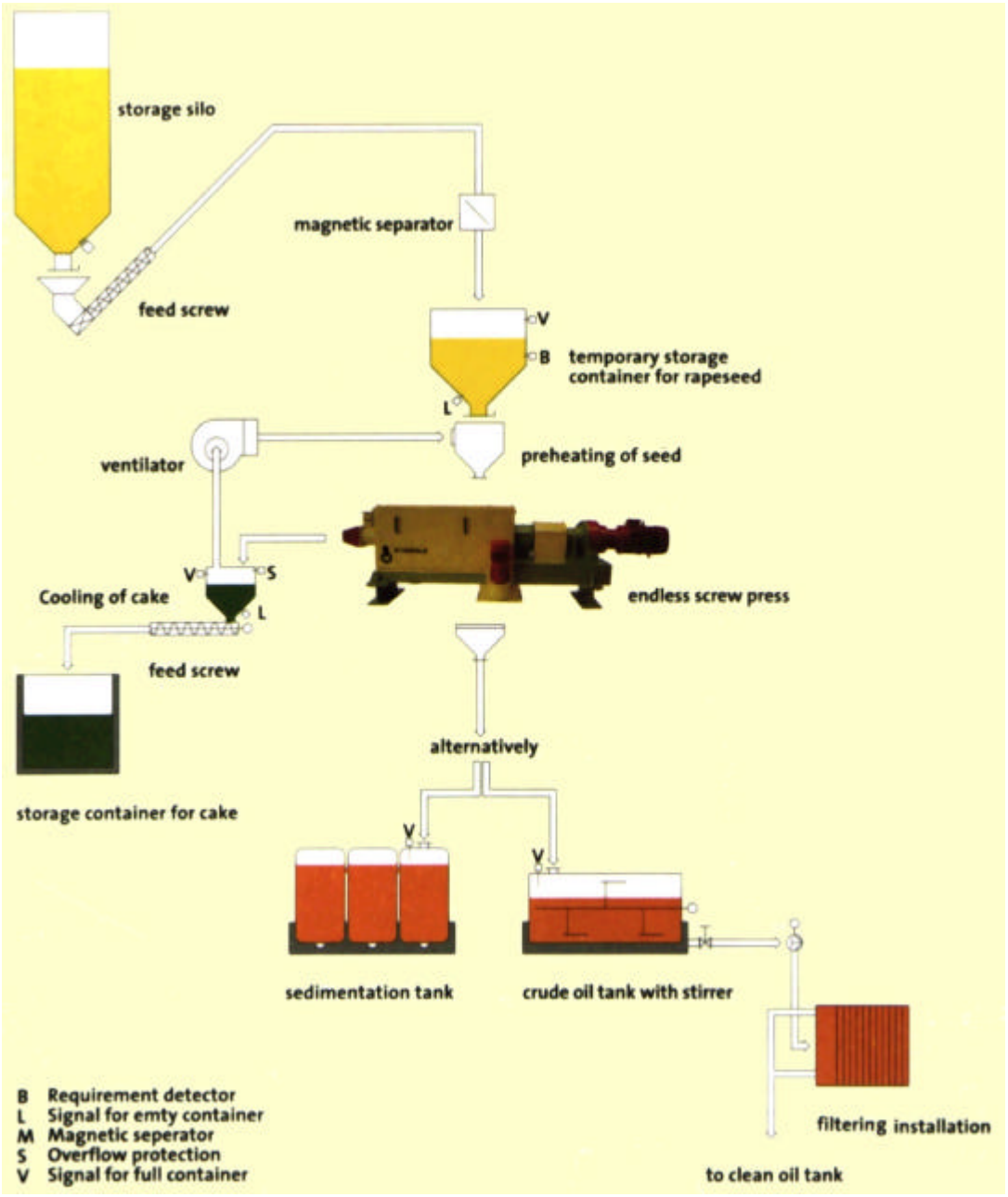
EQUIPMENT FOR

DECENTRALISED COLD PRESSING OF OIL SEEDS



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November 2000

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1. Edition

This paper should support a decentralised vegetable oil-economy in Denmark. Agriculture will become an important energy and raw material supplier in the future.
The future is now!

More information about plant oil technology:

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Engelsk - dansk oversættelse af udvalgte ord og forkortelser fra rapporten

"Equipment for Decentralised Cold Pressing of Oil Seeds"
"Udstyr for Decentral Koldpresning af Oliefrø"

Engelsk	Dansk
Affluent filter	"shunt" filter , parallel filter (filtrerer parallelt med hoved flow)
Bag filter	Pose filter
Barrel shim	Mellemlægningsring
Buffer storage tank	Bufferlagertank
Bulking	Transportere
Cartridge filter (på tysk: Kerzenfilter)	Patronfilter (langt tyndt filter)
Choke	Reduktion
Clogging	Blokere
Conveyor belt	Båndtransportør
d : day	
Deterioration	Forringelse
Disk strainer	Speciel snekkepresse. Presse cylinderen er opbygget af skiver og små afstandsstykker.
Expeller	Presse
f.i. : for instance	
Fan	blæser , ventilator
Friction	Modstand
Gap size	Åbning , afstand
h : hour	
Heat exchanger	Varmeveksler
Hopper	Tragt
Humidity	Fugtighed, vandindhold
Impurities	Urenheder
Leaf filter	Trykblad filter
Mesh size	Maske størrelse
Nozzle	Dyse
Perishable	Letfordærvelig
Pore diameter	Pore diameter
Purification	Rensning
Residual oil	Olie rest i foderkagen
Roller mill	Valse
RPM, Revolutions Per Minute	omdrejninger per minut
Solids / Particles	Fast stof / partikler
Stirrer	Omrører
Storage	Lager
Strainer	Filter, riller
Throughput	Gennemstrømning
Wear	Slid
Worm	Snekke , snegl
y : year	
Yield	Udbytte

EQUIPMENT FOR DECENTRALISED COLD PRESSING OF OIL SEEDS

1. Introduction

For many generations cold pressed oils have been extracted from high-fat oilseeds, and have been used for preparing meals and as remedies. Since several years, in fact of increasing ecological damage and of limited mineral oil resources, these oils are also used in the fields of technology.

Vegetable oil is traditionally used as a natural raw material to linoleum, paint, lacquers, cosmetics and washing powder additives. In the technical range there is a growing market in the field of lubricants (chain saw oil, gear oil, motor oil), hydraulic oils and special applications (e.g. oil for corrosion protection or formwork and parting agents for concrete). Advantages compared with fossil oil products are a much faster breakdown in the soil and no water endangerment with the same performance.

The energetic use of pure plant oil in motors (co-generation, diesel car engines) is an option to replace fossil fuels. Nowadays the technique is tested and well established. Pure plant oil-fuel has the advantages of a low sulphur content and safer handling. Using cold pressed plant oil instead of fossil diesel, there is a reduction in production of the green house gas CO_2. When considering the combustion, then plant oil is **CO_2–neutral**, because plants again consume the whole quantity of CO_2 emission. So the green house gas runs in a closed circle. When the whole process for the rape plant products is considered, the significant energy production from the rape straw gives a positive energy balance in the production of rape seed cake and rape seed oil. This means that the process leads to a **reduction in CO_2 emission.**

Everybody is able to produce his own fuel. The cold-pressing process does not require complicated machinery. The characteristics of this process are low energy requirement without any use of chemical extractive agents. These oil extraction machines are in continuous operation and do not require any special supervision.

Decentralised production of cold pressed vegetable oil creates **valuable animal feed** in the form of press-cake. The protein-rich cakes can partly replace imported Soya bean meal and thus reduce import dependency and risks for genetically modified Soya bean fodder. The local economy is stimulated.

This report gives support to find the right equipment for producing protein-rich press-cake and pure cold pressed plant oil and considers important process parameters. In the beginning, some general tips on how to run such a vegetable oil mill are given. Afterwards some producers of oil mill equipment are specified, with emphasis giving on a complete list of manufacturers of oil seed expeller-machinery. For preparation & filtering-equipment there are possibly more favourable suppliers.

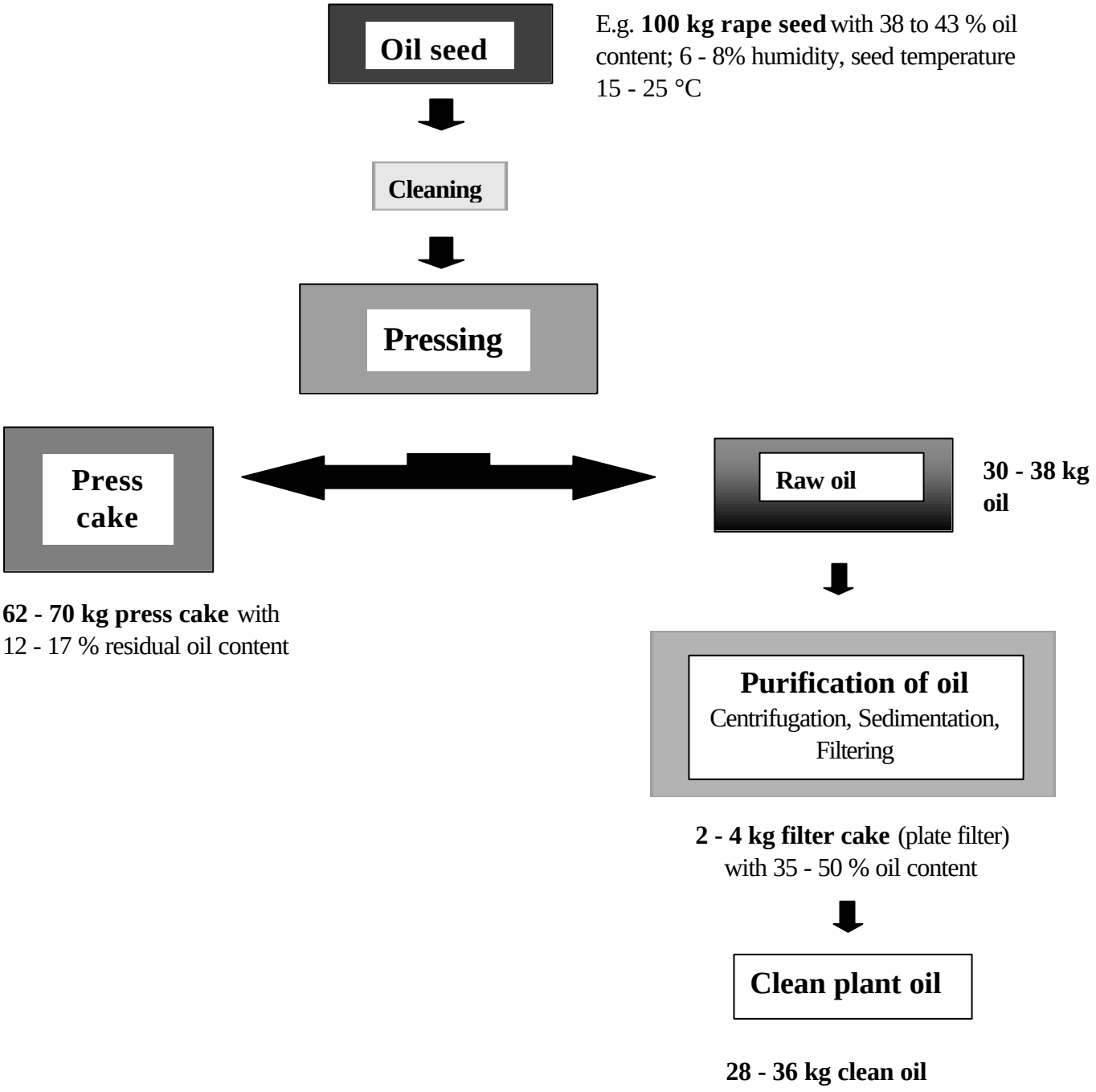
The technical specifications of the listed units mainly refer to the processing of rape seed crop, which is the main cultivated oil plant in Denmark. This report is intended to be a guide. We recommend contacting the companies for consultation about an optimal combination of different components.

2. Comparison of Decentralised cold pressing to Industrial extraction with solvents

Decentralised cold pressing	Industrial extraction with solvents
Medium scale, co-operative or private enterprises	Corporations that are mainly connected to multinational concerns
Located near to agricultural production	Located near central traffic points
Directly or indirectly connected to the agricultural production (no middleman)	Normally separated from the agricultural production (with middleman)
Capacities < 25 t/d	Capacities > 500 t/d
Production of cold pressed plant oil and press cake	Production of refined and half refined plant oil, extraction press cake
Higher feed value of the press cake (12–17 % oil content)	Oil content of extraction press cake <1 %
Low investment costs	High investment costs
Low energy consumption (80 kWh/t seed) (**on average 6 times lower than for industrial extraction**)	High energy consumption (470 kWh/t seed)
No use of chemical solvents or thermal conditioning of the seed	Solvent extraction and thermal pre- conditioning
No waste water	Waste water from the refining (approx. 50 l/l oil)
Low logistical expenses and security requirements	High logistical expense and security requirements
Short local transportation distances (typically 50 km), stimulation of local economy	Long, sometimes international transportation to and from central plants, high investment costs to ensure environmental protection
High flexibility (faster process adjustments to other kinds of oil seeds)	
Additional creation of value in rural areas	

3. Decentralised cold pressing of oil seeds

3.1 Overview over the process



3.2 General advice for a complete oil mill

It is most efficient to use gravity for transport of basic materials and products. For this reason it is advisable to install the whole plant in a building with several floors.

The main storage of the seed can be placed outside or inside the oil mill building. Conveying machinery transports the seed up to the buffer silo above the press. There the seed will be warmed up to room temperature before dropping into the press by gravity. The buffer silo should be the size of the daily processing capacity. A level sensor controls the filling.

It is important to clean the seed from stones, possible metal pieces and plant parts. This provides a more constant oil quality and reduces the risk of damaging the press. The contamination should be under 2 %. A sieve is used to remove stones and plant parts, and a magnetic separator removes possible metal parts. For cleaning rape seed, a sieve with a mesh size between **2,2 to 2,5 mm** is recommended. The seed is pre-warmed to about **20°C** by a special unit or by a heat exchanger that makes use of the heat from the warm press cake. Pre-heating the seed to over 20 °C has no additional benefit.

For economic reasons, automatic operation of the oil mill is only recommended for capacities over 500 kg/h for rape seed and over 700 kg/h for sunflower seed [1]. Hereby the filtering process should follow immediately the pressing (e.g. with a self-cleaning filter). A buffer storage tank directly after pressing with homogenisation unit (see illustration p. 16) is recommended if using a semiautomatic or automatic operating filter, in order to have the particles from the raw oil even distributed. The size of the tank should be 1 to 2 times the daily capacities.

For automatic operation of the whole process it is necessary to control the following parameters:

- throughput-control on the press cake outlet
- temperature control for nozzle and press cake tank
- filling-level of clean oil tank and press cake tank

Storage of clean plant oil

Following conditions are favourable for plant oil storage:

- low total impurities in the oil
- cool storage temperature
- avoiding temperature variations (and hence water-condensation)
- darkness (therefore metal tanks are better than plastic)
- for food oil production use a stainless steel container, with no cooper or steel materials, avoiding oxygen and water entry
- tanks should be easy to clean

Because of the high fatty acid content, rape seed oil is one of the most oxidation-resistant plant oils. The high vitamin E content supports this resistance. Bad storage conditions over long periods causes oxidation and hence increased viscosity & filtration problems.

Use of the press cake

The press cake which is obtained by cold pressing contains more residual oil and has therefore a higher value for animal food proposes than the one which is obtained by warm pressing or normal industrial extraction with solvents. By pressing **3 kg rape seed,** you produce approximately **1 kg rape seed oil** and **2 kg press cake**. The cake is the most valuable part of the process and the main product of the cold pressing. One hectare of land planted with rape crops yields an average amount of rape seed cake of approx. 2000kg.

The raw, fat rich press cake is a valuable protein fodder, and is widely used in agriculture. The highest creation of value can be obtained in using the press cake as animal fodder. To use self-produced press cake is a step towards to self-supply, self-control and additional income for farmers. Press cake from cold pressing of local oil seeds can replace imported Soya bean meal.

The cake is fed on cows, pigs, chicken, sheep and horses, and is an important source of nutrients and energy for this animals. Rape and sunflower press cake is an optimal cattle fodder. The cold pressed oil, especially the oil rich sediment, is used as fodder oil to improve low-energy pig fodder. Also the filter cake from plate filters with 35-50% oil-content is a valuable fodder.

The pellets should be stored cold, dark and dry. After pressing, the cake has a temperature of between 40 & 60 °C. Cooling down the press cake right after pressing is required for silo-storage. This cooling can be reached by transporting the cake with a conveyor belt to the silo. This avoids condensation and the resulting deterioration in the silo. Alternatively this heat can be recovered with a heat exchanger and used to warm up the seed. Such efficient units are offered by some screw press manufactures.

Rape press cake is not more perishable than grain, assuming a humidity of < 10 % in the cake. The company Strähle reported a storage ability of the press cake from a half-year without any difficulties under the above mentioned conditions. Another test [1] report on a cake-storage-ability of about three months without negative effects on the feed quality. Press cake chips from strainer presses can be pressed into pellets with special machines. The press cake in form of pellets gives the following advantages:

- Less dust created during transport and bulking
- Longer storage time: at least a half-year because of avoiding Alfa-toxin

Feed values and ingredients of rape expeller cake [16]:

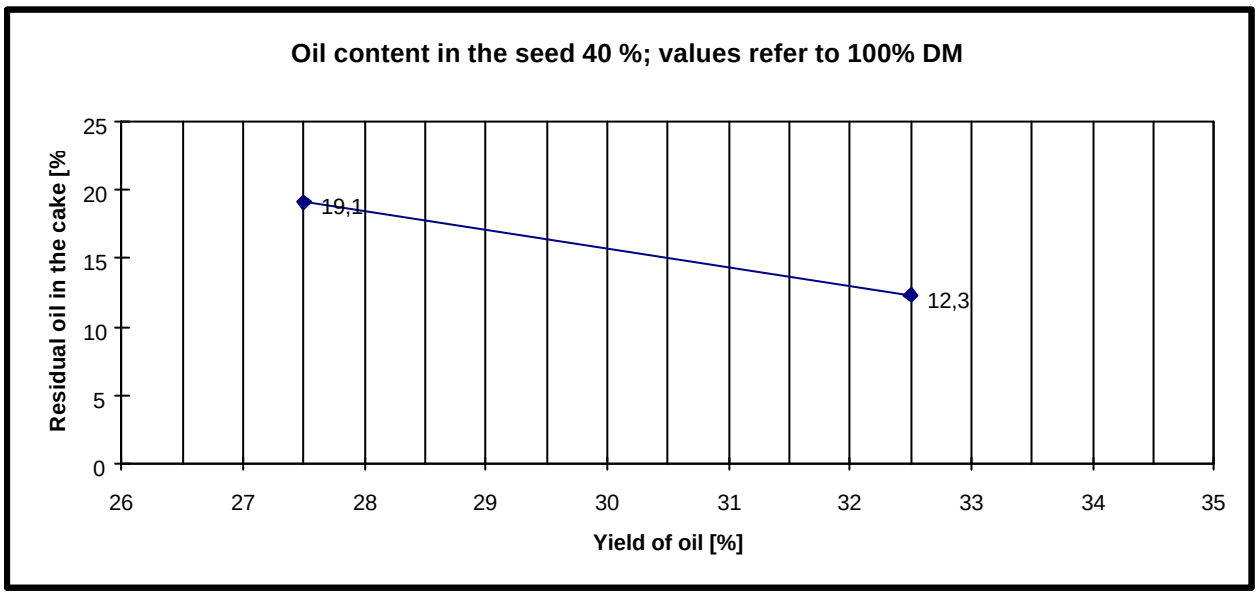
Dried Matter (DM)	-	87%
Raw protein	-	33%
Raw fat	-	15%
Raw fibre	-	10%
Energy (MJ/kg)	-	13,5
Minerals Ca/ P/ Na (g/kg)	-	6,3/ 10,8/ 0,1

According the law of animal foods in Germany, the following press cakes are suitable for animal feeding: Rape seed, flax, sunflower, and safflower. Advantages of rape seed cake compared to Soya meal as an animal fodder are an increased meat quality by pigs and a higher milk quality and quantity by cows.

Example [1]: Basic material, seed with 40% raw fat, 20% raw protein. All values refer to 90% DM[1].

Pressing		weaker	harder
Yield of 100kg seed			
- Oil	kg	**27,5**	**32,5**
- Cake	kg	72,5	67,5
Fodder value of the cake			
- Raw fat	g/kg	**170**	**110**
- Raw protein	g/kg	280	300
- Convertible energy pig	MJ/kg	12,6	11,4

The raw fat in the cake (residual oil) refers normally to 100%-dried matter. The moisture content in the press cake varies between approx. 5 and 10%. That means the values for raw fat in the cake will rise in our example from 170-110 g/kg to 191-123 g/kg, according 19,1 and 12,3 % residual oil in the cake (refer to diagram below).



Experimental test of calculate approx. residual oil content in the cake:
Catch oil and seed over a certain time simultaneously (e.g. 5 min) and weight it. The summed value of both is the weight of the supplied seed. Calculate the percentage yield of oil from the total input of seeds. Use the yield of oil in the table above for finding the approx. residual oil in the press cake. The results can be differing when pressing seeds with different content of oil. A weaker pressing results in more cake with a higher residual oil content. A high yield of oil gives less press cake with a lower residual oil content.

Important for the fodder value of rape seed cake is beside the raw protein content, the fat content and the content of glucosinolate (influence the acceptance through the animal)[1].

Optimal fat content of the cake (residual oil according 90% DM[1]): 17%
Maximal glucosinolate in the seed (according 90% DM): 18 mmol/kg[2]
Maximal glucosinolate in the cake (according 90% DM and 13,5% residual oil): 20 mmol/kg[3]

[1] DM - dried matter
[2] 1mmol glucosinolate according approx. 0,45g
[3] mmol/kg = µmol/g

3.3 Influences on product quality in decentralised oil mills

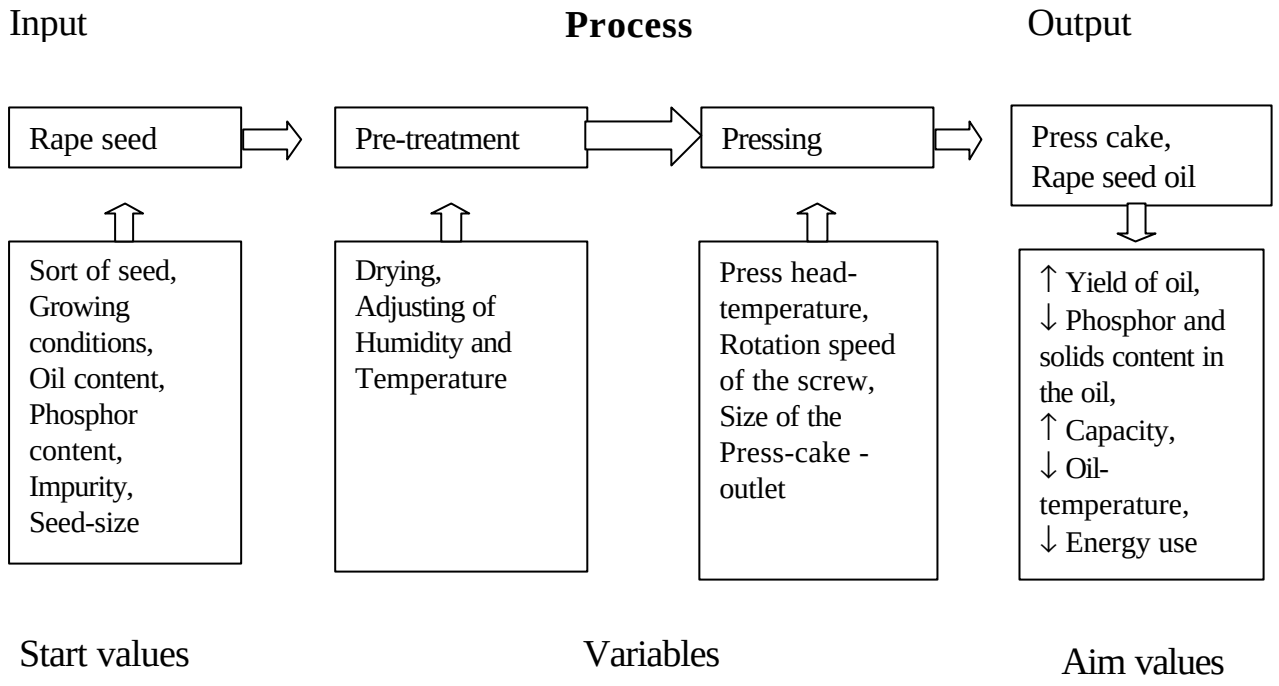


Fig.: Factors influencing the production of press cake and rape seed oil [6]

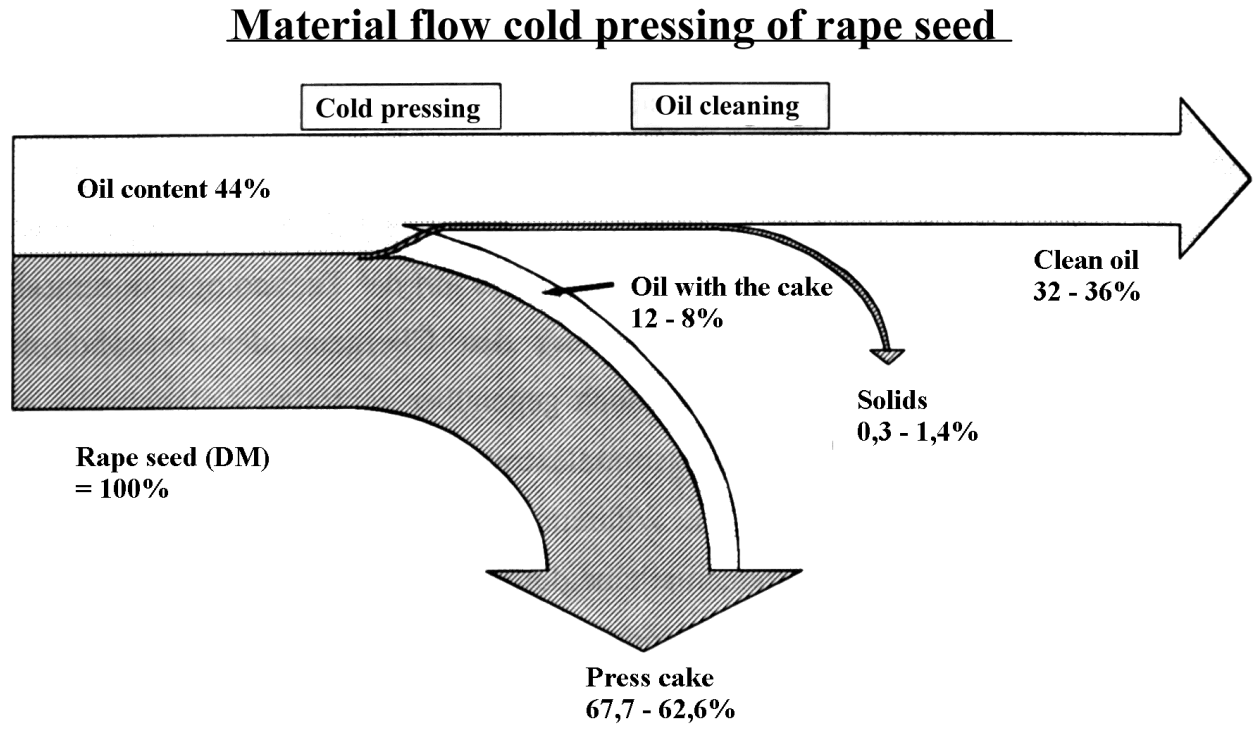


Fig.: [6] Material quantity distribution during cold pressing

The total percentage for "oil with the cake" of 8-12% according to 12,7-17,7% residual oil in the cake. The short form at Rape seed (DM) means dried matter.

Pre-treatment of the seed

To get a good oil-quality for technical use (see cap. 7. Standard for rape seed oil), especially a low phosphor content, the **temperature** and the **humidity of the seed** is important.

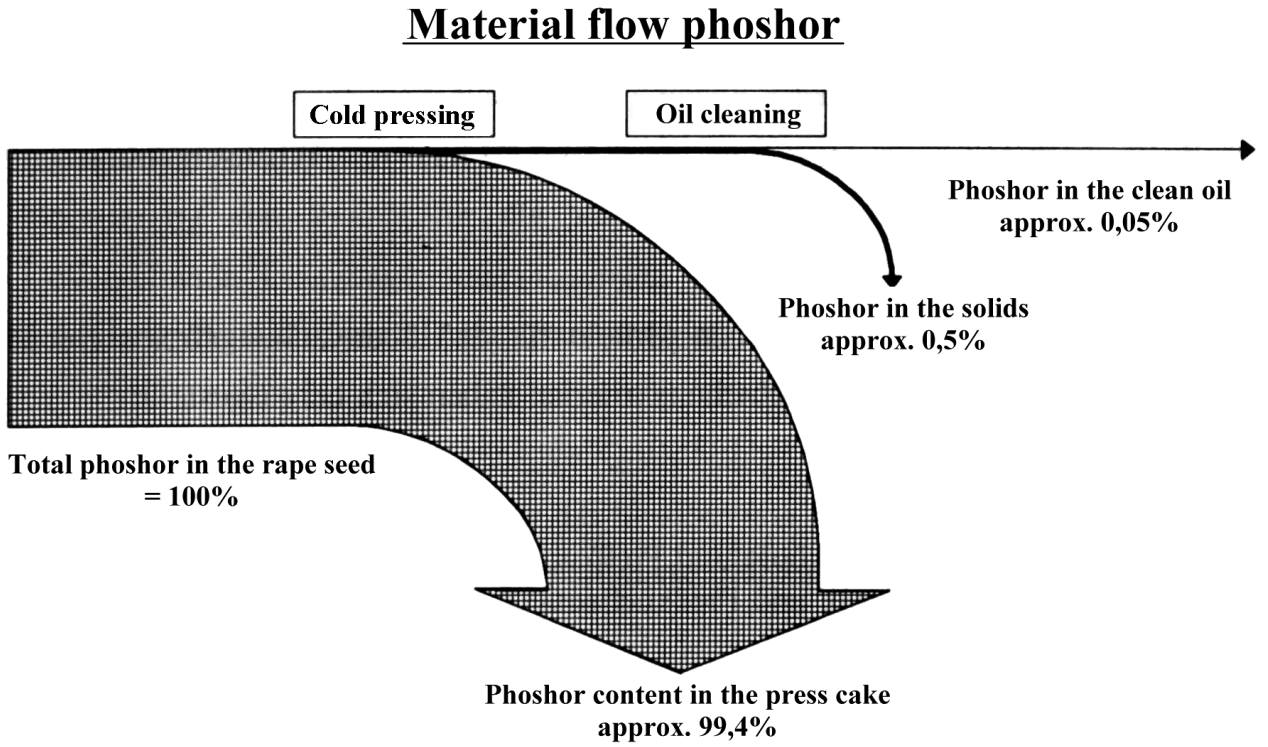


Fig.: [6] Flow of phosphor in the cold pressing process

When cold pressing, most of the phosphor, which is a component of the seed, goes into the press cake and not into the oil. This is one of the advantages of cold pressing compared with hot pressing-industrial processing of oil seeds, where the high phosphor content of the oil must be reduced by refining, at high cost.

The oil cleaning process removes an important amount of phosphor and should be done for this reason properly. If the seed humidity is reduced, the yield of oil rises and the phosphor content goes down. However, the capacity goes down and the content of solids increases. Besides the energy demand will increase by processing a too dry seed (see following scheme "Influence of seed humidity"). More humidity of the seed will lower the friction between the seeds during the pressing and increase the throughput (capacity) beside a decrease of the oil yield.

Seed Humidity ↑:	
Content of phosphor	↑
Throughput of seed	↑
Content of particles	↓
Yield of oil	↓
Energy demand	↓

Tab.: [6] Influence of seed-humidity on the cold pressing process with a screw press of nozzle type

The arrows in the table above reflect the tendency. With lowering the humidity, the opposite results occur. The humidity of the seed should be between **6,5 and 7,5 weight-percentage**. In this range, you get an optimum of capacity, yield of oil and content of phosphor and solids in raw oil.

The connection between some important variables and the aim values of the cold pressing is shown in the following table [6]. The tendencies are valid for a nozzle type press with 15 kg seed/h capacity and must be considered in context to each other according their height of influence.

Aim values	**Variables**		
	RPM ↑	Seed Humidity ↑	Seed temperature ↑
Phosphor content	↑	↑	↑
Throughput	↑	↑	↓
Content of particles	↑	↓	↓
Yield of oil	↓	↓	↑
Energy demand	↑	↓	↑

In the cold pressing of vegetable oil, the following aims must be balanced against each other [6]:

- Maximising capacity (seed throughput)
- Maximising yield of oil
- Minimising percentage solid in the oil

To crush the seed before pressing gives bad results, especially a rising content of solids and phosphor in the plant oil. Only kinds of tropical oil nuts and plants it is necessary to crush the size down to pea size. Some oil expeller producer offers adequate equipment, e.g. IBG Monforts. For screw presses with a high capacity (> 1000 kg seed/h) it is recommended to roll the seed (especially rape seed) to get a higher yield of oil (see company Reinartz). Roller mills are normally not used by decentralised plant oil mills.

Pre-warming of the seed should only go up to **20 °C**. There are no positive effects with higher seed temperature, but a negative effect (increasing phosphor content) by pre-heating the seed over 60 °C.

→Some oil expeller manufactures offer a heat-recovering unit to lead the heat of the press cake to the feeding hopper for warming up the seed immediately before it runs into the press (e.g. company Strähle).

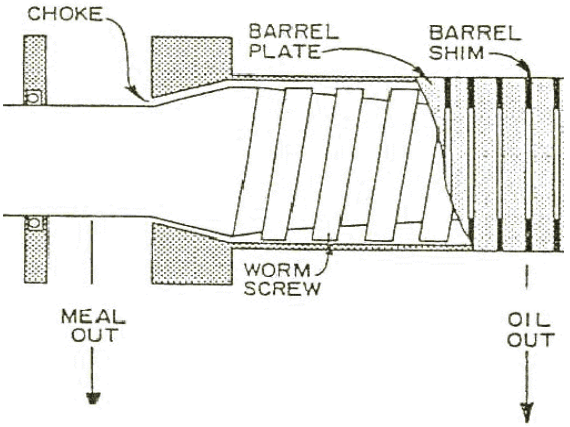
A heat exchanger unit should avoid direct contact between the warm and wet press cake-air and the cold seed because the humidity of the seed will rise by condensation. If the seed is too cold (< 10 °C), the oil yield will be low (a lot of unbroken seeds in the press cake visible) and more solids are in the oil.

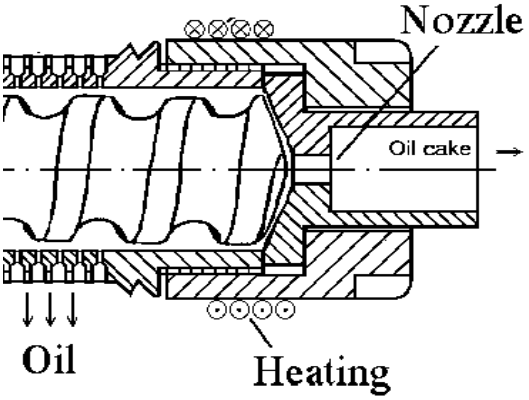
Sunflower seed has to be peeled before pressing. This reduces the wear of the machinery, gives higher oil content in the press cake, and reduces wax content in the oil.

Parameters of the press

There are two types of screw presses for production of cold pressed vegetable oil. They are different in the screw and in the kind of oil outlet (see cap. 4). The outlet can be built like a strainer, which means the press cylinder is created by metal-bars laying near to each other. The gaps between the bars form the oil outlet, which can be varied according to the kind of oil seed (see page 20 and below). The cake pressed out of an adjustable choke formed into plates (a kind of chips).

The oil outlet from the other type of oil presses consists of drilled holes in a special part of the cylinder tube. The press cake is forced out in form of pellets through a changeable nozzle at the end of the cylinder (see page 19 and below).





In order to avoid blockage of the press cake outlet for some types of screw presses it is necessary to heat this part of the press. This heating should be in the range between **60 & 80 °C**. A higher temperature on the press cake outlet will lead to a higher phosphor content in the oil. This temperature has an effect on the oil temperature, which should not rise over **40 °C**. With a lower temperature on the cake outlet the solid content in the oil rises.

The nozzle diameter and gap-size of the choke depends on the kind of seed. The optimum for the nozzle diameter varies between 6 and 8 mm. With 6 mm diameter a nozzle temperature of 60 °C and a low humidity in the seed will minimise the phosphor content in the oil. On the other hand a higher risk for blocking the nozzle is given under those conditions. The seed is pressed harder by a more small cake-outlet and the oil yield rise beside a decrease of the capacity.

An important parameter for the oil pressing is the residual oil in the press cake. A low value down too minimal 10% is possible by very hard pressing and indicates a high percentage yield of oil (up to 38 %). A harder pressing is obtained for a nozzle press by changing the nozzle diameter. For an increasing pressure, it is necessary at a strainer press to adjust the cake outlet and by changing single segments of the screw.

If the throughput is reduced (e.g. screw rotation speed is reduced), yield of oil is increased but solid content in the oil is also increased. Alternatively the throughput is increased, the yield is reduced and the solid content in the oil is reduced. It is possible to find an optimal compromise according to your individual aims with a revolution-regulated press-screw. This also allows pressing of a wide range of different oil seeds. Favourable rotation speeds for the screw is between **20 and 50 rpm**. In this range of rotation, a minimum of energy demand is required. The higher the throughput of seed, the greater the capacity of the oil cleaning installation must be. With this increasing oil production, the total quantity of solids in the oil rises also.

3.4 Economy

There follow 3 examples of decentralised cold pressing oil mills with capacities of **15 kg, 130 kg** and **750 kg/h,** showing the production cost of rape seed oil.

All dates are based on German conditions and prices in 1997!

The first example, with a capacity of 15 kg seed/h, is the oil mill W. König in Weiherhof near Empfingen, the second with 130 kg/h is the oil mill of W. Unsöld near Herrenberg (see also cap. 3.5.1) and the example with 750 kg/h is the oil mill of Mr. Gräf near Ufenheim.

Different operating hours and prices are considered. The annual fixed costs for the plant are approximately **15 %** of the investment, for spare parts and maintenance are **7,6 DKK /t seed** used and by an approximately energy demand of **35 kWh/ t seed 26,6 DKK** are marked.

Rape cultivation area	until approx. 40 ha			until approx. 350 ha		until approx. 2000 ha	
Seed capacity	15 kg/h			130 kg/h		750 kg/h	
Oil yield	31 kg oil/100 kg seed			33 kg oil/100 kg seed		33 kg oil/100 kg seed	
Oil production	4,65 kg/h			42,9 kg/h		247,5 kg/h	
Investment in DKK	57.000, -			912.000, -		4.332.000, -	
Operating time in hours/year	1000	4000	7500	4000	7500	4000	7500
Variable costs DKK/kg clean oil							
maintenance/ repair	0,023	0,023	0,023	0,023	0,023	0,023	0,023
electric energy	0,080	0,080	0,080	0,080	0,080	0,080	0,080
salaries	0,342	0,342	0,342	0,220	0,220	0,384	0,205
Fix costs DKK/kg clean oil	1,839	0,460	0,247	0,771	0,414	0,673	0,357
Conversion costs DKK/l rape seed oil	**2,101**	**0,832**	**0,635**	**1,007**	**0,676**	**1,068**	**0,612**

Ill.: [5] Costs of rape seed oil production in small scale mills

The labour times required are: for the **15 kg** plant **20 minutes daily working time** to **38 DKK**. By the **130 kg** plant are **1 hour daily** to **230 DKK** and by the big mill are an "man year" for an extra worker of **300.000, - DKK** taken into the account.

The conversion costs can be calculated by a plant operating time of 7.500 hours/year between 0,66 and 0,74 DKK per kg cleaned rape seed oil. The conversion costs increase significantly with a lower plant operation of 4.000 hours/year to approx. 1,14 DKK per kg oil. Less use of the plant leads to so high conversion costs, that these can only be compensated with a corresponding high oil price (food oil production, oil for special applications).

The **raw material costs** under *favourable conditions* (rape seed price 106 DKK/100 kg and press cake price 95 DKK/100 kg cake) are **1,37 DKK/kg oil**,
with probably *more realistic prices* (122 DKK/100 kg rape seed and press cake price 83 DKK/100 kg cake) **2,05 DKK/kg oil**,
with *unfavourable conditions* (171 DKK/100 kg rape seed and only 76 DKK/100 kg rape press cake) **3,68 DKK/kg oil.**

It is always favourable when the press cake is taken back from the rape seed producer and fed to his own farm animals. Then the income can be calculated according to the value of the protein rich rape cake. The value of the cake is even better when it substitutes Soya bean meal.

Market forces cause unpredictable changes in prices of seed, oil and press cake. It is therefore important to prove that both cake & oil can be produced below market price. The raw material costs in an oil mill with below mentioned conditions are around 75 percent of the total costs.

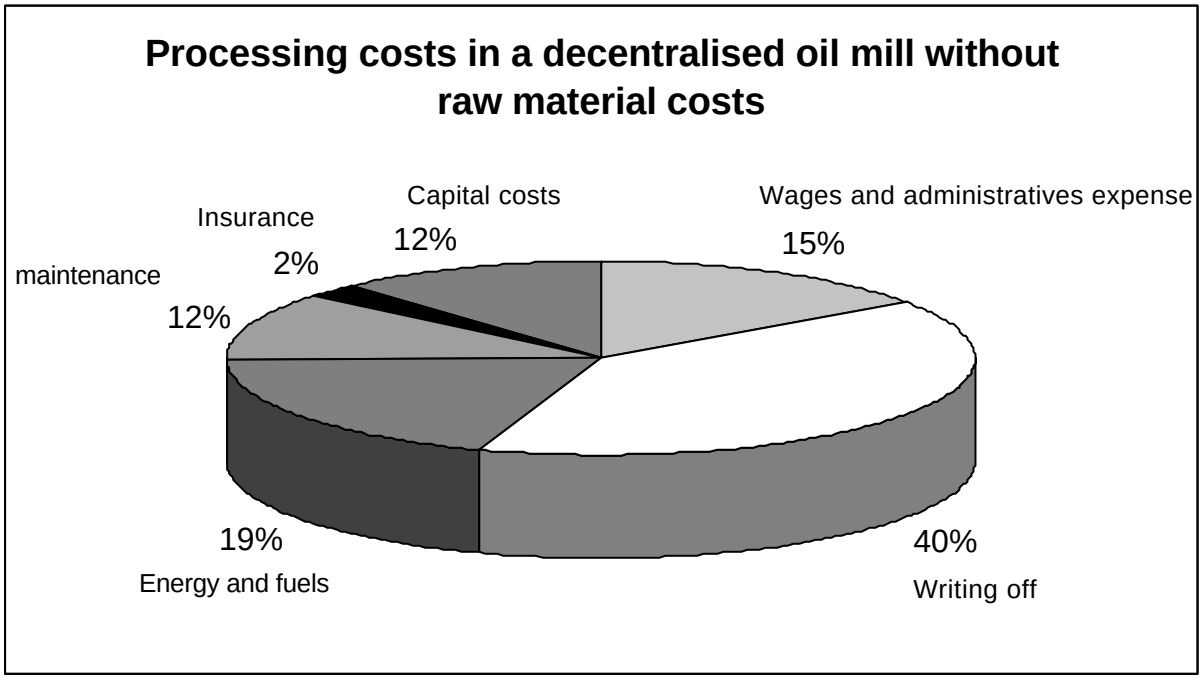


Fig.: [1], Oil mill with 750 t seed/y capacity, 133 DKK/100 kg rape seed, and 5000 h/y operation hours, 1,2 Mio. DKK investment

3.5 Examples of a complete oil mill

3.5.1 Gültsteiner Mühle

Address: Nehringer Str.
71083 Herrenberg-
Gültstein
GERMANY

Facts by Karl Maurer, 2/99 in [1]

Vegetable oil production capacity: 700 t oil/ a

Plant system:

- Seed storage tank 3000 m^3
- Magnetic separator
- Seed-pre-heating (up to max. 20 °C)/ Press cake heat recovery unit
- Screw press, REINARTZ, type AP 14 with 300-320 kg seed/ h
- 3000 l intermediate storage tank with homogenisation unit
- Screw pump
- 1. Chamber filter press, SCHENK type KFP 470-20-18 (for technical oil)
- 2. Chamber filter press, SCHENK filled with wooden saw dust (for food oil)
- Storage tank 54 m^3

Annual operating time: 7000- 8000 h

Man-hours required: 1 h (20 min. to clean the filter manually)

Investment: DKK 1.520.000, -
(DKK 1.102.000, - for the plant and DKK 418.000, - for building investments)

Maintenance costs: DKK 1,14, - /t seed during 4 years

Energy demand: 138 kWh/t filtered oil

3.5.2 Ölfruchtmühle Oberes Werntal

Address: Lerchenhof
97440 Ettleben
GERMANY

Facts given by Rainer Reuss, 9. 10. 99

Vegetable oil production plant capacity: 8,5 t seed/ d
2,83 t vegetable oil/ d

Plant system:

- scale
- Silo storage for oil seeds
- Screw expeller brand REINARTZ, type AP 14 with a capacity of 330-360 kg seed/h
- Filter 1: SCHENK, type KFP 470-20-18 (as a pre-filter)
- Filter 2: SCHENK, type Niro 490-B, 5 µm
- Clean oil storage tank
- Pipe work, pumps

Operation per year: - Season depending, total growing in the last years
- In the harvest time: 24 h/d

Man hours required: 2h/d;
1h/d needed for manual cleaning of 2 filters

Investment: total DKK 1.900.000, -

Maintenance: screw exchange because of a wrong seed pressing
(Thistle seed with a too low oil content of 20%)

Products: 2/3 non-food vegetable oil,
1/3 edible oil

3.5.3 Co-operative oil mill Plankstetten

Facts by Alexander Plank, 7.10. 1999

Address: Bahnhofstr. 33
92334 Berching
GERMANY

Possible total plant capacity: (700 t vegetable oil/y)

Actual production: 1200 t raps seed/ y
400 t vegetable oil/ y
800 t raps cake / y
9 t seed/ d

Plant system:

- Storage tank for seeds (for 2 days capacities)
- Rough, shake filter (approx. 3mm mesh size) for removing stones, possible metal parts, other plant parts
- Oil press, REINARTZ , type AP 14 , capacity 330-360 t seed/h
- Isolated intermediate storage tank with homogenisation; (stirring to avoid sedimentation of particles; good mixing of particles necessary for filtering), heating of the tank from the co- generator possible to have at least 35 °C oil temperature for the filtering process; filtering process starts with pumping the raw oil in a circle for 30 min to build up an extra fine filter membrane
- Cricket-filter, AMA FILTER (double capacity like the press for future expansions), automatic filter cleaning by compressed air
- Compressor for filter cleaning
- Storage tanks for clean vegetable oil (used one from a diary)
- Pipe work and oil pumps

-Plant planned and built by the operator!

Operation per year: 300 days/y, 12h /d

Man hours required: 1h /d

Energy need: for 370 kg seed /d - 12 to 15 kWh (with filtering),
by 34% yield he get out 125,8 kg vegetable oil/h

95 to 119 kWh/ t filtered oil

Investment:

Oil press: 490.000 DKK
Filter : 450.000 DKK

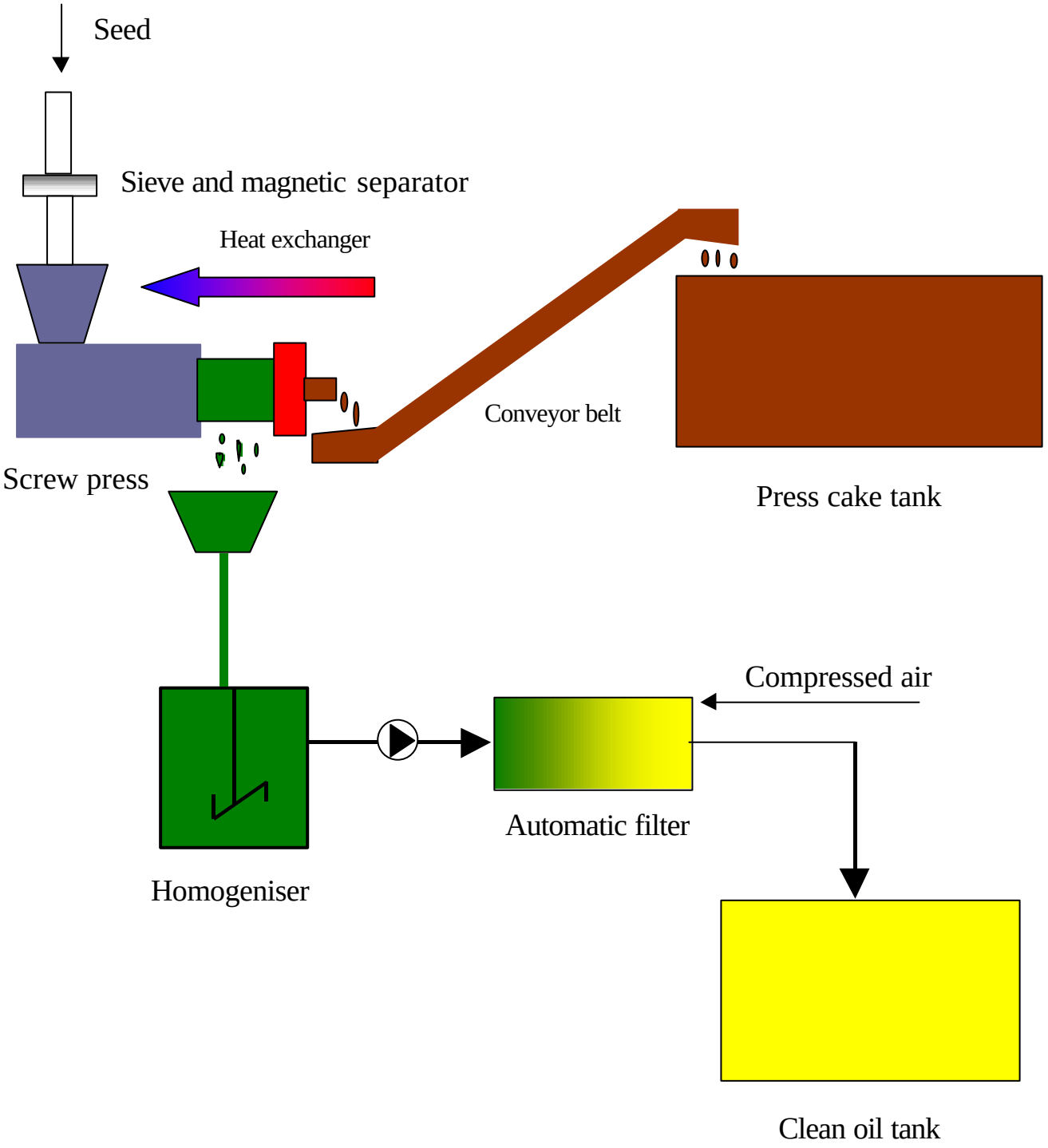
Total: approx. 1.900.000 DKK

Oil mill is owned by approx. 100 farmers and installed at a grain storage company.

Maintenance: Pressed 5000 t seed since installation of the plant

- no spare parts exchange necessary
- only change the gear oil of the oil press

Principe of the Oil mill Plankstetten (Germany)



3.5.4 Investment example for a complete decentralised oil plant

By company Karl Strähle (Germany)

1. Storage silo for rape seed *(not included in the complete price!)*
2. Magnetic separator
3. Buffer storage tank (feeding the press by gravity), approx. 5 m^3
4. Seed preheating (max. up to 20 °C) / press cake cooling unit
5. Screw oil expeller: for **150 kg seed/h, 300 kg seed/h** or **500 kg seed/h**
6. Press cake heat recover and blower
7. Storage for press cake *(not included in the complete price!)*
8. Raw oil tank (ca. 3000-4000 l) with stir unit 1,5 kW
9. Filter system: either a chamber filter press (semiautomatic) with piston pump or
   a full-automatic filter (Niagara filter) for plant capacities 300-500 kg seed/h advisable ; extra compressor necessary for automatic cleaning;
   The semiautomatic chamber filter press is included in the price!
10. Clean oil tank (f. i. here a used one 20 m^3 , material stainless V2A)

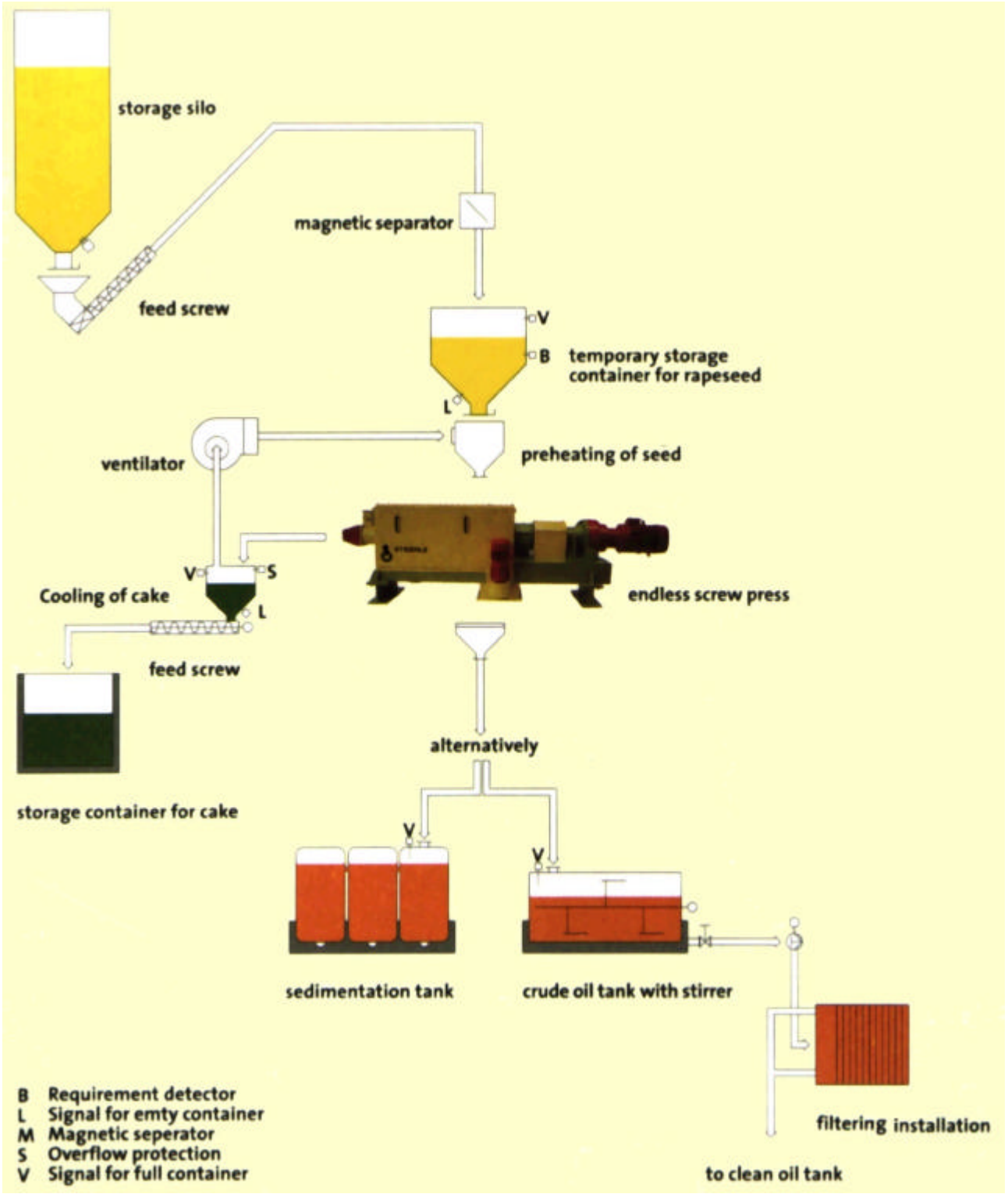
Recommended prices:

Complete system with a screw press capacity of **150 kg seed/h**:	approx.	570.000, - DKK
Complete system with a screw press capacity of **300 kg seed/h**:	approx.	785.080, - DKK
Complete system with a screw press capacity of **500 kg seed/h**:	approx.	1.015.000, - DKK

Additional costs depending on the local building situation; necessary for:

- Installations, building arrangements
- conveyer belts, pipe work for seed, oil and cake transport

Sketch of a complete cold pressing installation refer to 3.5.4



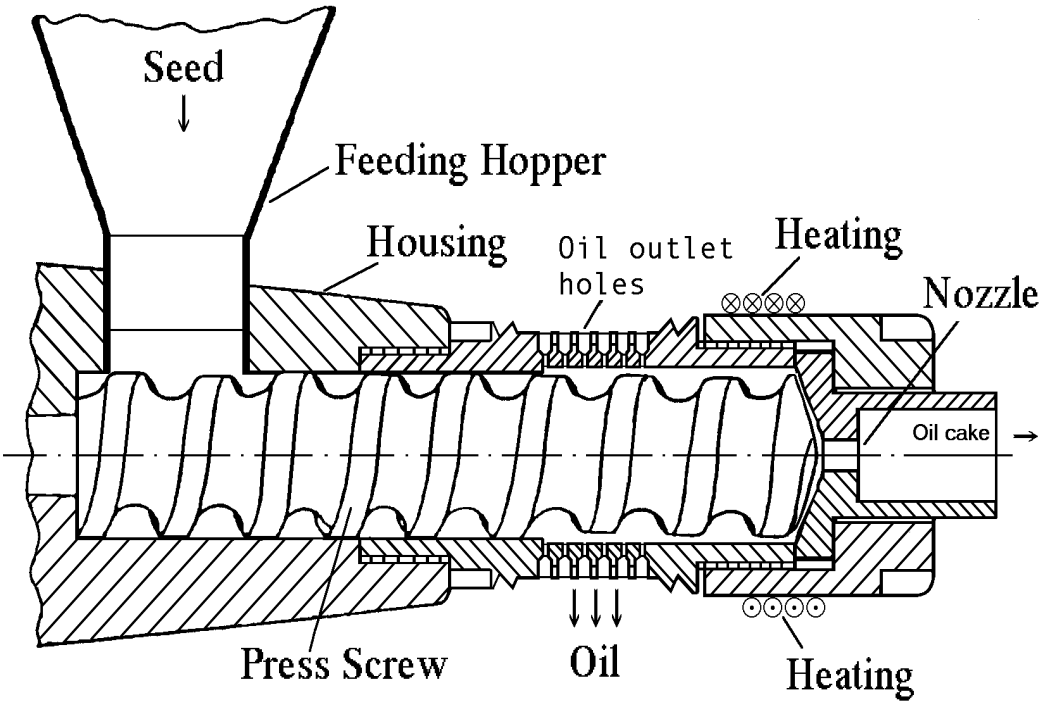
Drawing: [16] Strähle

4. Oil seed expeller

The difference between screw presses for cold pressing plant oil exists in the oil outlet. This difference also has an effect of the kind of screw and the press cake outlet of the oil expeller.
There are 2 main types of oil expeller machines:

Hole cylinder type

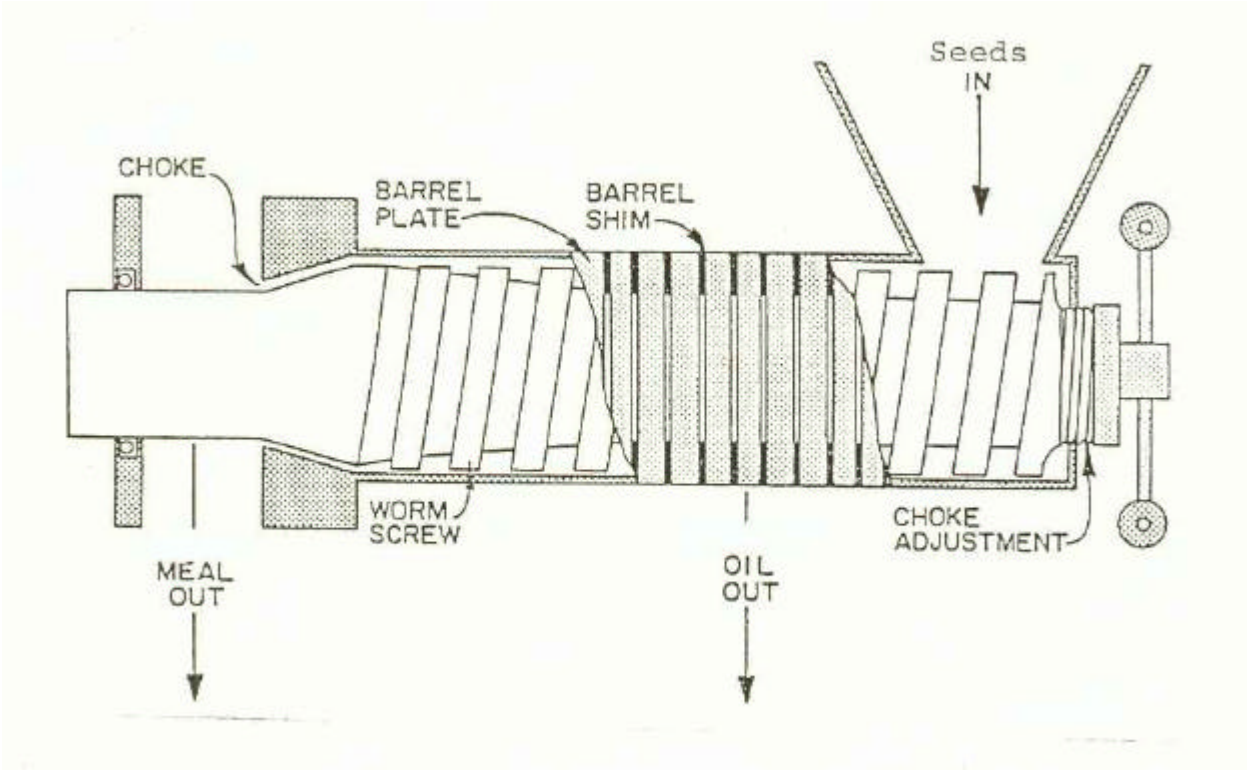
- The oil outlet in form of ***holes*** in the press tube. The seed get a rising compression in direction of the press head. The oil is pressed out of the seeds near the outlet holes and drained to them. Special perforations in the tube avoid turning of the press cake/seed-mix with the screw. Otherwise, there will be no movement forewords. The press cake is pressed through changeable nozzles and formed to pellets. The nozzle by the most types is heated to avoid blocking of the press cake. Hole cylinder types exist for small capacities (up to approximately 100 kg seed/h).



- Adjustment to press an other type of seeds by changing the nozzle and rotation speed
- Easier to clean and adjust than an strainer press

Strainer type

- The oil output in form of ***strainers*.** The strainers are builds up in form of bars, which are adjustable in the gaps to each other. Mostly the whole press tube consists of the strainer. The diameter of the screw increases. The press cake comes out of the choke formed as flat plates.



The diameter of the screw changed over the length to get a rising of the compression of the seed. This changing diameter can be formed several times on the screw. During the flow of the seed through the press, the oil is drained via the strainer, which surrounds the pressing space. The choke size can be adjusted to press the seed harder.

Some machines can remove the developed heat around the strainers by a water cooler. For pressing several oil seeds, it is necessary to change the gap size of the strainer-bars, where the oil comes out, to get an optimal yield of vegetable oil. At some types of strainer presses it is possible to change segments at the worm screw in order to change the compression of the seed. Other manufactures offer extra screws. In addition, the choke size and the rotations speed should be adjusted by pressing different kind of seed. Strainer press types exist in a wide capacity range from approx. 15 to 2000 kg seed/h.

4.1 Equipment for pre-treatment of the seed

4.1.1 Cimbria A/S

Address: Faartoftvej 22
P.O. Box 40
7700 Thisted
DENMARK

Phone: +45 9617 9000
Fax: +45 9617 9099
E-mail: mail@cimbria.com

Pipe magnet

Type MR 100

Capacity: 6 t seed/h
Price: 11.400, - DKK

The company also produces large-scale seed cleaner and screw presses (see CIMBRIA SKET).

4.1.2. La Mecanique Moderne

Address: Z.A.C. Artoipole
B.P. 42015
62060 Arras Cedex 9
FRANCE

Phone: +33 0321 5536 00
Fax: +33 0321 2404 34
Homepage: http://www.la-mecanique-moderne.com

Seed Cleaner

Type Rotary cleaner with external cyclone

Capacity: up to 1000 kg seed/h
Motor power: 0,37 kW
Fan power: 0,75 kW
Price: 59.900,- DKK

Note:

The seed is laid out in a uniform layer and is blown with air. The proportion of light wastes carried away is adjusted by changing the blowing strength. Seeds enter a rotary cylinder whose perforations let the seeds out and retains the large impurities, which exit at the end of the cylinder. The cleaner removes light wastes and separates broken seed and large impurities from the cleaned seeds. A double action sucking followed by the rotary cylinder effects this operation. Series of screens of different perforations give this equipment an all round application on all types of seeds and for various capacities.

4.2 Overview manufactures of cold pressing oil expeller

The table is ordered by the price of the units. Not included is company Cimbria Sket because they did not supply price information.

Company	Type	Capacity [kg seed/h]	Power [kW]	Weight [kg]	Price [DKK]
Täby	40a	8 - 16	1,1	60	20.100,-
IBG Monforts KOMET	CA 59 G	5 - 8	1	55	24.966,-
Karl Strähle	SK 60/1	15	3	135	25.855,-
Swea	Double screw	30	1,5		34.500,-
Heizomat	Heizopress S1	10	0,55		27.200,-
Täby	55	20 - 36	1,5	90	35.700,-
KEK	P 0015	15 - 30	2,2	165	37.734,-
Karl Strähle	SK 60/2	30	3	194	43.502,-
ABC Hansen	80	80			54.200,-
IBG Monforts KOMET	D 85 1G	10 - 25	1,5	210	58.520,-
Täby	70	40 - 60	2,2	122	63.770,-
Reinartz	AP 08	30 - 40	4		79.040,-
IBG Monforts KOMET	DD 85 G	20 - 50	3	260	89.262,-
Täby	90	80 - 108	4	187	89.860,-
La Mecanique Moderne	MBUL 20- 10	100	7,5		94.300,-
Frandsen Ecotec	40 – 1	100			100.000,-
KEK	P 0101	100	7,5	1080	122.246,-
Reinartz	AP 10/6	70 - 100	7,5		124.640,-
De Smet Rosedowns	mini 100	100 - 110	7,5		146.556,-
IBG Monforts KOMET	S 120 F	70 - 100	7,5	550	150.100,-
Karl Strähle	SK 130/3	150	7,5	750	152.000,-
De Smet Rosedowns	mini 200	200	15/ 22		199.370,-
Reinartz	AP 12	160 - 200	15		221.160,-
ABCHansen	300	300	18		286.900,-
Karl Strähle	SK 190/1	300	22	3000	311.600,-
Reinartz	AP 14/22	220 - 300	22		323.000,-
La Mecanique Moderne	MBU 75- 25	300	18,5		343.600,-
KEK	P 0350	350 - 450	22	4000	453.720,-
Reinartz	AP 14/30	400 - 500	30		471.200,-
Karl Strähle	SK 250/1	500	30	4500	478.800,-
La Mecanique Moderne	MBU 130- 75	650	55		660.800,-
La Mecanique Moderne	MBU 260- 125	1000	90		749.000,-
Reinartz	AP 15/45	700 - 900	45		931.000,-
Reinartz	AP 25/110	1.500 - 1.800	110		1.653.000,-

4.3 Oil expeller manufactures

4.3.1 ABC Hansen A/S

Address:	ABC Hansen A/S	Phone:	+45 8642 6488
	Kirkegade 1, P.O. Box 73	Fax:	+45 8641 3622
	8900 Randers	Telex:	65 126 refix dk
	Danmark	E-mail:	abc@abchansen.dk
		Homepage:	http://www.infoweb.co.za/stoneground/Maletsatsi.htm

Screw press

Oil expeller 80 kg sunflower seed/h	54.200, - DKK
Oil expeller 300 kg sunflower seed/h	286.900, - DKK
(18 kW, 380V Three phase, Shaft speed 50 RPM, working pressure adjustable)	

- Expeller provides cold pressing of oil from sunflower, linseed, canola (rape seed), pumpkin, groundnut, soya, copra, palm kernel, jojoba, apricot and peach kernels etc.
- Extraction rate of dehulled sunflower 30-35%, depending on the raw material
- Dehulling necessary for sunflower pressing
- Recommend flaking of rape seeds before pressing
- Equipment is manufactured in South Africa (MALETSATSI virgin oils industries (PTY) LTD)
- Electric system provide a semi-automated operation

Complete plant equipment

Seed cleaner with magnet	38.250, - DKK
Conditioning blower and elements	12.750, - DKK
Cake mill & conveyer 4 kW	24.000, - DKK
Pre-filter 80 kg/h	39.850, - DKK
Pre-filter 300 kg/h	57.380, - DKK
Polish-filter 80 kg/h	47.820, - DKK
Polish-filter 300 kg/h	57.400, - DKK
Silo 50 m^3	54.200, - DKK
Sludge pump	1.920, - DKK
High pressure pump	7.970, - DKK
Pipe installation 80 kg/h	4.000, - DKK
Pipe installation 300 kg/h	7.970, - DKK
Dehuller sunflower 80 kg/h	21.700, - DKK
Dehuller sunflower 300 kg/h	57.400, - DKK
Holding container 3 m^3	12.750, - DKK
Plastic tank with stand 10.000 l	9.400, - DKK

Complete plant installation

80 kg/h Basic oil expelling system sunflower	253.100, - DKK
300 kg/h Basic oil expelling system sunflower	710.400, - DKK
300 kg/h Oil expelling and storage system sunflower	850.000, - DKK
600 kg/h Oil expelling and storage system sunflower	1.307.700, - DKK
1200 kg/h Oil expelling and storage system sunflower	2.544.000, - DKK

4.3.2 Cimbria SKET GmbH

Address: Schilfbreite 2
39120 Magdeburg
GERMANY

Phone: +49 391 68 2249
Fax: +49 391 68 4233
E-mail: cimbria-sket@t-online.de

Member of the Danish CIMBRIA-group:
Faartoftvej 22
P.O. Box 40
7700 Thisted
DENMARK

Phone: +45 9617 9000
Fax: +45 9617 9099
E-mail: mail@cimbria.com
Homepage: http://www.cimbria.com

Screw presses

Type KP 15	Capacity:	250 kg -330 seed/h
	Residual oil in cake:	10-15%
	Power:	15 kW
	Weight:	approx. 2 t

Note:

- Screw press is prepared for heating and cooling in order to avoid start-up losses and overheating
- Screw equipment with highly wear-resistant parts
- Solid press frame
- Single stage hinged barrel
- Drive trough V-belt mechanism and spur gearing
- Tool set for all CIMBRIA SKET presses available against extra charge
- Electrical switch gear can be supplied against extra charge

Seed requirements:

- Content of contamination and foreign matter should not exceed 1%
- Seeds to be processed shall not contain any ferromagnetic particles or stones

Oil content	(%)	20- 50
Moisture content	(%)	5- 7
Seed temperature	(^{o}C)	15- 25

Type KP 21		
	Capacity:	1 t seed/h
	Residual oil in cake:	10-13%
	Power:	77 kW
	Weight:	approx. 7,5 t

Note:

- Variable speed feeder screw for continuous feeding of screw press
- Screw equipment with highly wear- resistant parts
- Low- noise drive with planetary gearing
- Solid press frame
- Single stage hinged barrel
- Oil collection tough including oil screw in the bottom of the press frame (Oil screw is driven through drive of screw press.)
- Tool set for maintenance and adjusting of the press available against extra charge
- Electrical switch gear can be supplied against extra charge

Seed requirements:

- Content of contamination and foreign matter should not exceed 1%
- Seeds to be processed shall not contain any ferromagnetic particles or stones

Kind of seed		Rape seed, Sunflower seed (peeled)
Oil content	(%)	39-46
Moisture content	(%)	6-7
Seed temperature	(^{o}C)	20-30

4.3.3 De Smet Rosedowns Limited

Address: Cannon street, Hull
HU2 0AD East Yorkshire
ENGLAND

Phone: +44 1482 3298 64
Fax: +44 1482 3298 64
E-mail: rosedowns@compuserve.com
Homepage: http://www.rosedowns.co.uk/home.html

Screw Presses

Type MINI 100	Capacity:	100-110 kg rape seed/h
	Residual oil in cake:	13 to 16%
	Approximate oil yield:	32 % of seed input
	Percentage solids in oil:	6 to 9% by volume
	Water content of oil:	Less than 0.2%
	Power consumed:	4 kW
	Price:	131.760, - DKK
	7,5 kW electric motor:	14.800, - DKK

Note:

- Technical process values according to rape seeds with 42% oil content, moisture content of 6 to 8% and reasonably clean
- Life of wearing parts for processing rape seed and linseed:
  - Choke ring - 900 to 1200 running hours
  - Shaft - 400 to 800 running hours
  - Barrel rings - 800 to 1200 running hours

  (Note rings at discharge end of press wear more rapidly than at feed end)

- The press can also be powered by a HATZ diesel engine instate of a electrical motor;
  Price: 23.760, - DKK

- Electro magnetic vibrator feeder complete with feeder tray and variable speed controller available;
  Price: 8.316, - DKK

- Set of press wearing parts, comprising:
  - 1-Discharge ring
  - 1-Set of pressure worms and distance pieces to fit on the main worm shaft
  - 1-Set of cage barrel rings

  Price: 27.760, - DKK

Type MINI 200		
	Capacity:	200 kg seed/h
	Approximately oil yield:	30%
	Residual oil in cake:	12 to 14%
	Price:	178.960, - DKK
	15 kW electric motor:	20.412, - DKK

Note:

- Electro magnetic vibrator feeder complete with feeder tray and variable speed controller available;
  Price: 9.940, - DKK

- Set of press wearing parts, comprising:
  1 discharge ring
  1 set of pressure screw and distance pieces to fit on the main worm shaft
  1 set of cage barrel rings
  Price: 37.050, - DKK

- options: feed hopper and support steelwork;
  Price: 9.940, - DKK

4.3.4 Frandsen Ecotec ApS

Address: Ærovej 14
9500 Hobro
DENMARK

Phone: +45 9851 1966
Fax: +45 9851 1909
E-mail: klitgaardfrandsen@mail.tele.dk

Screw Press

Type 40 – 1	Capacity:	95 – 115 kg seed/h, 35 – 42 l plant oil/h
	Residual oil in cake:	approx. 11-12%
	Rotation speed control frequently or mechanical varied:	15 – 80 rpm
	Price:	100.000, - DKK

Note:

Price including:

- Electric motor and gear
- Feeder
- Nozzle heating unit
- Nozzle set from 5 to 8 mm diameter in 0,5 mm steps (6 nozzles)
- Oil outlet control (automatic control of oil output and stop of the press when it is blocked)
- Tool set

All parts are made from high quality steel and the screw is fully hardened. No problems should occur by pressing unclean seed (plant residues).
Seals in the press head protect against clogging of dried linseed oil and leftover seeds, making otherwise the press tube difficult to dismantle. Especially linseed oil is here named, because of its big potential to block.
You can choose between two press heads. One with nozzle cake outlet to form press cake pellets and the other head with two small sideways outlets to form press cake chips. The last version creates less wear of the screw.

The company produces mainly shredders. In addition, they fabricate **spare parts for all screw press types**.

4.3.5 Heizomat GmbH

Address: Maicha 21
91710 Gunzenhausen
GERMANY

Phone: +49 9836 9797- 0
Fax: +49 9836 9797- 97
Homepage: http://www.heizomat.de

Screw press

Type Heizopress S1	Capacity:	up to 10 kg oil seed/h
	Motor power:	0,55 kW
	Revolutions:	0,48 rpm
	Price:	27.200, - DKK

Optional variable gear motor (20- 100 rpm) for several types of oil seed: 6.806, - DKK

Optional base (height 60 cm): 878, - DKK

Note:

Included is a preheating ring for the nozzle, which is necessary only for cold starts.

A magnet is situated in the feed canal to clean the seed from possible metal parts.

4.3.6 IBG Monforts GmbH & Co.

Address: Postfach 20 08 53
41208 Mönchengladbach
GERMANY

Phone: +49 2166 868 2- 0
Fax: +49 2166 868 2- 44
E-mail: info@ibg-monforts.de
Homepage: http://www.ibg-monforts.de/

Screw Presses

Type	Capacity [kg seed/h]	Motor power [kW]	Price [DKK]
CA 59 G	5 – 8	1,1	24.970, -
D 85 – 1G (former S 87 G)	10 – 25	3	58.520, -
DD 85 G (double screw)	20 – 50	3	89.262, -
S 120 F	70 – 100	7,5	150.100, -

Notes:

- Screw rotations are adjustable by a friction ring gear between 20 – 100 rpm
- All screw presses are deliverable with electric as well as with diesel motor or even hand driven
- Double screw press DD 85 G is delivered with two separate screws for each screw to press different kind of seeds (with different gradient of the screw turn)
- Screw press D 85 – 1G is delivered with two separate screws (with different gradient of the screw turn) for optimal pressing of different kind of oil seeds

Plate Filter (Filtration trough filter paper)

Model 20x20	Capacity:	20 - 60 l raw oil/h
	Feed pump 380 V	
	Weight:	70 kg
	Price:	47.500, - DKK

Model 40x40	Filter area:	0,16 up to 3,2 m^2
	Capacity:	120 – 240 l raw oil/h
	Weight:	160 kg
	Feed pump 380 V	
	Price:	85.500, - DKK
	Filter papers (100)	1.500, - DKK

Centrifuge

- From year 2000 on its possible to get a new developed IBG Monforts centrifuge to purify raw plant oil directly after pressing
- Advantages: No problems with blocked filters, easier to operate
- Separate all particles > 5 µm off

Capacity:	up to 500 l oil/h
Price:	approx. 95 - 114.000, - DKK

4.3.7 Karl Strähle GmbH & Co. KG

Address: Postfach 46
73263 Dettingen/ Teck
GERMANY

Phone: +49 7021 950 97- 0
Fax: +49 7021 950 97- 33
Homepage: www.straehle-maschinenbau.de

Screw press

Type	Capacity according to rape seed [kg seed/h]	Optional	Price [DKK]
SK 60/1	15	Speed control included Complete silo	25.855, - 33.858, - 9.690, -
SK 60/2 (double screw)	2 x 15	Speed control included Complete silo	43.500, - 56.635, - 13.224, -
SK 130/3	150		152.000, -
SK 190/1	300		311.600, -
SK 250/1	500		478.800, -

Note:

For all STÄHLE presses valid:

Cleaning of the seed is necessary for reasons of product quality as well as to avoid damages to the screw press. Impurities, like metal pieces, sand and stones should be removed.

Requirements for the humidity of the seed:	6-8%
Percentage yield of oil:	33%
Residual oil in cake:	12-15%

- All presses are equipped with electrical control box, overload protection and working hours counter.
- For the screw presses SK 60/1 and SK 60/2 there is the choice between one screw for fine grain and one for coarse seeds. One extra special screw is included in the specification. The price for an extra screw is 3.230, - DKK.
- For pressing different kind of seeds, it is necessary to change the gap size of the strainer, where the oil comes out, to get an optimal yield of vegetable oil. The adjustment is easy to do and takes 30 minutes.
- Optional is a press cake-cooling unit, which is coupled to a heat exchanger to heat up the oil seed around approximately 15 °C.
- A unit to press pellets from the press chips is also optional.

- Company Strähle developing a new type of strainer press with dicks instead of laying bars with a capacity up to 100 kg seed/h
- Advantages of the disks: higher yield of oil, lower fat content in the press cake, shorter and easier adjustment and cleaning times
- The disk strainer press coming out soon on the market.

4.3.8 KEK- Egon Keller GmbH & Co.

Address: Anton- Küppers- Weg 17
P.O. Box 140350
42824 Remscheid
GERMANY

Phone: +49 2191 8410- 0
Fax: +49 2191 8628 & 8629
E-mail: keller-kek@t-online.de
Homepage: http://www.keller-kek.de

Screw Press

Type KEK- P0015	Capacity:	20 kg seed/h (Referring to rape seed)
	Residual oil in cake:	15 %
	Motor power:	2,2 kW
	Variable speed control:	13 – 79 rpm
	Price:	30.210, - DKK
	Electric control box	7.524, - DKK

Type KEK- P0101	Capacity:	100 kg seed/h (Referring to rape seed)
	Residual oil in cake:	12 %
	Motor power:	7,5 kW
	Rotation speed:	36 rpm
	Including extra V- belt unit for screw rotations 24 rpm	
	Price:	110.090, - DKK
	Electric control box	12.160, - DKK

Type KEK- P0350	Capacity:	400 - 550 kg seed/h (Referring to rape seed)
	Residual oil in cake:	10-12 %
	Drive motor power:	22 kW
	Feeding screw motor:	2,2 kW
	Cone drives motor:	1,5 kW
	Price:	431.300, - DKK
	Electric control box:	22.420, - DKK

Plate filter

Type KEK- F0090	10 filter frames 250 x 250 mm and 10 run off taps, Cotton filter membrane, gear wheel pump with electric motor 0,12 kW, pipe work Filter cake volume: 0,01 m^3 Price: 29.260, - DKK Electric control box: 6.840, - DKK

Type KEK- F0500	20 filter frames 500 x 500 mm and 20 run off taps, Cotton filter membrane Cake volume: 0,1 m^3 Price: 75.240, - DKK Gearwheel pump KEK F0500P, electric control box, electric motor 1,5 kW, pipe work, full automatic method, operation pressure 5 bar, capacity 1200 l/h Price: 17.860, - DKK

Notes:

- Requirements for seed: Impurities < 1%; no metal pieces and stones; seed humidity 6-8%; seed temperature approx. 20-25 °C
- Between screw press and filter press is a intermediate storage tank recommended without homogenising unit (sedimentation desired)
- Filter paper necessary between the filter membranes to filter the particles > 5 µm out
- One possible deliverer for filter paper:

J. C. Binzer Papierfabrik
Berleburger Str. 71
35116 Hatzfeld/ Eder
Phone: +49 6452 3041

- filter paper size from 50 to 150 cm wide and 1,25 to 3 m long
- Price per m^2: 6,8 - 7,2 DKK

4.3.9 La Mecanique Moderne

Address: Z.A.C. Artoipole
B.P. 42015
62060 Arras Cedex 9
FRANCE

Phone: +33 0321 5536 00
Fax: +33 0321 2404 34
Homepage: http://www.la-mecanique-moderne.com

Screw press

Type MBUL 20- 10	Capacity:	100 kg seed/h
	Residual oil in cake:	14 %
	Power:	7,5 kW
	Weight:	880 kg
	Price:	94.300,- DKK
Plate Filter proposed for this screw press:		
Type FILHA8P	Capacity:	40 l raw oil/h
	Pump:	0,37 kW
	8 filter plates; taps and pipes	
	Price:	31.718,- DKK

Type MBU 75- 25	Capacity:	300 kg seed/h
	Residual oil in cake:	15 %
	Power:	18,5 kW
	Price:	343.600,- DKK
Plate Filter proposed for this screw press:		
Type FILHA16P	Capacity:	100 l raw oil/h
	Pump:	0,37 kW
	16 plates; taps and pipes	
	Price:	49.340,- DKK

Type MBU 130- 75	Capacity:	650 kg seed/h
	Power:	55 kW
	Residual oil in cake:	15 %
	Price:	660.800,- DKK
Plate Filter proposed for this screw press:		
Type 2 times FILHA16P	Capacity:	approx. 350 l raw oil/h
	Pump:	0,74 kW
	32 plates; taps and pipes	
	Price for the **2** filters:	98.680,- DKK
Alternatively, Vertical filter proposed:.		
Type FV5/5	Capacity:	approx. 350 l raw oil/h
	Price:	84.100,- DKK

The vertical filter is equipped with a vibrating device for cleaning out the dried filter cake. The filtering elements are made of a draining bore in stainless steel assembled between 2 filtering wire gauze.
The cycle of functioning consists of: Filling → Clarifying → Filtration → Draining → Drying → Cake discharge

Type MBU 260- 125	Capacity:	1000 kg seed/h
	Power:	90 kW
	Residual oil in cake:	15 %
	Price:	749.000,- DKK
Filter units proposed as by press type MBU 130- 75 (refer to above)		

General Notes:

To all screw presses are proposed a seed pre-cleaner from the same company La Mecanique Moderne (see cap. 4.3.11).
All screw presses of the MB type have a mobile cage driven by a hydraulic jack to change the cone distance of the press cake outlet.
All units can be powered optionally by a thermal engine.
The rotation speed is adjustable on all oil presses.

4.3.10 Maschinenfabrik Reinartz GmbH & Co. KG

Address: Postfach 10 09 50
41409 Neuss
GERMANY

Phone: +49 2131 9761- 0
Fax: +49 2131 9761- 12
E-mail: reinartzpressen@t-online.de
Homepage: http://www.reinartzpressen.com

Screw Press

Type	Capacity [kg seed/h]	Gear motor [kW]	Price [DKK]
Model AP 08	30 – 40	4	79.040, -
Model AP 10/06	70 – 100	7,5	124.640, -
Model AP 12	160 – 200	15	221.160, -
Model AP 14/22	220 – 300	22	323.000, -
Model AP 14/30	400 – 500	30	471.200, -
Model AP 15/45	700 – 900	45	931.000, -
Model AP 25/110	1.500 – 1.800	110	1.653.000, -

Filtration units fitting to REINARTZ oil press

	Filtration unit	Price [DKK]
For screw presses model AP 08 and AP 10/06	Chamber filter type Fi 30/02, including feed pump	60.800, -
For screw press model AP 12	Chamber filter type Fi 30/03, including feed pump	87.400, -
For screw presses model AP 14/22 and AP 14/30	Filtration facility with full automatic vertical filter, pipe work, electrical regulation as well as separate fine filter, including feed pump	355.300, -
For screw press model AP 15/45	Filtration facility with full automatic vertical filter, pipe work, electrical control as well as separate fine filter, including feed pump	482.600, -

Note:

- Delivery time are for models AP 08, AP 10/06, AP 12 and AP 14 approx. 3 – 4 months and 5 –6 months for models AP 15 and AP 25
- For the types AP 15/45 and AP 25/110 a pre-treatment with an roll crusher machine only for rape seeds is recommended to get increased yield of oil and less power requires for the press
  Price: 380.000, - DKK

4.3.11 SWEA Produktion A/S

Address: Vestervang 14
Bramdrupdam
6000 Kolding
DENMARK

Phone: +45 75 56 83 33
Fax: +45 75 56 83 97
E-mail: mail@swea.dk
Homepage: http://www.swea.dk

Screw press

Technical facts:	Capacity:	30 kg seed/h, 8 kg plant oil/h
	Residual oil in cake:	approx. 21 % (by processing rape seed)
	Motor power:	2,2 kW
	Energy demand:	approx. 125 kWh/t oil
	Price:	34.500 DKK

Note:

- **A new development with two screws, rotating in opposite directions, driven by one motor**
- Conic ending creates cake outlet
- No nozzles; two adjustable round bolts where the press cake comes out of a 2 mm round gap in flat pieces (chips)
- No heating of press cake outlet; heats itself up to operating temperature of 40 °C
- Less wear expected because of long distance (5 cm) between press cake outlet and screw head
- Softer pressing, more residual oil in the press cake

4.3.12 Skeppsta Maskin AB

Address:	Täby Skeppsta, 705 94 Örebro SWEDEN	Danish Agencies:	
Phone:	+46 19 22 80 05		Jøla Maskinfabrik
Fax:	+46 19 22 80 05		8740 Brædstrup
	E-mail/ Homepage:		DENMARK
	skeppsta.maskin@mbox200.swipnet.se	Phone:	+45 75 75 17 22
	http://www.oilpress.com	Fax:	+45 75 75 14 97

Screw presses

Type 40a	Capacity:	8 – 16 kg oil seed/h
	Motor:	1,1 kW
	Residual oil in cake:	10 – 18%
	Price:	20.100, - DKK
	Price spare part screw:	1.540, - DKK

Type 55	Capacity:	20 - 36 kg oil seed/h
	Motor:	1,5 kW
	Residual oil in cake:	10 – 18%
	Price:	35.700, - DKK
	Price with variable speed:	41.000, - DKK
	Price spare part screw:	3.100, - DKK
	Price spare part tube:	1.175, - DKK

Type 70	Capacity:	40 - 60 kg oil seed/h
	Motor:	2,2 kW
	Percentage oil yield:	25-37%
	Price:	63.770, - DKK
	Price spare part screw:	3.700, - DKK
	Price spare part tube:	1.362, - DKK
	Press type 70 powered by one cylinder HATZ Diesel Engine,	
	Price with HATZ motor:	58.633, - DKK

Type 90	Capacity:	80 - 108 kg seed/h
	Motor:	4,0 kW
	Percentage oil yield:	25 - 37%
	Price:	89.860, - DKK
	Price spare part screw:	4.985, - DKK
	Price spare part:	1.730, - DKK

Notes to TÄBY press types 55, 70, 90:

- Direct drive, no belts or chains between the drive unit and the press part.
- Hardened press components
- Gear drive in oil bath for continuous operation. Manual starting is required after a power failure. Interchangeable nozzles, tools and instruction manual supplied.
- Seed cakes of the pellet type.
- No threads in the press tube that could otherwise become clogged up with dried linseed oil and leftover seeds, making the press tube difficult to dismantle. Having no threads also means it is easier to assemble without having to worry about seeds getting caught in threads.
- A **magnet** in the seed hopper prevents metal getting into the press.
- Overload protection is provided by means of torque limit.
- A static frequency controller performs the rotation speed variation.
- Soft start, the rotation speed rises to the motor on-speed gradually without jerking.
- A toothed coupling between the gears and the oil press provides a soft power transition.
- Reversing option, useful when you want to dismantle the press head, etc., and if a foreign object becomes lodged in the unit.
- A display shows amps, rotation speed, volts and Hz.
- Fault location capability via the display, the four most recent faults triggered are stored.

TÄBY Oil fine filter after sedimentation *TYPE* F 70

Motor:	0,55 kW phase, enclosure IP 55 dust and waterproof, EEXE extended security. 1400 r/m at 50 Hz.
Frequency converter:	Fitted in electric cabinet. Gradual start. Motor protection. Variable speed control 500 - 1400 r/m.
Electric cabinet:	Enclosure classes IP 65 dust proof and waterproof.
Power supply:	220 Volt 10 Amp, single phase. 50/60 Hz
Pump:	Johnson Pump F70 S2-1. Acid proof steel, impeller pump, nitril rubbery impeller for vegetable oils. Oil temperature -15 to +85 C.
Cleaning:	Easy to dismantle. Only two wing nuts to be removed in order to ready housing for cleaning. Back-rise.
Pump-guard:	Johnson Pump Guard PV-1. Protects the pump at dry operations.
Filter house:	3-piece polycarbonate: clear 1N1-Mc 360 mms.
Filter:	1 piece coarse filter of 40 micron 248 mm of stainless steel. One fine filter cellulose-melamine resin 25 micron and 1 piece fine filter cellulose-melamine **5 micron**. Grade of Filtration can be ordered. Any of the filters can be engaged.
Capacity:	The oil must be settled before filtration (Sedimentation). No filtration direct from the press, there is too much sediment, the filter would be blocked. Example: Only pumping of rape seed oil (no filtering) at +14 °C: approx. 1500 litres per hour. Filtration 40 micron at +12 °C rape seed oil: approx. 850 litres per hour. Filtration 40 micron - 25 micron at +14 °C rape seed oil: 300 litres per hour. The capacity will increase with higher temperature of the oil.

Price ex works Örebro, Sweden, unpacked: 24.160, - DKK

5. Purification of plant-oil

Vegetable oil after cold pressing contains solids in the range of 1 – 13 percent by weight, depending on the kind of seed and the press conditions. Sedimentation, filtration or centrifugation can do purification of this raw oil. Also a combination of sedimentation and following filtration or centrifugation is possible. It is necessary to clean the oil from all particles > 5 µm size when it should be used in technical processes.

Between the pressing and cleaning process should not be a long time, like 3 months. Then you don't risk possible filtration problems when the oil was oxidised too much, which can happen with unfavourable storage conditions. See for the advice of plant oil storage at cap. 3.2.

Sedimentation

Sedimentation is the simplest and cheapest way of cleaning by using the gravity of the earth. The density difference between the oil and the solid particles is used to separate the fluid/ solid mix. Cleaning by sedimentation is recommended only by small processing capacities up to maximal daily capacities of **1 t seed/d and 200-300l oil/d**. For the reasons of space and time, it is not recommendable to have a sedimentation system for higher processing capacities.

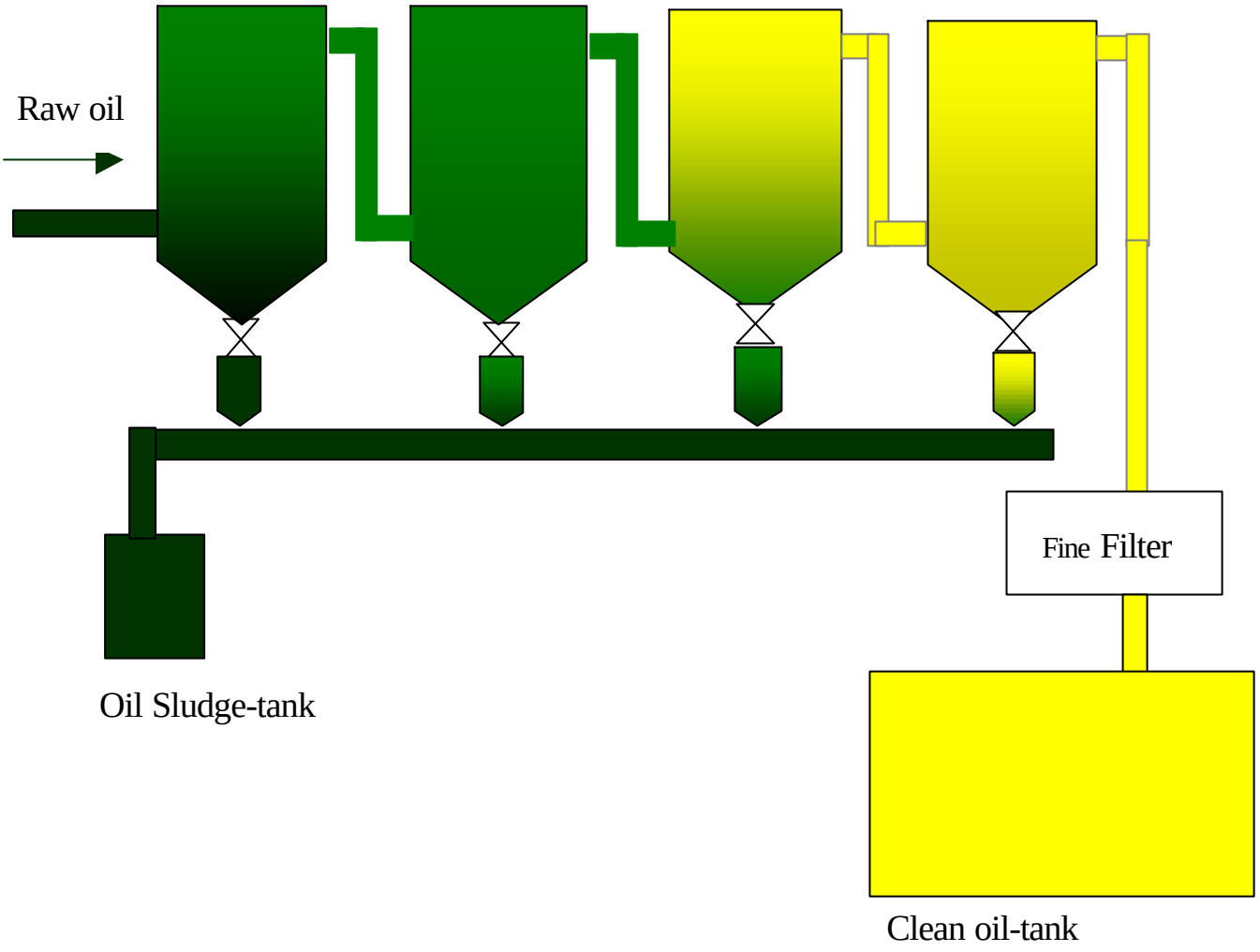
The disadvantage of sedimentation is a **high oil loss in the sediment**. Filtration and centrifugation are better solutions in order to get more yield of oil after the purification process.

The following sedimentation system works by the overflow principal. In each tank (sedimentation step) the oil should stay 2 – 4 days by recommended 20 °C ambient temperature. That is why it is necessary to have a single tank volume of several daily oil outputs. The sedimentation time depends on temperature because of the fast rising of the viscosity by falling temperature (see appendix for the viscosity diagram of rape seed oil). Lower temperature means a longer sedimentation time. The pipe connection diameter between the tanks should be at least between 20 and 30 mm to avoid high flow rates to keep the possibility for turbulence low.

A solution for a continuously working sedimentation system is the following. The sediment in the bottom of the tank can be led to a separating hopper. From the tank, a sludge pump can evacuate it. For this pumping it is recommended to have a valve between tank and hopper to avoid evacuating oil. Otherwise you will clean the tank by interrupting the oil production process with a more simple system.

The sediment can be filtered to keep losses of oil low. It is also a good feed with an even higher content of fat than press cake.

With optimal conditions, sedimentation removes all particles > 8 µm from the raw oil. That is why the plant oil must cleaned by a security filter (e.g. bag filter or fine filter) after sedimentation when it should be used as a fuel in a motor. The sedimentation tank system is mostly a home product by self-builders.



Centrifugation

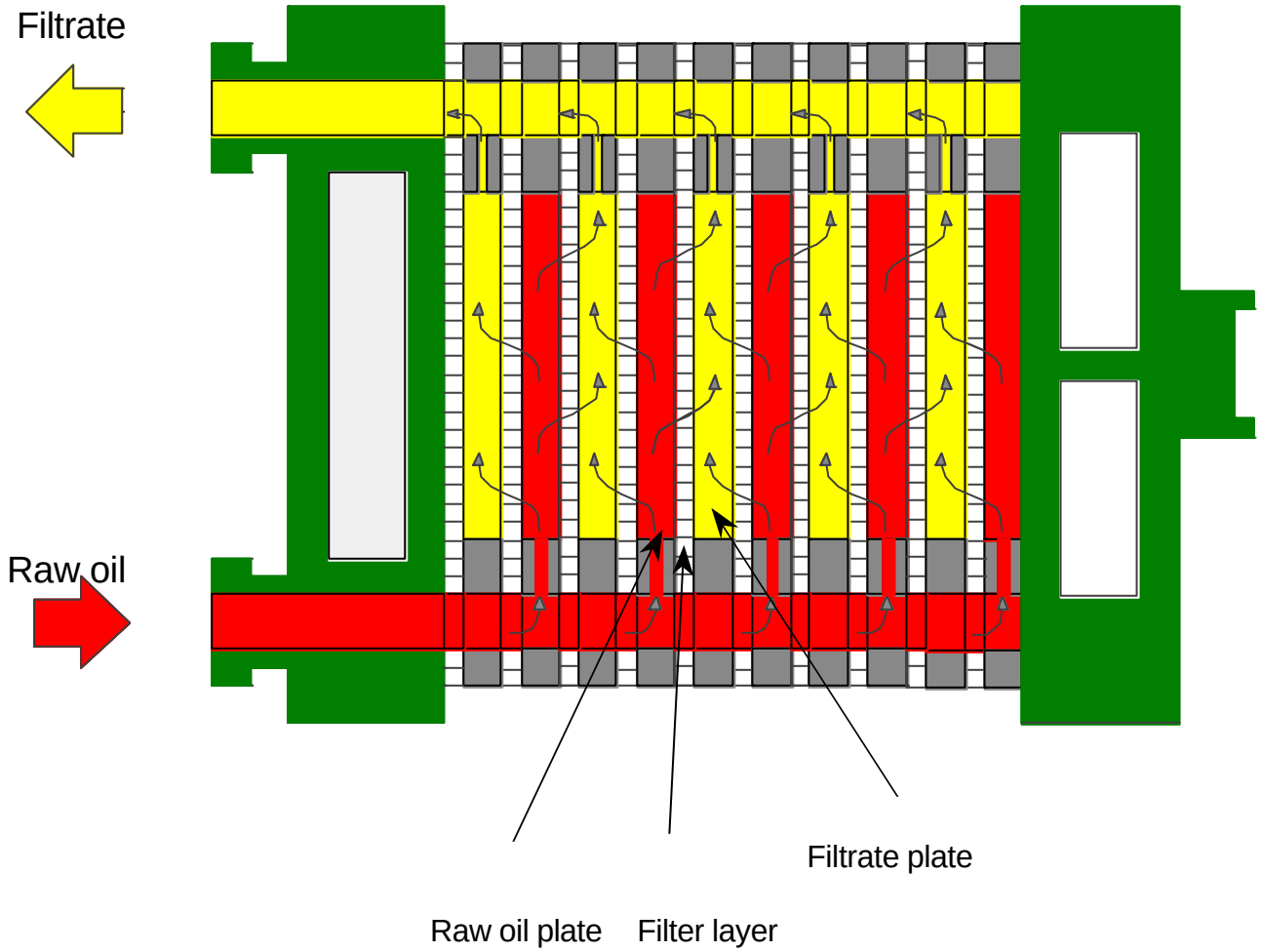
This kind of cleaning uses the centrifugal force and is a much faster sedimentation. Decanter and Separators are mostly common to use to purify olive oil, sometimes in combination. The types are choosing in depending of solids content in the oil and particle size. The viscosity of the vegetable oil for centrifugation is just as important as for filtering. It should be checked before choice of cleaning method. Some producers offer a special pre- heating unit to get the necessary low viscosity (see appendix for the viscosity diagram of rape seed oil).

Filtering

The raw oil is forced through a membrane in the filtration process and the filter media block impurities. The membrane materials are consisting of fabric, paper and metal. The membrane pore diameter is chosen to be a little bit bigger by plate, cricket and leaf filters, to avoid fast blocking of the filter. That is why in the first filtering step, bigger particles pass the filter until the solids build up an extra membrane. This membrane of particles provides a finer filtration. So some filter units operate for a short time in a circle before the filtering process starts (e.g. see oil-mill example Plankstetten: 30 min pumping the raw oil in a circle through the cricket filter before starting filtration).

The temperature of the plant oil is very important. A certain amount glycerine will come out of the oil at low temperatures (<10 °C), and block the filter fast. Also the flow of the oil through the filter decrease by low oil temperature. It is recommended to filter plant oil with a temperature of at least 20 & 30 °C. But it should not overheated up to 60 °C and more because of a higher oxidation and lower storage ability of the cleaned oil.

Operation Diagram Plate Filter



The filter membrane is made from thick woven materials such as polypropylene (PP), cotton, polyester (PE) or paper in Plate or Chamber filter. Paper can also be lying in addition to the membrane to make the cleaning easier.

The dirt holding capacity is important, as for all filter types. A high dirt or sludge volume allows a longer operating time before the filter should be cleaned or even the filter media changed.

Plate filters are flexible and can be extended by adding more frames for bigger capacities. There are widely applied in the food industry (e.g. beer, wine production) The filter-cake discharging can be manual or automatic. For a manual filter cake discharging, around a half-hour daily work must be planned. The filter-cake has oil content of 35 to 50 % in such plate filters. You get 2-4 kg filter-cake by processing 100 kg rape seed.

Company Schenk recommended for their plate filters an optimal solid content in the raw oil of 5%. The cleaning intervals will be shorter at a higher content of impurities in the oil. Otherwise the needed filter cake will build up poorly when the solids are lower.

Bag filters are constructed of non-woven materials such as polypropylene in the shape of a bag. Raw oil is placed in the bag and filtered through the bottom by gravity or pressure. The bag fills with filtered particles and is discharged.

Cartridge filter content a set of cartridges ordered in a chassis. Some of them are possible to clean, but the time used for this must be balanced against the price of a new set cartridges.

Cricket, Vertical cartridge and leaf filters are cleaned automatically in a blow back principle (so-called dry cake discharge) by compressed air. The cake discharge works automatically. An extra compressor is necessary.

Fine filters to use after sedimentation are in the mesh size of 5 µm and until today not washable. There are made for a one-time use only. Hereby you should take care of the price of the filter elements for fine filters. The sludge holding capacity is important for the stand time of the filter.

Affluent and main flow filters, which are normally used for motor oil and hydraulic oil, are applied as fine filter for vegetable oil after sedimentation. Such filters have a membrane size of 1µm. The filter material should be able to absorb a certain amount of water, otherwise it will block to fast and rise the costs of new filter inserts. Vegetable oil has a higher water content than mineral oil. This should considered choosing a filter which is normally used for mineral oil based products.

5.1 Filter equipment manufactures

Additional to the below listed producers, you should consider the offers of oil filters from the oil press companies at cap. 4.3, the points 1, 6, 8, 9,10 and 12.

5.1.1 Aage Christensen A/S

Address: Skelmosevej 10
2500 Valby
DENMARK

Phone: +45 36 44 24 44
Fax: +45 36 44 20 24
E-mail: aac@aagechristensen.dk
Homepage: http://www.amafilter.com

Filter for cleaning directly after cold pressing

Type AMA vertical leaf filter Model 42V- 195MS- 32	Capacity:	300 - 400 kg raw rape seed oil/h
	Fitration temperature:	35-40 °C
	Moisture content:	max. 0,1%
	Solids:	max. 6-8%
	Filtering area: 17,5 m^2	
	Cake holding capacity:	375 m^3
	Number of filter leaves:	11
	Leaf spacing:	70 mm
	Tank diameter:	1070 mm
	Empty weight: 1350 kg	
	Price:	156.980, - DKK
	Extra for packing:	2.192, - DKK

Note:

- Automatic cleaning of the filter by a vibrator with compressed air (6bar)
- AMA filter are widely used for filtering raw vegetable oil

Typical filtration cycle:	Filling	- 0,1 h
	Circulation	- 0,1-0,2 h
	Filtration	- 2-4 h
	Draining	- 0,1 h
	Cake drying	- 0,2 h
	Cake discharge	- 0,1 h

- Pumping of the raw oil in a circle before start to filter in order to build up the needed extra filter membrane from oil particles

Filter for cleaning cold pressed oil after sedimentation

Type AMA cartridge filter		
Model 4 AFW-1T-2	Capacity:	50 kg oil/h at 5µm
	Price:	5.150, - DKK
	1 set 4 filter cartridges:	100, - DKK
	Cartridges of 25 cm	
Type AMA cartridge filter		
Model 24 AFW-4T-2	Capacity:	50 kg oil/h at 5µm
	Price:	6.800, - DKK
	1 set 6 filter cartridges:	600, - DKK
	Cartridges of 100 cm	
Type AMA cartridge filter		
Model 36 AFW-4T-3F-M3	Capacity:	100 kg/h at 5µm
	Price:	15.300, - DKK
	1 set 9 filter cartridges	1.350, - DKK
	Cartridges of 100 cm	

Note:

- Stand time of one set of filter cartridges depends on the quality of the sedimentation process (amount of particles in the raw oil)
- Especially Model 4 AFW-1T-2, with a smaller filter area, can block too quickly at large amounts of particles (more often changing of filter cartridges)
- Differential pressure max.: 2,5 bar
- Cotton cartridges recommended
- Feeding pump necessary

Type AMA bag filter		
Model AF1-90-T-2	Capacity:	50 kg oil/h
	Differential pressure max.:	2,5 bar
	Price:	8.400, - DKK
	1 filter bag (5µm)	30, - DKK
Type AMA bag filter		
Model AF1-180-T-2	Capacity:	100 kg oil/h
	Differential pressure max.:	2,5 bar
	Price:	8.700, - DKK
	1 filter bag (5µm)	40, - DKK

Note:

- Bag filters are suitable for the removal of high concentrations of particles
- Polyester (PE) filter bags recommended
- Beside this single filters, bag filters are also available as multiple filters for parallel utilisation
- Feeding pump necessary

5.1.2 Alfa Laval A/S

Address: Krondalvej 7
2610 Rødovre
DENMARK

Phone: +45 4457 6200
Fax: +45 4457 6244
E-mail: alfalaval.dk@alfalaval.com
Homepage: http://www.alfalaval.dk

Jutland agencies: P.O. Box 221
6600 VEJEN
DENMARK
Phone: +45 44 57 62 00
Fax: +45 75 36 06 52
E-mail: denmark.info@alfalaval.com

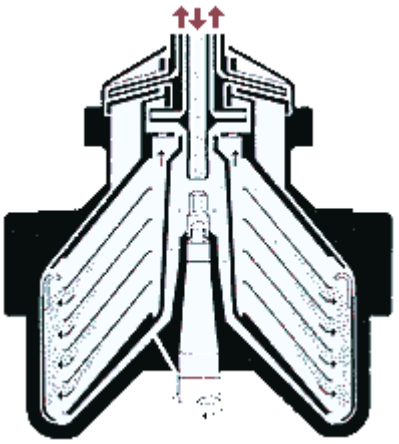
Solids-retaining centrifugal separator for cleaning of raw oil

Type Alfa Laval Separator module
Solid bowl MIB 303S-13/33

Capacity:	80 - 120 l oil/h
Viscosity:	max. 40 cst
Separation temperature:	35 - 65 °C
Weight total:	93 kg
Bowl sludge volume:	0,6 l
Bowl speed:	7.300 rpm
Heater:	700 to 2.100 W
Price:	115.000, - DKK

Note:

- Rape seed oil temperature of at least **35 °C** (max. viscosity of 40 cst)
- Working in clarifier (solids separation) or purifier (water and solids separation) mode
- Removes water and 99% of all particles in the size range 2-5 µm
- Including moveable trolley with electric-motor, pump, collecting tank, control functions and mobile **electric pre-heater**
- Manual bowl cleaning every 1 to 3 days necessary
- Also as periodic or continues self cleaning versions available
- This separator is normally applied for mineral oil based products



5.1.3 CJC - C.C. Jensen A/S

Address: CJC oil filter systems
Løvholmen 13
5700 Svendborg
DENMARK

Phone: +45 6321 2014
Fax: +45 6222 4615
E-mail: cjt@cjc.dk
Homepage: http://www.cjc.dk

Filtration of oil after Sedimentation

Type Module fine filter LG 15/25 L	Capacity: Sludge stuff volume: Max. Viscosity: Weight: Max. Pressure: Water absorption, total: Price incl. 1 set filter insert: Spare filter insert:	90 l oil/h 1,5 l 100 cst 16 kg 2 bar 1 kg 7.860, - DKK 623,- DKK

Note:

- Feed pump is included
- Filter removes particles > 3 µm and water
- Circulation-Principe off-line: pumping in an circle for a more precisely filtering result; also on- line filtering process possible
- Modular system extendable
- For max. 600 l off- line filtering (model HDU 27/27B M85 for 2400 l tanks off-line filtering)
- Raw rape seed oil temperature should be at least 20 °C for optimal operating

5.1.4 Flottweg GmbH

Address: Industriestrasse 6 - 8
84137 Vilsbiburg
GERMANY

Phone: +49 8741 301- 0
Fax: +49 8741 301- 300
E-mail: mail@flottweg.de
Homepage: http://www.flottweg.com

Centrifuge

Rated capacities: 3500 l oil/h
Sludge chamber volume: 1,5 to 15 l
Bowl speed: 8580 rpm

Prices from: 114.000, - to 380.000, - DKK

Note:

- Cleaning ability down to 0,5 µm
- Pre-heating recommended up to 50 °C
- Company make pre-tests for costumers to find out the optimum process (company charges money for the test, which is reimbursed when unit is ordered)
- Raw sedimentation of the crude oil is recommended in order to avoid expensive high capacity separators (up to 2,5 % content of solids recommendable for less discharging)
- Discontinuous working method
- Manual or automatic sludge discharging
- Flottweg equipment is normally applied in the olive oil industry

Decanter

Capacities from: 300 kg oil/h
Prices from: 380.000, - DKK

Note:

- Continuous working method

5.1.5 KHS Skandinavien ApS

Address: Naverland 15
2600 Glostrup
DENMARK

Phone: +45 4345 9477
Fax: +45 4343 1078
E-mail: filtration@khs-skand.dk
Homepage: http://www.begerow.de

Filtering of raw oil after sedimentation

Type SF 220	Filter area:	0,076 m^2
	Capacity:	approx. 15- 20 l raw oil/h
	Max. Differential pressure:	3 bar
	Price:	stainless 10.572,75 DKK
		in brass 7.449,00 DKK

Note:

- The SF 220 is a small removable unit with pump, motor and filter mounted in one place.
- 2 or 4 filter membrane possible:
  K 1 Ø 22 cm (4 µm nominal), approx. 5 DKK/item
- 4 filter membrane for two step filtration: coarse pre- filtration to fine filtration
- Depth filtration material: Filter sheets (cellulose, resin)
- KHS filter are widely applied in the food sector (e.g. beer, wine)

Filtering of raw oil directly after pressing with plate filters

Type BECO SF 2000	Filter format:	200x200 mm
	Filter area:	between 0,07 m^2 & 1,02 m^2 (2 to 30 depth filtration sheets selectable
	Operating pressure:	10 bar
Type BECO SF/ASF 4000	Filter area:	between 0,28 m^2 & 14,00 m^2 (2 to 100 depth filtration sheets selectable
	Operating pressure:	6 bar

5.1.6 SCHENK- Filterbau GmbH

Address: Postfach 20
73548 Waldstetten
GERMANY

Phone: +49 7171 401- 0
Fax: +49 7171 401- 124
E-mail: info@schenk-filters.de
Homepage: http://www.schenk-filters.de

Danish agencies: Telegrafenvej 5
2750 Ballerup
DENMARK

Phone: +45 449 733 22
Fax: +45 446 833 04

Filter for cleaning raw plant oil after sedimentation

Type Module filter MF 325- 1	Flow capacity:	600 l oil/h
	Price for filter chassis:	38.000, - DKK
	Price for 1 module 2,1 m^2 filter area:	684, - DKK
Type Module filter MF 325- 2	Flow capacity:	1260 l oil/h
	Price for filter chassis:	41.800, - DKK
	Price for 2 module 4,2 m^2 filter area:	1.368, - DKK

Note:

As a rule you can say per m^2 filter area the flow capacity is about 200- 300 l filter medium/h.

The dirty raw plant oil runs after the start of the filter process 1- 2 min in a circle in order to build up an extra filter layer that works as an extra filter membrane. After this preparing of the filter it switches automatically over to filtering mode.

The filter module must be changed after a certain time of use, which depends on the cleanness of the plant oil after sedimentation. The filter process can also run with a lower filtering power (lower pump rpm) in order to have a higher stand time for the modules.

The filter must be cleaned with compressed air after each use. See Company's homepage for more technical details about module filters, also with higher capacities.

Filter for cleaning directly after cold pressing

Type Plate and frame press KFP 470/40	Capacity:	200 kg oil/h
	Filter area:	15,6 m^2
	Sludge volume:	106 l
	Price:	136.800, -DKK
Type Plate and frame press KFP 630/40	Capacity:	300 kg oil/h
	Filter area:	22,4 m^2
	Sludge volume:	254 l
	Price:	165.300, -DKK

Note:

Characteristics:

- Manual cake discharge
- Moveable frame
- Lateral plate suspension on bars
- Compression of filter stack via manual hydraulic or Electro-hydraulic
- Schenk filter are widely applied in the food industry and specially fore vegetable oil filtration

6. Accessories

6.1 Pumps

Address: **JOHNSON PUMPER A/S**
Roskildevej 342 B
2630 Taastrup
DENMARK
Phone: +45 4352 2400
Fax: +45 4352 1577

Type Impeller pump
F 3B19

Capacities: from 60 l oil/h
Pressure: from 1 bar

Price: from 2.828, - DKK

Type Gear pump
RB 2-02F

Capacity: 360 l/h
Pressure: 40 bars
Price: 7.256, - DKK

For sludge pumping (e.g. by sedimentation system): Membrane pumps

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6.2 Tank stations

Address: **COGÈTIL SCANDINAVIA A/S**
Hannerupvej 230, Hvilsom
9500 Hobro
DENMARK

Phone: +45 9854 8411
Fax: +45 9854 8153

Complete system Self-sucking impeller Pump, tube and pistol

Capacity: 40/50 l/h
Price: 1.200, - DKK
Price single pump: 900, - DKK

Flow counter

Mechanical counter unit, adjustable (important for plant oil because of different viscosity to fossil oils)

Price: 695, - DKK

Security filter after pump

Filter head; Price: 90, - DKK

Filter element 10 µm; Price: 100, - DKK

Address: **HAMAG Elektronik A/S**
6230 Rødekro
DENMARK

Phone: +45 7466 2575
Fax: +45 7466 2611

Hand pumps for oil

Centrifugal pump HR 1/ HR2

Capacity: Approx. 0,2 l per rpm; Approx. 20 l/min
Weight: 3 kg
Price: 500, - DKK

Electrical pumps, complete systems

Self-sucking pump, 4 m tube, pistol PGA 60 – 40

Capacity: 50 l/h
Price: 1.650, - DKK

Self-sucking fin pump HORNET W80, 4m tube, pistol

Capacity: 80 l/h
Price: 2.550, - DKK

7. Standardisation of cold pressed Rape Seed Oil

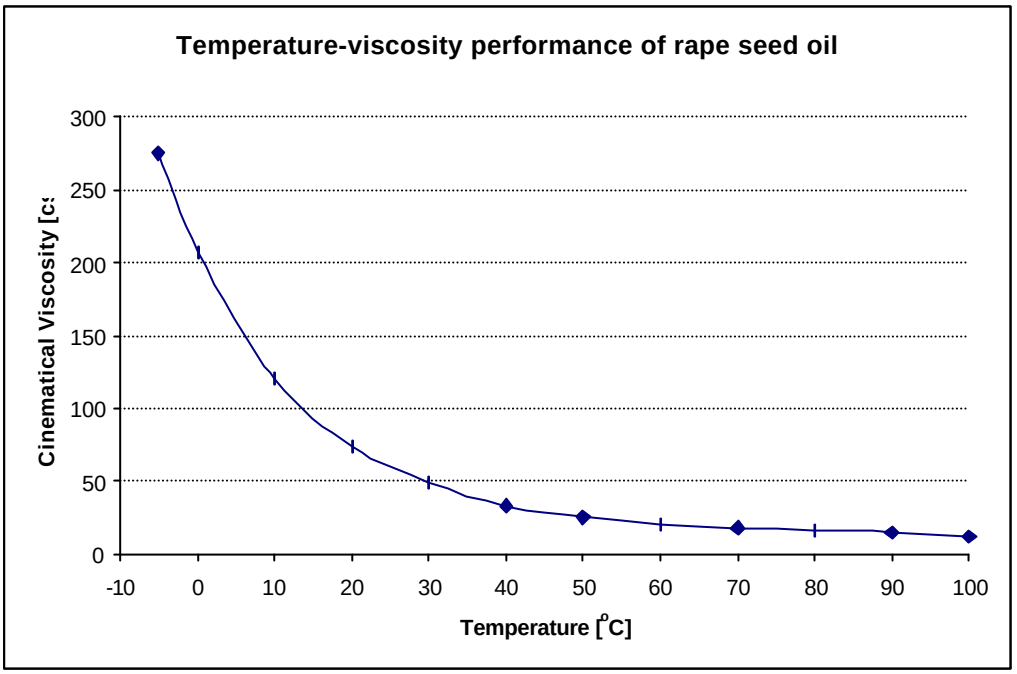
Fuel for Plant Oil Adapted Diesel Engines [7]

To reliably operate plant oil adapted diesel engines, a certain quality of the fuel must be defined. In the working group "Decentralised Oil Processing" at the Landtechnik Weihenstephan (Germany), representatives of engine manufacturers, oil producers, analysing institutes, plant operators, scientists and representatives from the ministries, set a standard for rape seed oil as a fuel in adapted engines. The standard comprises a number of important parameters, which describe the given natural oil characteristics (e.g. calorific value, viscosity), and contents (e.g. total impurity and phosphorus), that are important for engine operation. The standard is provisional, until further experiments for meeting marginal values are concluded. But, it is a common basis in warranty cases for engine manufacturers, oil producers and plant operators.

LANDTECHNIK WEIHENSTEPHAN	**LTV-Work-Session on Decentral Vegetable Oil Production, Weihenstephan** **Quality Standard for Rapeseed Oil as a Fuel (RK-Qualitätsstandard)** 05/2000	in Cooperation with:

Properties / Contents	Unit	Limiting Value		Testing Method
		min.	max.	
charcteristic properties for Rapeseed Oil				
Density (15 °C)	kg/m³	900	930	DIN EN ISO 3675 DIN EN ISO 12185
Flash Point by P.-M.	°C	220		DIN EN 22719
Calorific Value	kJ/kg	35000		DIN 51900-3
Kinematic Viscosity (40 °C)	mm²/s		38	DIN EN ISO 3104
Low Temperature Behaviour				Rotational Viscometer (testing conditions will be developed)
Cetane Number				Testing method will be reviewed
Carbon Residue	Mass-%		0.40	DIN EN ISO 10370
Iodine Number	g/100 g	100	120	DIN 53241-1
Sulphur Content	mg/kg		20	ASTM D5453-93
variable properties				
Contamination	mg/kg		25	DIN EN 12662
Acid Value	mg KOH/g		2.0	DIN EN ISO 660
Oxidation Stability (110 °C)	h	5.0		ISO 6886
Phosphorus Content	mg/kg		15	ASTM D3231-99
Ash Content	Mass-%		0.01	DIN EN ISO 6245
Water Content	Mass-%		0.075	pr EN ISO 12937

Appendix



The higher the value of the viscosity, the thicker the plant oil becomes. A high viscosity of the oil can cause low pumping speed and harder filtering possibility. That's why it will be favourable for the filtering process to have a rape seed oil temperature between 20 and 35 °C, depending of the filtering technology.

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