A Common Misconception About Frying Food

There is a common misconception that deep-fat frying food in oil at lower temperatures produces fried food with higher levels of fat. The reasoning goes something like this: Foods fried at a lower temperature take longer to cook providing more time for oil to be absorbed. True? No, false!

Many research studies have shown that *the amount of oil absorbed during frying is directly proportional to the amount of moisture lost from the food*. This has been shown to be true for French fries, tortilla chips, breaded chicken, skinless chicken breasts, and other foods (*Food Technology*, April 1995, pages 142-145).

When raw food is placed in hot oil heated to 177° C (350° F) the oil bubbles furiously. The bubbles are caused by the rapid release of steam from the surface of the food. The loss of moisture produces pores near the surface of the food. When the food is removed from the fryer the film of hot oil coating the food is rapidly absorbed into the pores. The conversion of moisture to stream requires energy in the form of heat transferred from the hot oil. Hotter oil converts more moisture to steam resulting in more oil being absorbed by the food. Thus:

Higher temperature = more moisture lost = greater pore volume = more oil absorbed

Water occurs in food in three forms: Free, adsorbed, and bound. Free water is literally water that can be squeezed out of food. Adsorbed (spelled with a “d”) water is water that is bound to the surface of proteins and carbohydrates, and is not as easily removed from food as free water. It takes more energy (as heat) to remove adsorbed water from food. Bound water is water that is part of the structure of crystalline substances and cannot be removed from food except with lots of energy. Each form takes more energy to convert the water to steam:

Bound >> Adsorbed > Free

Thus lower frying temperatures release less moisture from food so less oil is absorbed (spelled with a “b”). But why doesn’t frying food at lower temperatures for longer periods of time result in the absorption of more oil? Careful studies of the amount of moisture lost, and oil absorbed, during deep-fat frying of tortilla chips at both 150° C (302° F) and 190° C (374° F) showed that more moisture is lost, and more oil absorbed, at the higher frying temperature. Most significantly, after reaching the maximum moisture lost at each temperature both the *loss of moisture and absorption of oil leveled off,* with no further increase in oil content even after extended frying time (see fig. 5, Journal Food Process Engineering, 1995,18: 307-320). The same results have been obtained with deep-fat frying skinless chicken breasts at 170° C (338° F), 180° (356° F), and 190° C (374° F) (Drying Technology, 2005, 23: 907-923). Essentially, *the temperature of the frying oil determines how much moisture is lost, the volume of the pore structure created, and the amount of oil absorbed by the food, and not the cooking time*.

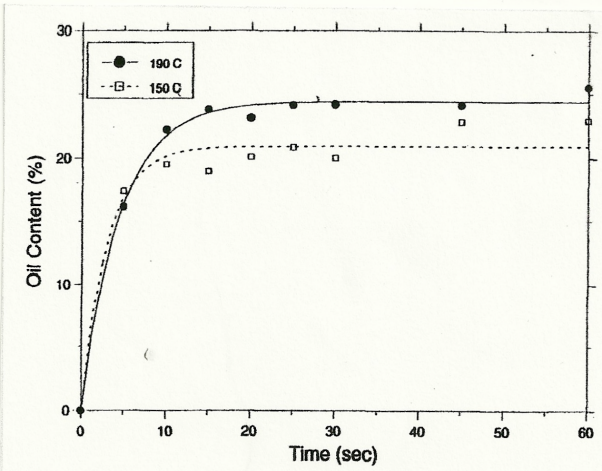

FIG. 5. COMPARISON OF OIL CONTENT OF TORTILLA CHIPS FRIED AT DIFFERENT FRYING TEMPERATURES
[dots are observed values and lines are the simulated values]

These results were put to good use by the test cooks at *Cook's Illustrated Magazine* (July & August, 2009, pages 20-21) in the development of a recipe for "Easier French Fries". The classical two-stage method of making French fries calls for cooking the raw potatoes in oil at 325° F until just beginning to color, removing them from the oil, increasing the oil temperature to 350° F, and returning the potatoes to the hotter oil until golden brown. This method ensures potatoes with a crispy golden crust and tender, soft interior. Total cooking time is less than ten minutes.

The recipe for easier French fries developed by Cook's Illustrated calls for adding the raw potatoes to cold oil, and heating the oil over high heat for 25 minutes until the temperature of the oil reaches a little less than 280° F. The French fries cooked this way are just as golden brown on the outside, and creamy soft on the inside as the French fries cooked by the classical two-stage method. Laboratory analysis of the fat content of fries cooked by the two methods showed *the fries cooked at the lower temperature, but 2.5 times longer, contained 30% less oil.* And now you know why.