (19%)
250 g locust bean gum (26%)
250 g guar gum (26%)

Mix all powders. Disperse into sorbet base at 40 °C. Bring mixture to 85 °C to fully hydrate stabilizers. Chill to 4 °C and let base mature for 6 hours. Follow further directions in recipe for churning and freezing. See p. 95 for example of use.

Francisco J. Migoya in *Frozen Desserts*



Non-hydrocolloid foams



Photo by Bob Fang

Chocolate tofu espuma

115 g semi-sweet 53% chocolate, melted
400 g soft silken tofu
125 g milk (soy, dairy, almond)
25 g confectionary sugar

Soak tofu for 3 minutes in off-boiling hot water (removes chalkiness). Add desired milk to control the consistency of the mixture before going into the siphon. With too little milk the mixture is stiff and hard to foam up with the siphon. Add sugar and blend to incorporate all ingredients. Pour into 500 mL siphon and charge with nitrous oxide and chill for at least 5 hours before serving. Allow siphon to sit in room temperature for a few minutes prior to dispensing.

Bob Fang

Spinach espuma

500 g drained and pressed out spinach
200 g vegetable or poultry stock
300 g heavy cream (33%)
salt
nutmeg
white pepper

Purée the cooled spinach with the cold vegetable or poultry stock very carefully in a mixer and pass through a fine sieve. Add the cream, season to taste and pour into a heat resistant whipper. Charge with nitrous oxide

Tip: Lightly brown 50 g of diced shallots and one chopped clove of garlic, add before puréeing the mixture. Refine with just a few squirts of lemon juice. Try warm spinach espuma: Pour in the ingredients when still hot or heat whipper to around 60 °C.

iSi North America via <http://www.prairiemoon.biz>

Warm potato espuma

600 g boiled potatoes (boil until powdery)
300 g whole milk
100 g water in which potatoes were boiled
50 g butter
salt
nutmeg

Boil potatoes in salt water until done and pass through a sieve. Mix with hot milk, water in which potatoes were boiled and butter. Season and pour into a heat resistant whipper while warm. Charge with nitrous oxide.

iSi North America via <http://www.prairiemoon.biz>

Potato foam

250 g potatoes, peeled and cut into chunks
125 g single cream
30 g virgin olive oil, plus extra for drizzling

Place the potatoes in a pan of cold water, bring to the boil, and cook for about 20 minutes until soft. Drain, reserving 100 g of the cooking water. Place the cooked potato and the water in a blender. Purée, adding the cream little by little. Follow the same procedure with the oil until you have a smooth emulsion. Season with salt. Strain, then fill the siphon using a funnel. Charge with nitrous oxide, shake, and keep warm in a bain-marie at 70 °C.

Ferran Adria via <http://www.chubbyhubby.net>

Vanilla yogurt parfait

250 g plain yogurt
250 g heavy cream
2 T vanilla syrup

Fill 0.5 L whipper and charge with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

<http://www.isinorthamerica.com>

Chocolate mousse

400 g heavy cream
3 g instant coffee
50 g instant cocoa
40 g cognac/brandy
confectioners' sugar to taste

Swirl to dissolve all ingredients. Fill 0.5 L whipper and charge with nitrous oxide. Shake and refrigerate for 2-4 hours before using.

<http://www.isinorthamerica.com>

Foamy hot ginger mayonnaise foam

60 g egg yolk (ca. 3 yolks)
130 g eggs (ca. 2 eggs)
150 g sunflower oil
50 g olive oil
50 g ginger oil
7 g Dijon mustard
7 g raspberry vinegar
7 g salt

Mix all ingredients in a bowl. Pass through strainer and fill 0.5 L whipper. Charge with nitrous oxide. Heat in bain marie to 70 °C. Shake every 15 min to prevent egg from setting.

Translated from <http://www.kochpiraten.de>

Chocolate chantilly

200 g water

150-200 g chocolate (> 50% cocoa)

Put the chocolate and water into a pan (or bowl of metal), and immerse it into a larger pan with water which is gently heated. Stir the chocolate and water mixture occasionally until it forms a uniform mixture. Immerse the pan into a larger pan with cold water and some ice cubes. Whisk the chocolate water mixture until it thickens.

Hervé This

Zabaglione

5 egg yolks (~100 g)
grated zest of ½ lemon
a pinch of powdered vanilla
or a few drops of vanilla essence
180 g sugar
200 g white wine
100 g Marsala

Whisk yolks, zest, vanilla and sugar in a basin until thick and pale. Place basin in a bain marie and continue whisking. Add white wine and Marsala, a little at a time. Remove basin from bain marie when the zabaglione is thick and frothy.

Larousse Gastronomique

Vessel 75 with maple syrup foam

Foam

4 egg whites (~140 g)
180 g water
120 g maple syrup
60 g lemon juice

Drink

90 g Bourbon
3 healthy dashes Peychaud's bitters

Foam: Place all into a ISI canister, charge with nitrous oxide and refrigerate.

Drink: Stir in mixing glass, strain into rocks glass, top with maple syrup foam, garnish with orange zest.

Jamie Boudreau via <http://www.smallscreennetwork.com>

Marshmallow fluff

110 g egg whites
675 g cups light corn syrup
2.5 g salt
260 g icing sugar (confectioner's)
15 g vanilla extract

In a large bowl, combine egg whites, corn syrup and salt; beat with mixer in high speed for 10 minutes or until thick. Add in icing sugar; beat on low speed until blended. Beat in vanilla until blended. Use this in any recipe called for marshmallow creme. The fluff may be frozen

for later use or kept in a refrigerator for 1 week. Make sure to stir well with a spoon before use after freezing or refrigerating.

<http://www.recipezaar.com/75813>



Photo by Erik Fooladi

Egg white foam (Troll cream)

- 1 egg white (~35 g)
- 80 g sugar
- 125 g berries (blueberries, cranberries, etc.)

Whisk egg white until soft peaks form. Add sugar while still whisking. Fold in berries and serve as dessert.

<http://peppernet.no>

Vauquelin

- 1 egg white (~35 g)
- 150 g fruit syrup/cordial (e.g. blueberry)

Whisk egg white, preferably in a metal or glass bowl. Slowly add syrup while still whisking. One egg white yields approximately 2 L of foam. Spoon out portions and set foam in microwave at 3-400 W for a couple of seconds.

Adapted from Hervé This

iSi scrambled eggs

- 6 whole eggs (about 300-350 g)
- 50 g sweet butter
- 75 g milk
- 6 g salt

Mix ingredients and cook sous vide at 72.5 °C for 25 min (71 °C for a looser texture, 73-74 °C if you want a more dense texture). Transfer to iSi canister, charge with two nitrous oxide charges and hold canister at 65 °C. Serve.

Adapted from Aki Kamoza and H. Alexander Talbot in http://blog.ideasinfood.com/ideas_in_food/2009/09/inspired-by.html



Photo by Linda Anctil

Microwave corn cake

- 190 g whole eggs
- 20 g egg yolks
- 80 g sugar
- 1.5 g salt
- 75 g corn juice
- 40 g melted butter
- 30 g flour

In a bowl, whisk together the whole eggs and egg yolks. Add the remaining ingredients and whisk until blended and smooth.

Pass through a fine mesh sieve. Transfer batter into the canister of a whipped cream charger. Charge with 2 nitrous oxide cartridges. Shake vigorously. Invert canister and discharge batter into a 250 mL plastic cup. Immediately place in microwave oven and heat at 90% power (900 watts) for 40 seconds. Invert cup and tap to dislodge cake. Repeat with remaining batter.

Linda Anctil in

<http://www.playingwithfireandwater.com/files/microwave-corn-cake.pdf>



Photo by Chad Galliano

Foamed garlic oil

200 g of roasted garlic olive oil
16 g mono-/diglycerides (8%)

Heat oil to 65 °C to dissolve mono-/diglycerides. Allow the oil to come to room temperature, pour it into an iSi, and charge it twice with nitrous oxide. Shake well and foam.

*Chad Galliano (inspired by Ferran Adrià) in
<http://chadzilla.typepad.com/chadzilla/2009/01/garlic-oil.html>,*

Stretchy potato ice cream

250 g milk (cold)
250 g cream (cold)
160 g sugar (cold, if possible)
1.5 vanilla beans, scraped
2.5 g salt
5 egg yolks (cold) (~100 g)
225 g steamed peeled potatoes, cool
liquid nitrogen

Combine milk, cream, sugar, vanilla scrapings, salt, and egg yolks in a blender. Pour into a vacuum bag and seal at a high vacuum. Cook in a circulated bath at 82 °C for 17-20 minutes. Smack the bag around a bit on the counter to smooth it out. Chill in an ice bath. Blend the

base with the potatoes in a blender. Freeze the mix with liquid nitrogen in a kitchen aid mixer.

Dave Arnold via <http://www.cookingissues.com/2010/06/30/stretched-today-gone-tomorrow-potato-ice-cream-2/>

Apple vinegar meringue (Italian)

15 g sugar
32 g water
15 g apple balsamic vinegar
50 g egg white (45%)

Heat sugar, water and vinegar in pan to 121 °C to make caramel. Whisk egg whites to soft peaks. Add syrup and keep whisking until bowl is cool. Pipe onto she and dehydrate for 12 h at 55 °C.

René Redzepi in NOMA

Sea buckthorn mousse

50 g sea buckthorn juice (reduced from 70 g)
50 g sugar
17 g water
1.5 g citric acid (0.94)
4 g apple balsamic vinegar
35 g egg whites (22%)
1.5 g egg white powder

Heat and reduce juice to 50 g, cool. Combine sugar, water, citric acid and vinegar in pan and heat to 121 °C to make a caramel. Whip egg whites/egg white powder and caramel to make Italian meringue. Fold in juice reduction and leave in fridge. If desired, scoop out balls and roll in maltodextrin powder.

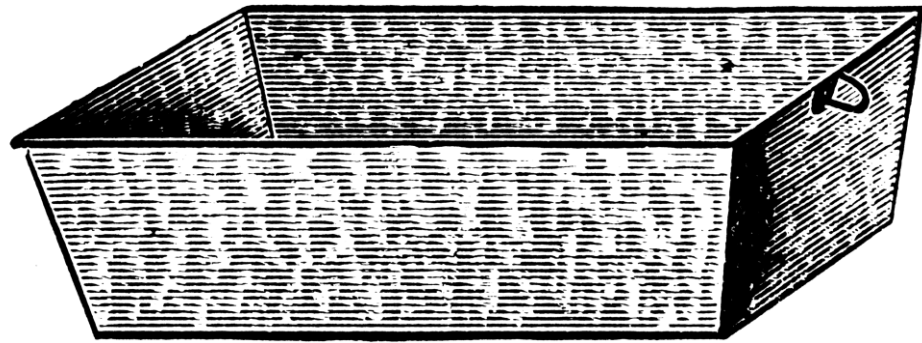
René Redzepi in NOMA

Microwavable meringues

1 egg white (~35 g)
300 g powdered sugar

Lightly whisk egg whites and combine with sugar. Roll into small balls. Place in microwave (three at a time) and cook for 90 sec on high. Meringue will rise and set.

Matt Golding in The Kitchen as Laboratory



Non-hydrocolloid gels

This section includes gels that form spontaneously during preparation, mainly without addition of an external hydrocolloid. In most cases natural sources of the hydrocolloid are used. The section also includes milk curds made with proteolytic enzymes.

Junket (basic recipe)

500 g milk
15 g sugar
5 mL liquid rennet*
grated nutmeg

**) Rennet is available in powder, tablet or liquid form.*

Heat milk to 37 °C. Dissolve sugar. Add rennet and stir gently. Pour into shallow dish and leave undisturbed to set in a warm place. Chill. Sprinkle with nutmeg before serving.

Gelling principle: Rennet is a proteolytic enzyme. When rennet is added to milk it catalyses the denaturation of milk proteins, changing them from a water-soluble form to a water-insoluble form, which leads to the formation of a milk curd. More specifically the "hairy coating" of κ -casein prevents micelles

from aggregating. Proteolytic enzymes modify the κ -casein, making the micelles more prone to calcium induced gelling.

Adapted from <http://www.cookitsimply.com/recipe-0010-02734t.html>

Junket with coffee flavor

600 g milk
7 g instant espresso coffee powder
12 g caster sugar
5 mL liquid rennet

15 g dark chocolate, grated
2 bananas, sliced
60 g cream, whipped

Heat milk with coffee powder and sugar to 37 °C. Add rennet, stir briefly and pour into 4 serving dishes serving dishes. Leave for 1-2 h until set. Cover and chill for an additional 2-3 hours. Sprinkle with grated chocolate. Serve with bananas and whipped cream.

Gelling principle: Same as for Junket.

*Norma MacMillan
via <http://allrecipes.co.uk/recipe/2851/coffee-junket.aspx>*



Photo by Ardo Beltz

Cuajada (Spanish rennet pudding)

1000 g ewe's milk (or regular cows milk)
20 g rennet

Bring milk to boil, remove from the heat and pour into 4 individual bowls. Leave to cool. When the temperature reaches 37 °C, sprinkle the rennet over the top and stir lightly to dissolve. Leave to cool and set without further stirring. Serve with sugar or honey, nuts and raisins.

Gelling principle: Same as for Junket.

<http://www.foodsfromspain.com>



Photo by Chika Watanabe
<http://www.flickr.com/photos/chikawatanabe/4085859918/>

Ginger milk custard

5-10 g fresh ginger juice
200 g milk
10-20 g sugar

Grate ginger and squeeze the juice. Filter through strainer or filter paper into a bowl. Mix sugar and milk and heat to > 80 °C. Cool to ~50 °C (not confirmed). Pour into bowl with ginger juice and wait for 3-5 min. The milk will gel and can be eaten with a spoon.

Gelling principle: Same as for Junket. Ginger contains a proteolytic enzyme zingibain (zingipain). When milk is added to ginger juice, the protease catalyses denaturation of the protein in the milk, changing it from a water-soluble form to a water-insoluble form, which leads to the formation of milk curd.

http://en.wikipedia.org/wiki/Ginger_milk_curd



Photo by Brappy
http://en.wikipedia.org/wiki/File:Aiyu_jelly_by_brappy!_in_Taipei.jpg

Aiyu jelly

Seeds of *Ficus pumila* var. *awkeotsang*
Hard water

Seeds are placed in a cotton cloth bag, submerged in cold water and rubbed. A slimy gel will be extracted from the bag of aiyu seeds as it is squeezed and massaged. After several minutes of massaging and washing, no more of the yellowish tea-coloured gel will be extracted, and the contents of the bag are discarded. The washed gel is then allowed to set into a jelly either in a cool location or in the refrigerator. The jelly is usually served with honey and lemon juice. Note that sugar inhibits the gelling. Since the gel does not dissolve in hot water, aiyu is sometimes used as an ingredient in hot pot.

Gelling principle: The seeds contain highly methoxylated galacturonan. The fruit also contains a methyl esterase. Massaging the seeds liberates this enzyme which makes the hydrocolloid present more prone to form gels in

contact with the calcium present in hard water (hence there will be no gelling in an area with soft water or if distilled water is used).

http://en.wikipedia.org/wiki/Aiyu_jelly
Food Hydrocolloids: Structures, Properties, and Functions
(edited by Katsuyoshi Nishinari, Etsushiro Doi)



Photo by Sjschen

Grass jelly

Mesona chinensis (stalks, leaves)
potassium carbonate (K_2CO_3)
starch

Boil aged and slightly oxidized stalks and leaves of *Mesona chinensis* with potassium carbonate for several hours with a little starch. Cool the liquid to a jelly-like consistency. Cut jelly into cubes and mix with syrup to produce a drink or dessert. The jelly itself has a slight bitter taste, a light iodine and lavender flavor, and is a translucent black.

Gelling principle: *Mesona chinensis* contains a non-starch polysaccharide known as Mesone Blumes Gum (MBG) which interacts with starch.

http://en.wikipedia.org/wiki/Grass_jelly



Photo by Martin Lersch

Gelled seafood sauce

250 g horseradish
4 L ketchup
25 g lemon juice

Grate/grind horseradish with a little water. Mix with ketchup. Adjust with lemon juice (and possibly salt) to taste. Refrigerate. The gelling doesn't happen until a day or so later.

Gelling principle: I'm not sure, but two possibilities are that horseradish contains some kind of pectin methyltransferase or that horseradish peroxidase can act as such an enzyme on methoxylated pectin in the ketchup.

<http://blog.khymos.org/2010/12/17/gelling-ketchup-with-horseradish/>



Photo by DryPot

Tofu

Tofu is prepared by curdling of soy milk with one of several coagulants. A full description of the process is beyond the scope of texture, but can easily be found by searching for "how to make tofu".

Salt coagulant: Calcium sulfate (CaSO_4) is the traditional choice. It produces a tender, yet slightly brittle texture. Nigari salts - magnesium chloride (MgCl_2) and calcium chloride (CaCl_2), yield a smooth and tender texture.

Acid coagulant: Glucono-delta lactone produces an almost jelly like texture as that found in "silken" tofu. Is often used in combination with calcium sulfate. Other acids such as acetic acid and citric acid may also be used, although they have a larger effect on the taste.

Enzyme coagulant: proteases such as papain can be used.

Gelling principle: A thorough description is well beyond this text, but the metal ions with a double positive charge (calcium, magnesium) play a crucial role in linking together protein chains. This is not too different from how calcium helps form gels with carrageenan, low acyl gellan, low methoxyl pectin, sodium alginate and hominy.

<http://en.wikipedia.org/wiki/Tofu>



Photo by Geoff Lane

Hominy

Hominy is made by soaking and cooking corn (maize) grains in a solution of slacked lime (calcium hydroxide, $\text{Ca}(\text{OH})_2$) in a process termed *nixtamalization*. The soaked maize is washed and the resulting masa is then dried and ground into a powder, masa seca or masa harina, which for instance can be used to make tortillas. A full description of the process is beyond the scope of this recipe collection, but can be easily found by searching for "homemade hominy".

Gelling principle: The lime is highly alkaline. This helps the dissolution of hemicellulose, the major glue-like component of the maize cell walls, and loosens the hulls from the kernels and softens the corn. Some of the corn oil is broken down into emulsifying agents (monoglycerides and diglycerides), while bonding of the corn proteins to each other is also facilitated. The divalent calcium in lime acts as a cross-linking agent for protein and polysaccharide acidic side chains. This cross-linking can be compared with the calcium induced gel formation in carrageenan, low acyl gellan, low methoxyl pectin, sodium alginate and tofu.

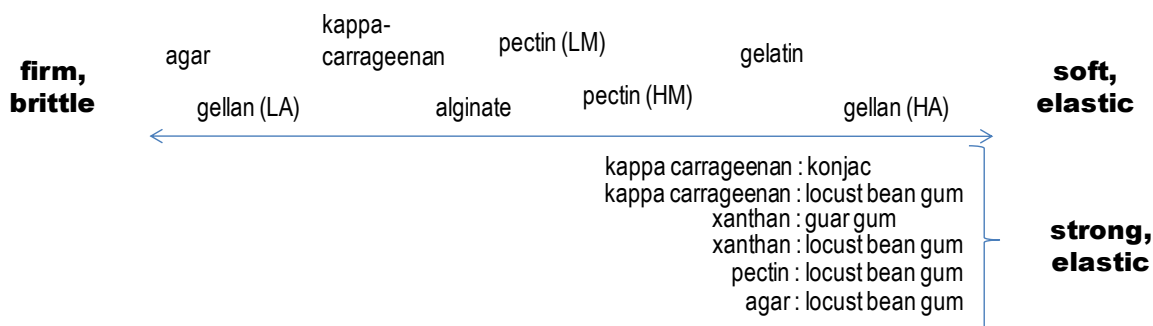
<http://en.wikipedia.org/wiki/Hominy>
<http://en.wikipedia.org/wiki/Nixtamalization>

Do you know other examples of non-hydrocolloid gels that form spontaneously? Feel free to send me an email at webmaster@khymos.org.

Appendix

Comparison of gel texture in common gelling agents

(adapted from "CRC Handbook of hydrocolloids")



Synergies

Hydrocolloids (ratio or percentage)	Effect/texture
high methoxyl pectin + sodium alginate	gel formation at lower solid contents and pH < 3.8
iota carrageenan + starch	gives gels which are four times stronger than with starch alone
kappa carrageenan (0.6%) + konjac (0.4%)	strong, elastic gels (konjac interacts more strongly with kappa carrageenan than locust bean gum)
kappa carrageenan + locust bean gum (maximum gel strength at 65:35, lower syneresis at 20:80)	elastic gels with low syneresis when cooled below 50-60 °C
methyl cellulose + starches	increased viscosity, better water binding
xanthan (0.6%) + konjac (0.4%)	strong gel
xanthan (1%) + konjac (0.02-0.03%)	viscosity of xanthan is raised 2-3 times upon heating
xanthan + guar gum	increased viscosity, strong and elastic gel
xanthan + locust bean gum	increased viscosity, strong and elastic gel

Viscosity of 1% hydrocolloid solutions compared with that of common foods

Food ^{a)} /Hydrocolloid ^{b)}	Viscosity (Pa s) with shear
Whipping cream	0.02
Raw egg yolk	0.09
Carrageenan, 1% in water	0.1-1.5
Sodium alginate, 1% in water	0.2-0.4
Xanthan, 1% in water	1-2; without shear: > 10 ^{d)}
Guar gum, 1% in water	3-5
Locust bean gum, 1% in water	2.5-3.5
Molasses	3.3
Sweetened condensed milk	6.8
Mayonnaise	12.1
Honey	18.3
Nutella	28.1
Marmite	43.9
Konjac:xanthan (80:20), 1% ^{c)}	161

a) 25 °C at 10 s⁻¹. Ref: Vega et al. *Food Biophys* 2011, 152. b) 25 °C at 20 s⁻¹ Ref: Hui, Handbook of Food Science, Technology, and Engineering, Vol. 3., 2006, CRC. c) Laaman, Hydrocolloids in Food Processing, 2011, Wiley. d) Nussinovitch, Cooking innovations, 2013, CRC.

Volume-weight conversion of hydrocolloids

Warning: Please note that densities a powder varies greatly with particle size and packing. This means that the same ingredient can display a very large range of different densities. Therefore this table should be considered as **very rough indication** of the densities, and hence only be used when a balance is not available. Whenever possible it is recommended to weigh ingredients on a sufficiently accurate balance.

Name	Density (g/mL)	mL/g	g/teaspoon (5 mL)	g/tablespoon (15 mL)
Agar	0.48	2.1	2.4	7.2
Calcium chloride	0.80	1.3	4.0	12
Calcium gluconate	0.62	1.6	3.1	9.3
Calcium lactate	0.68	1.4	3.4	10.3
Calcium lactate gluconate	0.58	1.7	2.9	8.7
Cornstarch	0.64	1.6	3.2	9.6
Gellan gum	0.39	2.6	1.9	5.8
Guar gum	0.63	1.6	3.2	9.5
Iota carrageenan	0.65	1.5	3.3	9.8
Kappa carrageenan	0.65	1.5	3.3	9.8
Lecithin	0.46	2.2	2.3	6.9
Locust bean gum	~0.6	1.7	1.8	9
Maltodextrin	0.42	2.4	2.1	6.3
Methyl cellulose	0.27	3.7	1.3	4.0
Mono/diglyceride				
Pectin	0.68	1.4	3.4	10.3
Sodium alginate	0.69	1.4	3.5	10.4
Sodium citrate				
Sucrose esters of fatty acids				
Tara gum	0.63	1.6	3.2	9.5
Xanthan gum	0.69	1.4	3.5	10.4

You can help fill out the table by measuring the densities of hydrocolloids and reporting them back to webmaster@khymos.org. More info about this on <http://blog.khymos.org/2008/04/30/help-needed-with-densities-of-hydrocolloids>. A useful table can also be found at <http://fr.molecularcuisine.org/forum/showthread.php?tid=139>.

texturePro measuring spoon-weight conversions

Warning: Please note the significant difference between the two sources! Until numbers can be confirmed it is not advisable to convert recipes in "Texture" to texturePro measuring spoons based on this table. If you have more accurate conversions at hand - please let me know by sending an email to webmaster@khymos.org.

Name	texturePro name	1 texturePro measuring spoon equals approximately ^{a)}	1 texturePro measuring spoon equals approximately ^{b)}
Agar	Agazoon	0.1 g	0.64 g
Calcic	Calazoon		0.33 g
Gellan	Gellazoon	0.9 g	0.50 g
Iota	Iotazoon	0.3-0.4 g	0.24 g
Lecite	Emulzoon		0.14 g
Methyl cellulose	Celluzoon	0.5 g	
Sodium alginate	Algizoon	0.8 g	1.33 g
Xanthan	Xanthazoon	0.5 g	0.5 g

a) Conversions are based on recipes found in *Verwegen kochen* by Heiko Antoniewicz and Klaus Dahlbeck.

b) Conversions are based on recipes found in *Avant-Garde molekularküche und andere progressive kochtechniken* by Ralf Bos and Thomas Ruhl. Numbers taken from <http://fr.molecularcuisine.org/forum/showthread.php?tid=2>.

List of common chemicals

Popular name	Synonyms	Formula	CAS	E-number
calcium chloride	calcium(II)chloride, calcium dichloride (anhydrous)	CaCl ₂	[10043-52-4]	E509
calcium gluconate	calcium (2R,3S,4R,5R)- 2,3,4,5,6-pentahydroxyhexanoate	C ₁₂ H ₂₂ CaO ₁₄	[299-28-5]	E578
calcium lactate	calcium 2-hydroxypropanoate	C ₆ H ₁₀ CaO ₆	[814-80-2]	E327
calcium lactate gluconate	Glocal	C ₉ H ₁₆ CaO ₁₀	[11116-97-5]	E327+E578
carbon dioxide		CO ₂	[124-38-9]	E290
citric acid	2-hydroxypropane-1,2,3-tricarboxylic acid	C ₆ H ₈ O ₇	[77-92-9]	E330
cream of tartar	potassium bitartrate, potassium hydrogen tartrate	KC ₄ H ₅ O ₆	[868-14-4]	E336
glycerol	glycerine, glycerin, propane-1,2,3-triol	C ₃ H ₈ O ₃	[56-81-5]	E422
isomalt		C ₁₂ H ₂₄ O ₁₁	[64519-82-0]	E953
lime	pickling lime, calcium hydroxide	Ca(OH) ₂	[1305-62-0]	E526
nitrous oxide	dinitrogen oxide	N ₂ O	[10024-97-2]	E942
potassium citrate	tripotassium citrate	C ₆ H ₅ K ₃ O ₇	[866-84-2]	E332
potassium phosphate	potassium dihydrogenphosphate	KH ₂ PO ₄	[7778-77-0]	E340
sodium citrate	trisodium citrate, trisodium 2-hydroxypropane-1,2,3-tricarboxylate	Na ₃ C ₆ H ₅ O ₇	[68-04-2]	E331
sorbitol	(2R,3S,4S,5S)-hexane-1,2,3,4,5,6-hexol	C ₆ H ₁₄ O ₆	[50-70-4]	E420

Gelatin gels with alcohol

Alcohol in dish (%)	Suggested amount of gelatin (%) *
0	1
5	1.8
10	2
15	2.2
20	2.4
30	2.8

* The experiment was conducted with a powdered, 180 bloom gelatin. The concentrations give gels of approximately the same gel strength for the different ethanol/water mixtures. Notice that alcohol can influence the melting temperature. Added sugar will increase the gel strength. The range 5-15% has been tested. Values for 15-30% are extrapolated. For gels with > 30% alcohol it is recommended to check the gel properties before serving.

Gelatin and bloom strength

Name	Bloom strength	Grams pr. sheet
Bronze	125-155	3.3
Silver	160	2.5
Gold	190-220	2.0
Platinum	235-265	1.7

Formula for conversion of bloom strengths

The required mass of gelatin B can be calculated if the mass of A is known as well as the bloom strengths of gelatin A and B.

$$\text{massB} = \text{massA} \times \frac{\text{bloomstrengthA}}{\text{bloomstrengthB}}$$

Sources on the net (see <http://forums.egullet.org/index.php?showtopic=85599>) cite a formula where mass A is multiplied with the square root of (bloom strength A/bloom strength B). However, the formula fits better with the data given for gelatin sheets in the table above when the square root is omitted.

Conversion table for brand names

Many "branded" hydrocolloid mixtures are not included in this collection as their composition is not openly available. Examples include Versawhip, Pure-Cote, Genutine, Ultra-Tex and Ultra-Sperse. The best source for information on these is to contact the producers directly and talk to one of their application managers. Some of the products also become so specialized that any description would be beyond the scope of this collection.

Name	Texturas	CP Kelco	texturePro ^{d)}	Sosa ^{d)}
Agar	Agar		Agazoon	
Calcium chloride	Calcic			Clorur/Gelesfera B
Calcium gluconate	Gluc ^{a)}			Gluconolactat ^{a)}
Calcium lactate			Calazoon	
Gellan gum		Kelcogel	Gellazoon	
- low acyl	Gellan	Kelcogel F		
- high acyl		Kelcogel LT 100		
Guar gum			Guarzoon	
Iota carrageenan	Iota	Genuvisco	lotazoon	
Kappa carrageenan	Kappa	Genu Texturizer		
Lambda carrageenan		Genuvisco		
Lecithin	Lecite			Soya lecithin Gelespuma ^{b)}
Locust bean gum		Genu Gum	Locuzoon	
Maltodextrin	Malto			Maltosec
Methyl cellulose	Metil	Cekol	Celluzoon	Metilgel
Mono/diglyceride	Glice			Emulsifying paste
Pectin		Genu		GelGras
Sodium alginate	Algin		Algizoon	Gelesfera A
Sodium citrate	Citras			Kit pH
Sucrose esters of fatty acids	Sucro			
Xanthan gum	Xantana	Keltrol	Xanthazoon	Gelespesa ^{c)}

a) A mixture of calcium gluconate and calcium lactate

b) A mixture of lecithin, glucose, potassium phosphate and silica

c) A mixture of xanthan and maltodextrin

d) It seems as if all texturePro and many of the Sosa products are blended with maltodextrin. This helps dispersion and may also allow the use of a measuring spoon as the volume increases. Measuring spoon-weight conversions for some of the texturePro products are presented in a separate table (page 114). Where the exact blending ratio is not known, these products can not be used with the recipes in this collection.

Equal strength calcium setting baths

To obtain the same concentration of calcium ions in solution, different amounts of calcium salt have to be used, depending on the molecular weight (MW). The table below shows amounts to add to operate at the same calcium concentrations, as well as concentrations obtained when adding the salts at 0.5, 2.5 and 5%. Calcium chloride is very hygroscopic, and upon exposure to air it will bind moisture from the air. But as long as the powder is free flowing it is safe to assume that it is anhydrous (or least only a mono- or dihydrate). As it binds more water calcium chloride becomes more or less impossible to measure out and very sticky.

To obtain the same calcium concentration that you get with a 0.5% solution of calcium chloride one must prepare either a 1.94% solution of calcium gluconate or a 0.98% solution of calcium lactate. As a rule of thumb one should use twice as much calcium lactate and four times as much calcium gluconate as calcium chloride for the same effect.

Salt used	Amount	Calcium concentration
calcium chloride, anhydrous (MW = 110.98)	5 g/L (= 0.5%)	0.045 M
calcium chloride, dihydrate (MW = 147.01)	5 g/L (0.5%)	0.034 M
calcium gluconate (MW = 430.37)	5 g/L (0.5%)	0.012 M
	25 g/L (2.5%)	0.058 M
	50 g/L (5.0%)	0.116 M
	19.4 g/L (1.94%)	0.045 M (same as 0.5% calcium chloride)
calcium lactate (MW = 218.22)	5 g/L (0.5%)	0.022 M
	25 g/L (2.5%)	0.114 M
	50 g/L (5.0%)	0.229 M
	9.8 g/L (0.98%)	0.045 M (same as 0.5% calcium chloride)

Calcium content of some calcium rich food products

In nutrition tables calcium contents of food is typically reported in mg/100 g. A content of 100 mg/100 g corresponds to a calcium concentration of 0.025 M. Some typical calcium concentrations are given in the table below. Note that the calcium not necessarily is present in a form that makes it available gelling purposes.

Food product	Calcium mg/100 g	Calcium conc. M	Food product	Calcium mg/100 g	Calcium conc. M
Sesame seeds	980	0.244	Garlic, raw	181	0.045
Semi-soft/hard cheese	800	0.199	Basil, fresh	177	0.044
Mozarella	720	0.179	Instant coffee	141	0.035
Brie	510	0.127	Rhubarb	140	0.035
Tahini	426	0.106	Yoghurt	128	0.031
Spinach, frozen	280	0.069	Ice cream (dairy)	120	0.029
Dried figs	250	0.062	Hazelnuts	114	0.028
Peppermint, fresh	243	0.060	Pistachios, raw	105	0.026
Almonds	240	0.059	Milk	100	0.025
Soya flour	210	0.052	Olives	88	0.022
Molasses	205	0.051	Blackcurrant	65	0.016

Sources: <http://www.nof-norge.org/filer/temaark/Kalsiuminnhold.doc> and <http://www.ars.usda.gov/Services/docs.htm?docid=23634>

Temperature ranges for sugar work

°C	°F	Sugar stage	Sugar concentration (Brix, °Bx)
110-111	230-233	Thread	80 %
112-115	234-240	Soft ball (fudge)	85 %
118-120	244-248	Firm ball	87 %
121-130	250-266	Hard ball	92 %
132-143	270-290	Soft crack	95 %
146-154	295-310	Hard crack (toffee)	99 %
160	320	Clear liquid	100 %
170	340	Brown liquid (caramel)	100 %
177	350	Burnt sugar	100 %

Temperature conversion table

°C	°F	°C	°F	°F	°C	°F	°C
-30	-22	140	284	-30	-34	290	143
-20	-4	150	302	-20	-29	310	154
-10	14	160	320	-10	-23	330	166
0	32	170	338	10	-12	350	177
10	50	180	356	30	-1	370	188
20	68	190	374	50	10	390	199
30	86	200	392	70	21	410	210
40	104	210	410	90	32	430	221
50	122	220	428	110	43	450	232
60	140	230	446	130	54	470	243
70	158	240	464	150	66	490	254
80	176	250	482	170	77	510	266
90	194	260	500	190	88	530	277
100	212	270	518	210	99	550	288
110	230	280	536	230	110	570	299
120	248	290	554	250	121	590	310
130	266	300	572	270	132	610	321

Miscellaneous

nitrous oxide = dinitrogen oxide = N_2O = cream charger

carbon dioxide = CO_2 = soda charger

t = tea spoon = 5 mL

T = table spoon = 15 mL

1 large egg \approx 60 g (including shell)

1 large egg white \approx 35 g \approx 5 g egg white powder + 30 g water

1 large egg yolk \approx 20 g

Comparison of hydrocolloid properties

Name	agar (E406)	carrageenan (E407) iota type	carrageenan (E407) kappa type	cornstarch	gelatin (E441)
Origin	polysaccharide obtained from red algae (several species)	polysaccharide obtained from red seaweed	polysaccharide obtained from red seaweed.	polysaccharide extracted from maize/corn	protein obtained from collagen in animals
Properties, texture	thermoreversible, heat resistant, brittle gel; high hysteresis	thermoreversible, soft, shear-thinning, elastic gel with calcium	thermoreversible, firm, brittle gel with potassium	thermoirreversible thickener	thermoreversible, soft, elastic gel; melts in mouth
Clarity	clear to semi-opaque		clear/slightly turbid	opaque	clear, transparent
Dispersion	in cold or hot water	cold water, dispersion is improved by mixing with sugar (3-5x) or small amounts of alcohol	cold water, dispersion is improved by mixing with sugar (3-5x) or small amounts of alcohol	cold water	bloom in cold water.
Hydration (dissolution)	> 90 °C; heating to boil necessary for gelling.	> 70 °C; for high sugar concentrations: add sugar after hydration.	> 70 °C	62-72 °C	~50 °C
pH	2.5-10	4-10	4-10		4-10 (weaker gels for pH <5 and >9)
Setting	35-45 °C, rapid (minutes)	40-70 °C (0.2-0.8%), higher temp. with increasing electrolyte conc., setting t. incr. w/locust bean gum	30-60 °C (0.2-0.8%), higher temp. with increasing electrolyte conc.	thickens when heated > 70 °C	< 15 °C, slow (hours)
Melting	80-90 °C%	5-10 °C above setting temperature (unless mixed with starch)	10-20 °C above setting temperature (unless mixed with certain proteins)		25-40 °C
Promoter	sugar; sorbitol and glycerol improve elasticity, stronger gel at higher pH	calcium yields soft and elastic gels, potassium and sodium also promote gelling	potassium, milk protein, calcium		transglutaminase (1-3%), milk, sugar, low alcohol conc., low salt conc.
Inhibitor	tannic acid (counteracted by add. of glycerol); prolonged heating at pH outside the range 5.5-8	hydrolysis of solution at low pH with prolonged heating; gels are stable	salts; hydrolysis of solution at low pH with prolonged heating; gels are stable	pH around 2-3 lowers viscosity	salts; acids; prolonged heating; proteases in fresh kiwi, papaya, pineapple, peach, mango, guava, fig, ginger; high alcohol conc.; tannins can cause precipitation;
Tolerates	salt, sugar, alcohol, acid, proteases	salt			alcohol up to ~40%
Viscosity of solution	low	medium	low	high once fully hydrated	low
Typical concentration	0.2% will set, 0.5% gives firm jelly, [0.07-3%]*	1-1.5% for gel [0.02-1.5%]*	1.5% for gel [0.02-1.5%]*	[0.4-10.4%]*	0.5-1.5% for espumas; 0.6-1.7% for gels; [0.12-7.9%]*
Synergies	locust bean gum (only with certain agar types)	starch	locust bean gum (increased elasticity, improves clarity, reduced syneresis), konjac, tara, milk protein		
Syneresis	yes (can be prevented by replacing 0.1-0.2% agar with locust bean gum)	no	yes		

* Concentrations in [square brackets] show range exemplified in this collection.

Table continued on next page

Name	<i>gellan (E418) low acyl (LA)</i>	<i>gellan (E418) high acyl (HA)</i>	<i>guar gum (E412)</i>	<i>konjac glucomannan (E425)</i>	<i>locust (carob) bean gum (E410)</i>
Origin	polysaccharide obtained by fermentation of <i>Sphingomonas elodea</i>	polysaccharide obtained by fermentation of <i>Sphingomonas elodea</i>	polysaccharide extracted from the seeds of the legume <i>Cyamopsis tetragonolobus</i>	polysaccharide extracted from the tuber <i>Lasioideae Amorphophallus</i>	polysaccharide extracted from the seeds of the legume <i>Ceratonia siliqua</i>
Properties, texture	<i>thermoirreversible</i> , hard, brittle gel; sodium/potassium ions give <i>thermoreversible</i> gels	<i>thermoreversible</i> , soft, elastic gel; thickener if not heated	very stable, quick acting thickener, suitable for suspending particles	shear-thinning viscous sol. with fatty mouth feel; <i>thermoreversible</i> elastic gels w. xanthan/kappa carrageenan; <i>thermoirreversible</i> gels at pH 9-10	thickener, often used in ice cream; elastic gel in 1:1 ratio with xanthan
Clarity	transparent	opaque	transparent	transparent	
Dispersion	cold water; d. is improved (allowing add. to hot solutions) by mixing with sugar (3-5x), glycerol, alcohol or oils (3-5x); hard water promotes d.	cold water; d. is improved (allowing add. to hot solutions) by mixing with sugar (3-5x), glycerol, alcohol or oils (3-5x); hard water promotes d.	cold water, d. is improved by mixing with sugar (3-5x) or <u>small</u> amounts of alcohol	cold water; d. can be improved by mixing with sugar or flour (3-5x).	cold water; d. can be improved by mixing with sugar (3-5x).
Hydration (dissolution)	90-95 °C; keep pH > 3.9; add sugar after hydration; inhibited in presence of sodium and calcium, but 0.1-0.3% sodium citrate helps	85-95 °C; can be hydrated at pH < 4; less sensitive to ions; add sugar after hydration	cold or hot water	cold water with continuous stirring for at least 2h	> 90 °C
pH	4-10	3-10	4-10	~3-10	4-10
Setting	10-60 °C, rapid (minutes)	70-80 °C		gelling: pH >9 followed by heating > 80 °C	
Melting	does not melt	70-80 °C		w. xanthan: yes, alkaline gels: no	
Promoter	gelling promoted by calcium, magnesium, sodium, potassium and acids	gelling is not sensitive to ions		xanthan, kappa carrageenan	will only gel in presence of agar, kappa carrageenan or xanthan
Inhibitor	will not hydrate at pH < 3.9 or with sodium/calcium salts present		low pH, alcohol	viscosity decreases with decreasing pH; gelling occurs at higher pH.	
Tolerates		salts, acidic foods	salt and sugar	salt, acidic foods	
Viscosity of solution	low	high	high in cold low in hot	low temperature: high high temperature: lower	low temperature: high highest viscosity obtained > 60 °C
Typical concentration	0.4-0.7% for gels (self supporting from 0.05%); [0.03-2.6%]*	0.4-0.7% for gels (self supporting from 0.2%); [0.03-2.6%]*	0.2-0.5% (very sticky solutions above 1%); [0.14-0.67%]*	0.1-0.3% for viscous solutions; [0.39-1.1%]*	0.1-1.0%; [0.32-0.9%]*
Synergies			locust bean gum, xanthan	xanthan, kappa carrageenan, locust bean gum	xanthan, kappa carrageenan
Syneresis	no (if left untouched)	no			

Table continued on next page

Name	methyl cellulose (E461)	pectin (E440) low methoxyl (LM)	pectin (E440) high methoxyl (HM)	sodium alginate (E401)	xanthan (E415)
Origin	a modified polysaccharide derived from cellulose rich plants.	polysaccharide derived from citrus peel and apple pomace.	polysaccharide derived from citrus peel and apple pomace.	polysaccharide extracted from brown algae.	polysaccharide obtained by fermentation of <i>Xanthomonas campestris</i>
Texture	thermoreversible soft elastic gel when heated; helps form and stabilize foams when cold	thermoreversible gels	thermoirreversible gels	thermoirreversible gel in presence of calcium ions; shear-thinning thickener in absence of calcium	high viscosity, shear-thinning; thermoreversible soft elastic gels w. locust bean gum or konjac
Clarity		clear, transparent	clear, transparent	clear, transparent	clear, mostly transparent
Dispersion	hot or cold water, use slow speed to avoid foaming; mix with small amount of hot water to avoid lumps and stir into the rest of the cold water	cold water; d. can be improved by mixing with sugar (3-5x)	cold water; d. can be improved by mixing with sugar (3-5x)	cold water; d. can be improved by mixing with sugar (3-5x); add. of acidic liquids may cause precipitation of alginic acid	cold or hot water; d. can be improved by mixing with sugar (10x) or glycerol, alcohol or vegetable oil.
Hydration (dissolution)	cold water, leave over night; add salt after complete hydration	cold or hot water	cold or hot water; will not dissolve if > 25% sugar	cold or hot water; if cold, allow to hydrate for a couple of hours	cold or hot water; does not hydrate at high sugar concentrations (>65%).
pH	2-13	2.5-5.5	2.5-4	2.8-10	1-13
Setting	gels when heated to 50-60 °C		40-85 °C (depending on pH and degree of methoxylation)	independant of temp.	
Melting	melts below the setting temperature	yes	no	no (but prolonged heating at low/high pH will destabilize gel)	
Promoter	salt lowers setting temperature	requires calcium ions for gelling; can gel in presence of milk (0.6-0.9% pectin required)	requires acidity (pH < 3.5) and high sugar contents for gelling (60-80% soluble solids, mainly sugar)	requires calcium for gelling	
Inhibitor	alcohol rises setting temperature	high sugar concentrations, low pH, alcohol		precipitates as alginic acid at pH < 4 (is corrected by add. of sodium citrate); gels at too high ion/salt concentrations	
Tolerates	acids, bases			up to ~50% ethanol (d. and hydrate in water before addition of alcohol)	acids/bases, salts, heating, enzymes, up to 60% ethanol
Viscosity of solution	low when cold, high when hot	low	low	low in neutral water, high at lower pH (< 5.5)	high (independent of temperature)
Typical concentration	1-2% for gels; [0.26-3.4%]*	[0.15-3.1%]*	[0.15-6.3%]*	0.5-1% for normal spherification; [0.3-5%]*	0.25% thin running sauce, 0.7-1.5% thick sauces, 0.5-0.8% foams; [0.07-1%]*
Synergies					guar, locust bean gum, konjac, tara
Syneresis	yes	yes	yes	yes	

Glossary

Dispersion A mixture of two components that are non-miscible. For hydrocolloids in particular it is often the case that they do not hydrate (or dissolve) instantly, and that hydration is associated with swelling which easily causes lumping. It is therefore necessary to disperse hydrocolloids in water. This can be done with an immersion blender, a conventional blender or by grinding/mixing the hydrocolloid with a helping agent such as sugar, oil or alcohol prior to dispersion in water. Refer to table on page 120 for details.

Emulsion A mixture of two immiscible liquids where one (the dispersed phase) is dispersed in the other (the continuous phase). An example includes mayonnaise where oil droplets are dispersed in water which is the continuous phase. Oppositely, in butter water is dispersed in fat. An emulsion is stabilized by surface active components which have a water soluble and a fat soluble end. Lecithin is an example of a compound with such properties.

Hydration The process where a hydrocolloid binds to water and becomes fully dissolved. Proper hydration requires that the hydrocolloid first is dispersed, and depending on the hydrocolloid, hydration may occur at lower or higher temperature (see table on page 120 for details).

Hydrocolloid A substance that forms a gel in contact with water.

pH A measure of the acidity or basicity of a solution. The scale ranges from pH 1 to pH 14. Neutral solutions have pH 7, acidic solutions have pH below 7 and basic solutions have pH above 7. pH is easily measured with an electronic pH meter or special paper strips which are compared with color charts after wetting.

Sequestrant A sequestrant forms a stable compound (known as a chelate) with polyvalent metal atoms such as calcium.

This can be particularly useful when trying to disperse hydrocolloids that form gels upon contact with calcium ions into calcium rich foods. By adding the sequestrant to the calcium containing food (or water) the hydrocolloid can easily be dispersed without forming lumps.

Shear-thinning A liquid or gel where stirring or agitation causes a decrease in viscosity. The viscosity is regained when the liquid or gel is left undisturbed.

Spherification A process for shaping liquids into spheres. With calcium induced gelling only a thin layer is gelled, leaving a liquid centre. In normal spherification a flavored liquid containing either sodium alginate, gellan or carrageenan is dripped into a setting bath with calcium. In reverse spherification a calcium containing food (or an ingredients mixed with a soluble calcium salt) is dripped into a hydrocolloid setting bath. When agar or gelatin are used the flavor liquid is dripped into cold oil. These spheres do not have a liquid centre.

Syneresis The process where liquid is expelled from a gel. This is typically not a desired feature for gels, whereas it is the main principle behind gel filtration (see examples with agar and gelatin in the recipe section).

Synergy Some combinations of hydrocolloids yields results which differ significantly from that of the individual components. See page 113 for some examples.

Thermoirreversible gel A gel that does not melt upon heating. Excessive heating however may cause evaporation of the water and collapse of the gel.

Thermoreversible gel A gel that melts upon heating and sets upon cooling.

Viscosity A measure of the resistance of a fluid against flow. Water has low viscosity.

References

In addition to the references given for each recipe, the following books and websites have been consulted in the compilation of the recipes and the appendix:

Books

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- Phillips, G. O.; Williams, P. A. (ed.) CRC handbook of hydrocolloids, 2000, Woodhead.

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- <http://food.oregonstate.edu/learn/gum.html>
- <http://www.cybercolloids.net>
- <http://en.wikipedia.org>
- <http://www.texturaselbulli.com>
- <http://www.sosa.cat>
- <http://forums.egullet.org>
- <http://www.cpkelco.com>
- <http://www.foodproductdesign.com>

Suppliers

Europe

<http://www.100x100chef.com>
<http://www.bienmanger.com>
<http://www.bos-food.de>
<http://www.buchgourmet.de>
<http://www.creamsupplies.co.uk>
<http://www.cuisine-innovation.fr>
<http://www.gastronomie.kalys.com>
<http://www.infusions4chefs.co.uk>
<http://www.jeloshop.de>
<http://www.mcc-metropolis.com>
<http://www.phode.com>
<http://www.texturaselbulli.com>
<http://www.texturepro.de>

Asia

<http://www.ajiusafood.com>

Australia

<http://www.mfcd.net/depot>
<http://www.redspooncompany.com/>
<http://www.chefsarmoury.com/>
<http://www.molecularfoods.com.au/>
<http://www.prestigeproducts.com.au/online-shop>

North America

<http://le-sanctuaire.com>
<http://parisgourmet.com>
<http://www.allforchefs.info>
<http://www.chefrubber.com>
<http://www.culinary-imports.com/>
<http://www.dcduby.com/entertain>
<http://www.lepicerie.com>
<http://www.modernistpantry.com/>
<http://www.molecule-r.com/>
<http://www.myspicesage.com/>
<http://www.powdertothepeople.ca/>
<http://www.terraspace.com>
<http://www.thechefstableathome.com>
<http://www.ticgums.com>
<http://www.tienda.com>
<http://www.willpowder.net>

South America

<http://www.gastronomy11.lojatemporaria.com>
<http://www.passionfoods.biz>
<http://crmgastronomy.com/>

Updated list available at <http://khymos.org/suppliers.php>.

To be added, please send a link to webmaster@khymos.org.

Texture index

Overview of texture-hydrocolloid combinations represented in recipe collection

X indicates use of single hydrocolloid + indicates use in combination with other hydrocolloids	Agar	Carrageenan	Cornstarch	Gelatin	Gellan	Guar gum	Gum arabic	Isomalt	Konjac	Lecithin	Locust bean gum	Maltodextrin	Methyl cellulose	Pectin	Sodium alginate	Tara	Xanthan
	Emulsion	X			X	X					X			X			
Film	X	X		X	X								X	X	X		
Fluid gel	+	X+			X				+								+
Foam	X+	X+	X	X+					+	X+		X	X+	X			X+
Frozen	+	X+	X	X+	X	X+			X	X	X+	+		X			X+
Gel	X+	X+	X+	X+	X+	X+	X+	+	X+	X	+	+	X+	X+	X	X	X+
Liquid	X	X+	X	X	X	X				X	X	X	+	X			X+
Noodle	X+				X+				X		+		X				+
Other use	X		+	X		+	X			X			X	X			X+
Solid			X		X		X	X	X			X		X			
Solid foam	X+	+	+	X+		+	X	X+			+		X+	X+			X+
Spherification	X+	X		X	X						+				X		

Know a recipe that fills a "hole" in the table? Let me know at webmaster@khymos.org.

List of recipes according to texture and hydrocolloid used

Category	Category includes *
Emulsion	Liquids with a significant proportion of fat/oil
Film	Thin, flexible sheets
Fluid gel	Gels which have been sheared after gelling to yield a purée like texture
Foam	Airs, espumas, fluffed/foamy gels, soufflés, whipped cream, mousse, chantilly, meringues, zabaglione
Frozen	Ice creams, sorbets, grainta, frozen foams
Gel	Gels, jellies, jams, marmalades, lokums, spreads, icings
Liquid	Liquids and thickened liquids, zabaglione
Noodle	Noodles made by gelling in PVC tube, extrusion in setting liquid or cutting/shaping of films
Other use	All recipes not fitting into any of the remaining categories
Solid	Very hard (non-flexible) gels and solids, tuiles, powdered fats/oils
Solid foam	Marshmallows, frozen foams, meringues, tuiles
Spherification	Calcium and potassium induced gelling (normal/reverse), instant gelling in cold oil or liquid nitrogen

* Note that the same recipe might appear in several categories

A plus sign (+) after a hydrocolloid means it is used in combination with other hydrocolloids in the listed recipes.

Emulsion

Agar	
Vinaigraite sheets	15
Gelatin	
Kientzheim butter foam	38
Olive oil gummy bears	35
Gellan	
Olive oil gelatin	44
Lecithin	
Emulsified vinaigrette	57
Orange air with olive oil	58
Methyl cellulose	
Olive oil soba noodles	68
Xanthan	
Balsamic vinegar dressing	91
Fruit pureé mayonnaise.....	90
Iberian ham cream	89

Film

Agar	
Cold cod-fish salad with agar wrapping .	13
Dehydrated lime curd	11
Vinaigraite sheets	15
Carrageenan	
Ginger film and fluid gel.....	19
Maple coating	19
Gelatin	
Edible wrapper/film	34
Gellan	
Consommé macaroni	45
Saffron tagliatelle.....	45

Methyl cellulose	
Hot mozzarella sheets	69
Thick film (like plastic/leather)	72
Thin film (brittle, melting)	71
Pectin	
Blackberry yogurt ravioli	78
Raspberry sheets.....	77
Sodium alginate	
Thin film	86

Fluid gel

Agar+	
Flavored agar cream.....	100
Fluid gel (basic recipe).....	100
Carrageenan	
Chocolate foam, chantilly and dessert...	18
Ginger film and fluid gel.....	19
Carrageenan+	
Mint jelly, sauce and foam	94
Gellan	
Almond fluid gel	41
Buttermilk fluid gel	43
Fluid gel for beverages	40
Grape fluid gel	45
Hot tea fluid gel.....	40
Pomegranate and vodka fluid gel.....	42
Pulp suspension beverage (fluid gel)	40
Konjac+	
Mint jelly, sauce and foam	94
Xanthan+	
Flavored agar cream.....	100

Fluid gel (basic recipe)	100	Tea air	58
Foam		Lecithin+	
Agar		Citrus air	99
Chocolate pudding	12	Maltodextrin	
Hot red berry chantilly	14	Sour mix recipe	65
Hot vegetable mousse	11	Methyl cellulose	
Agar+		Cellulose stabilized foam	69
Flavored agar cream	100	Methyl cellulose+	
Carrageenan		Beetroot meringue	96
Basic foam with carrageenan	19	Lemon whip	100
Chocolate foam, chantilly and dessert ...	18	Marshmallow foam	95
Carrageenan+		Passion fruit sabayon	97
Hot transparent savory mousse	98	Ravioli filled with mango mousse	100
Mint jelly, sauce and foam	94	Sour mix with a twist	99
Cornstarch		Warm chocolate coffee mousse	102
Grapefruit souffles	24	Non-hydrocolloid	
Soft meringue for pie filling	23	Apple vinegar meringue (Italian)	108
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Bavarian cream	34	Chocolate tofu espuma	105
Citrus foam	28	Egg white foam (Troll cream)	107
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Cucumber yoghurt espuma	31	Sea buckthorn mousse	108
Elderflower mousse	30	Spinach espuma	105
Filled mozzarella balloons	33	Vanilla yogurt parfait	106
Fruit espuma	29	Vauquelin	107
Grape sponge	37	Vessel 75 with maple syrup foam	106
Heat stable gelatin gel and foam	36	Warm potato espuma	105
Key lime cloud	28	Zabaglione	106
Kientzheim butter foam	38	Pectin	
Mango espuma	30	Green tea sour mousse	76
Piña colada espuma	32	Xanthan	
Raspberry espuma	31	Fake cappuccino foam	88
Red beet foam	32	Foamy strawberries with balsamic vinegar	
Saffron foam	30	89
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Stabilization of whipped cream	33	Xanthan+	
Sweet lemon foam	35	Beetroot meringue	96
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Gelatin+		Flavored agar cream	100
Ravioli filled with mango mousse	100	Hot transparent savory mousse	98
Soy sauce gelled foam	103	Lemon whip	100
Warm chocolate coffee mousse	102	Marshmallow foam	95
Isomalt		Passion fruit sabayon	97
Apple vinegar meringue	53	Sour mix with a twist	99
Isomalt+		Soy sauce gelled foam	103
Beetroot meringue	96	Frozen	
Konjac+		Agar+	
Hot transparent savory mousse	98	Chocolate ganache	95
Mint jelly, sauce and foam	94	Martini sorbet	98
Lecithin		Carboxy methyl cellulose+	
Frozen parmesan air	58	Sorbet stabilizer mix	104
Lime air	57	Carboxymethyl cellulose+	
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Cryopoached coconut meringue	19	Frozen lime meringue	101
Carrageenan+		Martini sorbet	98
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Sugar reduced meringue	95	Agar	
Cornstarch		Agar drink with lime	14
Cornstarch ice cream	24	Agar gel cubes	14
Gelatin		Agar Tobiko (cold oil technique)	15
Beer sorbet	28	Battered baby squids with agar noodles	14
Cranberry Ginger Sorbet	28	Chocolate flavored doughnut icing	16
Frozen champagne	35	Coconut jelly with strawberry sauce	10
Gazpacho sorbet	29	Cold cod-fish salad with agar wrapping .	13
Grape sponge	37	Fruit jelly	12
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Tzatziki ice cream	28	Hot lobster gelatin	10
Gelatin+		Lemon curd with agar	11
Chocolate ganache	95	Mango cheese cake filling	11
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Lemon sorbet	95	Parmesan spaghetti	15
Sorbet stabilizer mix	104	Sweet potato jelly	15
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Lemon sorbet	61	Celery pudding	18
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Cucumber sorbet	101	Milk gel	18
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Orange ice cream	88	Milk pudding	101
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Liquorice candy	25	Warm tomato jelly	43
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Vanilla pudding	25	Dessert jelly	100
Cornstarch+		Fig cylinders	96
Chocolate flan	103	Guar gum	
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90 years of aviation	34	Guar gum+	
Bavarian cream	34	Milk pudding	101
Carbonated yuzu jelly	31	Gum arabic	
Cheese cake with lemon	31	Hard gums	51
Cranberry Ginger Sorbet	28	Soft gums and pastilles	52
Edible wrapper/film	34	Gum arabic+	
Fruit jelly	35	Loukoums chew (Turkish delight)	97
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Heat stable gelatin gel and foam	36	Isomalt+	
Jellied gin and tonic	37	Olive oil gummy worms	104
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Mint gel	42	Tender broad bean balls	68
Olive oil gelatin	44	Thick film (like plastic/leather)	72
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unBloody Mary (gelatin filtration).....	32
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Cornstarch	
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Jelly sweets	44
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Alkaline konjac gel.....	55
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Bitter almond oil crumbs.....	65
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Dry caramel	64
Nutella powder	64
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Apple candy	77
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Most hydrocolloids are compatible with alcohol and specific information about this is included in the table on page 120. However, for illustrative purposes the recipes which include alcohol are listed in this separate index.

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Zabaglione	106
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Martini sorbet	98

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90 years of aviation	34
Jellied gin and tonic	37
Margarita jelly beans	33
Red wine jelly	35
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Solid foam

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Pectin	
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About Khymos

Khymos

Khymos is a blog about popular food science, molecular gastronomy and modernist cuisine. It was established in 2006 by Martin Lersch.

What is in the name Khymos?

The name of this site, *khymos* (in Greek: χυμός), means “juice”. It is however related to *al-kimiya*, the Arabic word from which our word chemistry derives from. Other related words include *Khemia*, the old name of Egypt (meaning land of black earth) and the Greek *khein* and *khymatos* meaning “to pour” and “that which is poured out” respectively. So in a sense, the word *khymos* provides a link between chemistry and food! I therefore thought it would be a suitable name for a site dealing with molecular gastronomy and related subjects.

Who is Martin Lersch?

Martin Lersch is a chemist and a food enthusiast living in Norway. He earned his PhD in organic chemistry in 2006 at the University of Oslo. He currently works with R&D in a biorefinery. Besides his daytime job he holds a strong interest in molecular gastronomy and popular food science, and has blogged about this at Khymos since 2006. The very first version of *Texture* was published on Khymos in August 2007. During the last 10 years he has given numerous food and kitchen related popular science talks and has made several appearances in Norwegian newspapers and on national radio and TV. Martin Lersch can be contacted at webmaster@khymos.org.

Further reading

For more about hydrocolloids, molecular gastronomy and modernist cuisine visit my blog Khymos and follow me on twitter:

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