# Stability of Hydrogenated Soybean Fat at Prefrying and Storage of Deep-Frozen French Fries

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## INTRODUCTION

The French fry industry uses considerable amounts of hydrogenated fat for prefrying. In 1981, the Dutch industry produced 312,500 tons of French fries, the EEC (minus Denmark, Eire, Italy) 832,300 tons, of which 74% was deep-frozen product. With an average fat content of 5%, the fat usage amounted to 41,000 tons in the EEC.

In the French fry industry, doubts are raised concerning the suitability of soybean oil based fat for prefrying. Typical off-flavors might be developed impairing the quality and shelf-life of the product.

Therefore, an investigation was started in 1982 into the suitability of hydrogenated soybean fat for prefrying and storing deep-frozen French fries, in comparison with the very frequently used hardened palm fat.

## DESIGN OF THE EXPERIMENTS

A comparative frying and storage experiment on laboratory scale was made. French fries were prefried in five frying fats at 160 C. After being chilled, the fries were frozen in an air stream at -30 C and stored at -18 to -20 C. The frying was continued for three days, but intermittently the oil and fat were heated without frying food at 140-180 C in order to simulate frying in oil or fat of decreasing quality and stability.

The five frying fats were selected from ten commercial samples through a screening by incubation at 60 C and analysis for flavor stability. The selected commercial samples were: a hydrogenated soybean oil (25% C18:2), two hydrogenated soybean fats (0% C18:2) (mp 41 and 44 C) and a hydrogenated palm fat (0% C18:2) (mp 45 C). The fifth sample was prepared by CIVO-Institutes TNO (the Netherlands) according to an experimental procedure including a heat treatment of the soybeans before extraction in order to get an improved oil quality. The latter sample was a hydrogenated soybean fat (0% C18:2) (mp 44-46 C).

The changes in oil or fat quality during the frying test and during the storage of deep-frozen fries were determined. These as well as flavor qualities after finish frying in soybean fat are being analyzed at 3-monthly intervals.

## RESULTS AND DISCUSSION

Table I summarizes analyzed changes in the frying oil and fats during three days of frying and heating. For comparative purposes, a fat sample taken from an industrial French fry cooker (hardened palm 45) is included. Soybean fat 1 underwent a rapid increase of peroxide value already at the first frying (9.1). This sample also showed a larger increase in polar components than the other soybean fats, almost comparable to the more unsaturated soybean oil. Both palm fats were quite high in polar components.

During the first three months of storage of the deep-frozen fries, no significant changes in flavor quality after finish frying or in characteristics of extracted oil or fat have been noticed. However, odor and taste of finish fried fries prefried in soybean fat 1 and palm fat were rated at lower levels from the start of the storage period (Table II). The panel ascribed this lower score to a different from normal fat flavor after finish frying.

**TABLE II**

**Odor and Taste Evaluation[a] of Finish Fried French Fries (Average of 3 Frying Days)**

| Oil/fat | Storage period | |
|---|---|---|
| | 3 weeks | 3 months |
| Soybean oil | 6 | 6 |
| Soybean fat 1 | 4 | 5 |
| Soybean fat 2 | 6 | 8 |
| CIVO Soybean fat | 6 | 8 |
| Palm fat | 5 | 5 |
| Industrial product (palm fat) | 8 | 8 |

[a]7 points scale (2-8).

### Preliminary Conclusions

To date, these are as follows.

- No indications have been found that hydrogenated soybean fats (or even an oil) are less stable than palm fat at prefrying French fries or at deep-frozen storage (up to 3 months).
- Of five selected fats, both a hydrogenated soybean and a palm fat gave less favorable results regarding the flavor quality of prefried fries.
- An experimentally produced soybean fat (CIVO-Institutes TNO) performed quite well during frying and storage of deep-frozen product.

**TABLE I**

**Effect of Prefrying (and Heating) on Peroxides (PO), Polar Components (PC) and Free Fatty Acids (FFA)**

| Oil/fat | PO (μmol/g) | | PC (%) | | FFA (%) | |
|---|---|---|---|---|---|---|
| | Fresh | Used[a] | Fresh | Used[a] | Fresh | Used[a] |
| Soybean oil | 0.7 | 3.1 | 2.1 | 6.7 | 0 | 0.05 |
| Soybean fat 1 | 0.7 | 9.1 | 1.1 | 4.9 | 0.04 | 0.10 |
| Soybean fat 2 | 0.9 | 4.6 | 1.3 | 3.0 | 0.04 | 0.10 |
| CIVO Soybean fat | 0.3 | 6.7 | 1.1 | 2.9 | 0.03 | 0.06 |
| Palm fat | 0.7 | 3.4 | 5.9 | 6.6 | 0.07 | 0.21 |
| Industrial cooker/palm fat | – | 1.8 | – | 8.1 | – | 0.16 |

[a]Highest value measured during 3 days.