

The logo for AAK, consisting of the letters 'AAK' in a bold, blue, sans-serif font. The letter 'A' is stylized with a small circle at the bottom right of its stem.

AarhusKarlshamn

# Formulation and use of Frying Oils

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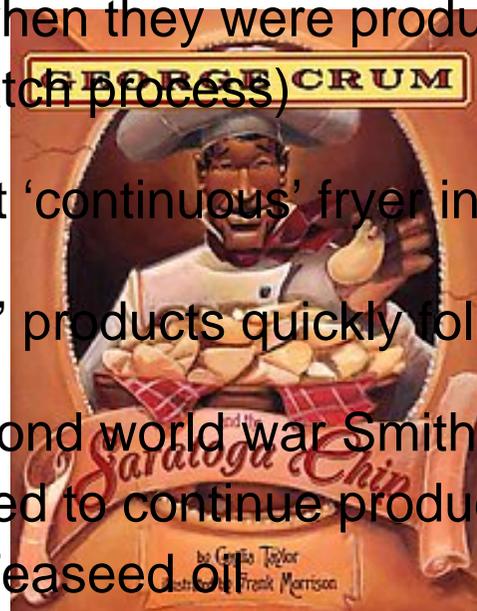
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## Brief History of Frying

- At least as early as 1600 BC
- Romans referred to the practice as 'boiling in oil'
- Then in 1853 potato crisps first invented by George Crum (a native American) a chef in the resort of Saratoga Springs
- Around 1900 when they were produced as a snack item, (but still in a batch process)
- In 1929 the first 'continuous' fryer invented by the J D
- Other 'par fried' products quickly followed.
- During the second world war Smiths Crisps were the only snack food compar in the UK allowed to continue production owing to shortages and the only oil available was Teaseed oil





# The Purpose of Frying

Reduce moisture content



Increase oil content



Efficient heat transfer

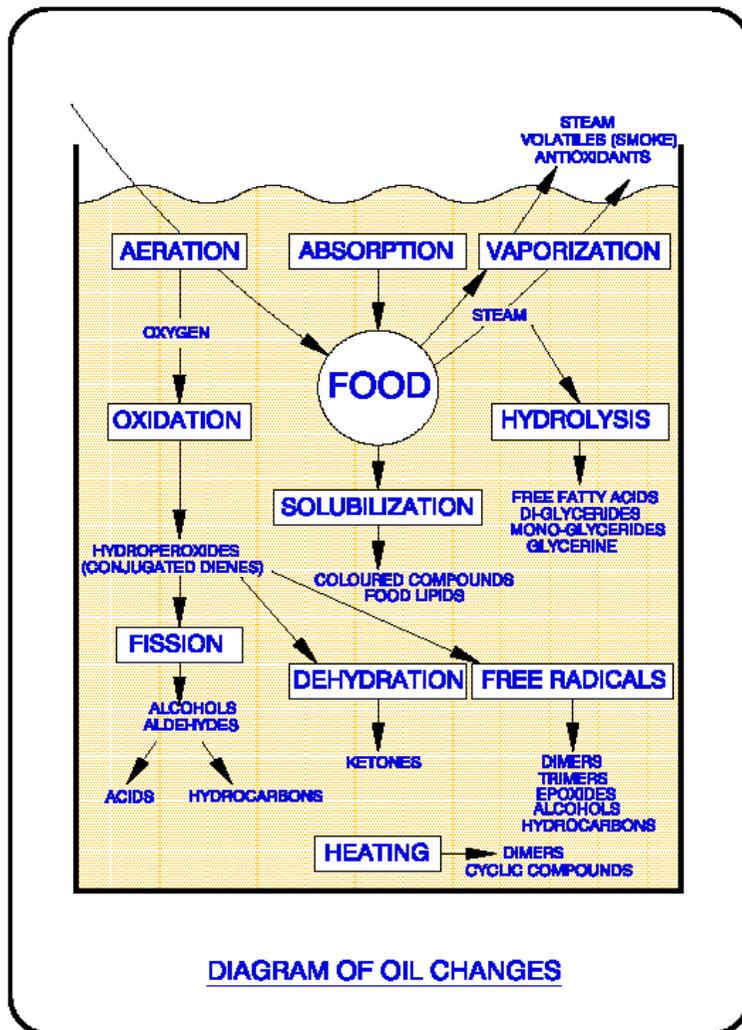


Impart desirable flavour, texture and colour





# What happens in the fryer



## Hydrolysis – action of water

Creates FFA and reduces smoke point

Creates monoglycerides which stabilise foaming

## Oxidation – reaction of hot unsaturated oil with Oxygen

Gives rise to off flavours (rancidity)

Initiates polymerisation

## Polymerisation – creation of long chain molecules

Increases oil viscosity – less effective heat transfer

Causes an increase in oil absorption on the fried product

Produces gums which stick to the fryer wall



## Oils commonly used in deep frying operations

### Liquid and semi liquid oils

- Rapeseed
- Soyabean
- Sunflower
- Cottonseed
- Peanut
- Palm Olein
- Olive Oil
- Partially Hydrogenated

### Solid Fats

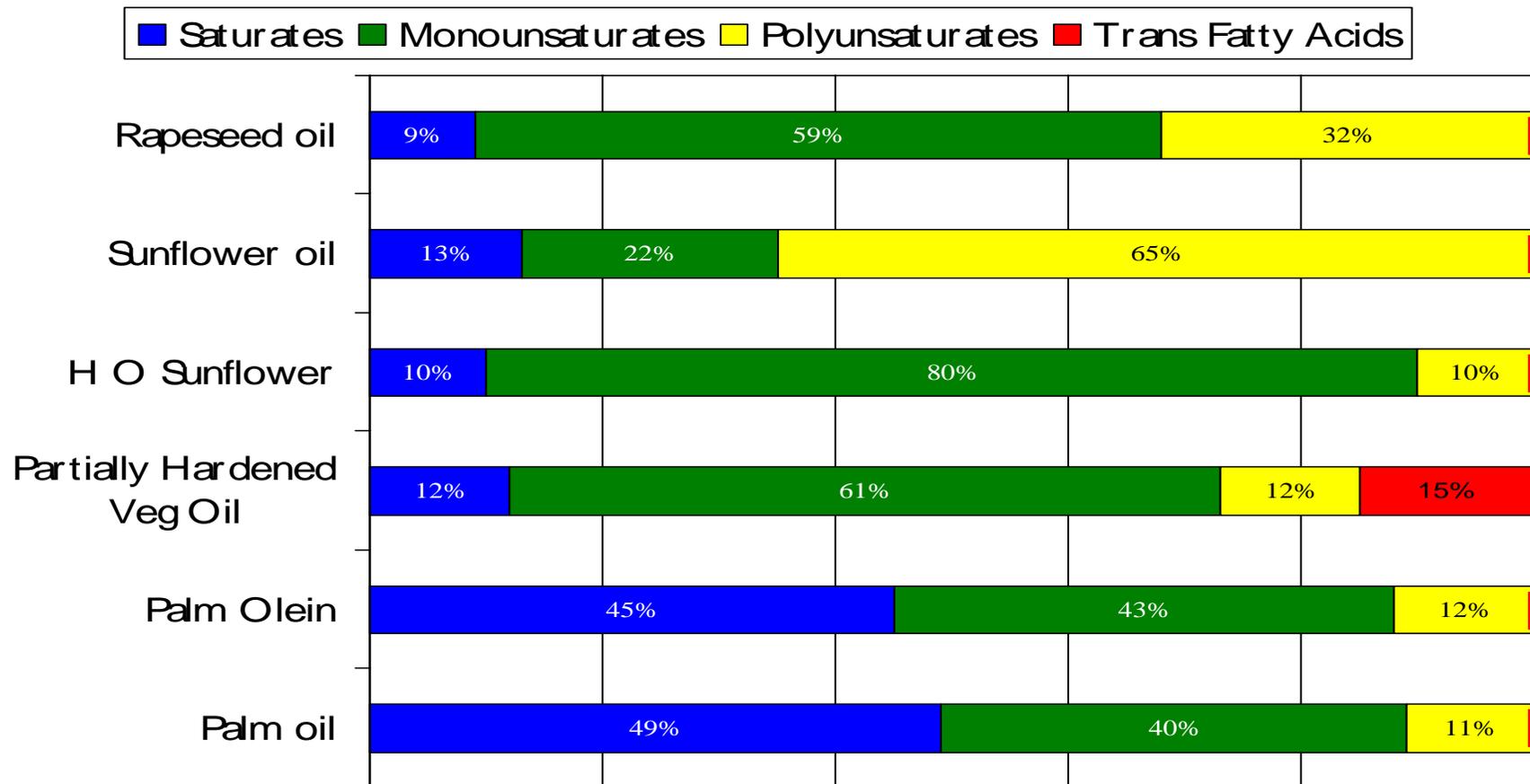
- Palm Oil
- Lard
- Hydrogenated Fats

### New Crops Varieties

- High Oleic Sunflower / Rape
- Low Linolenic Soya

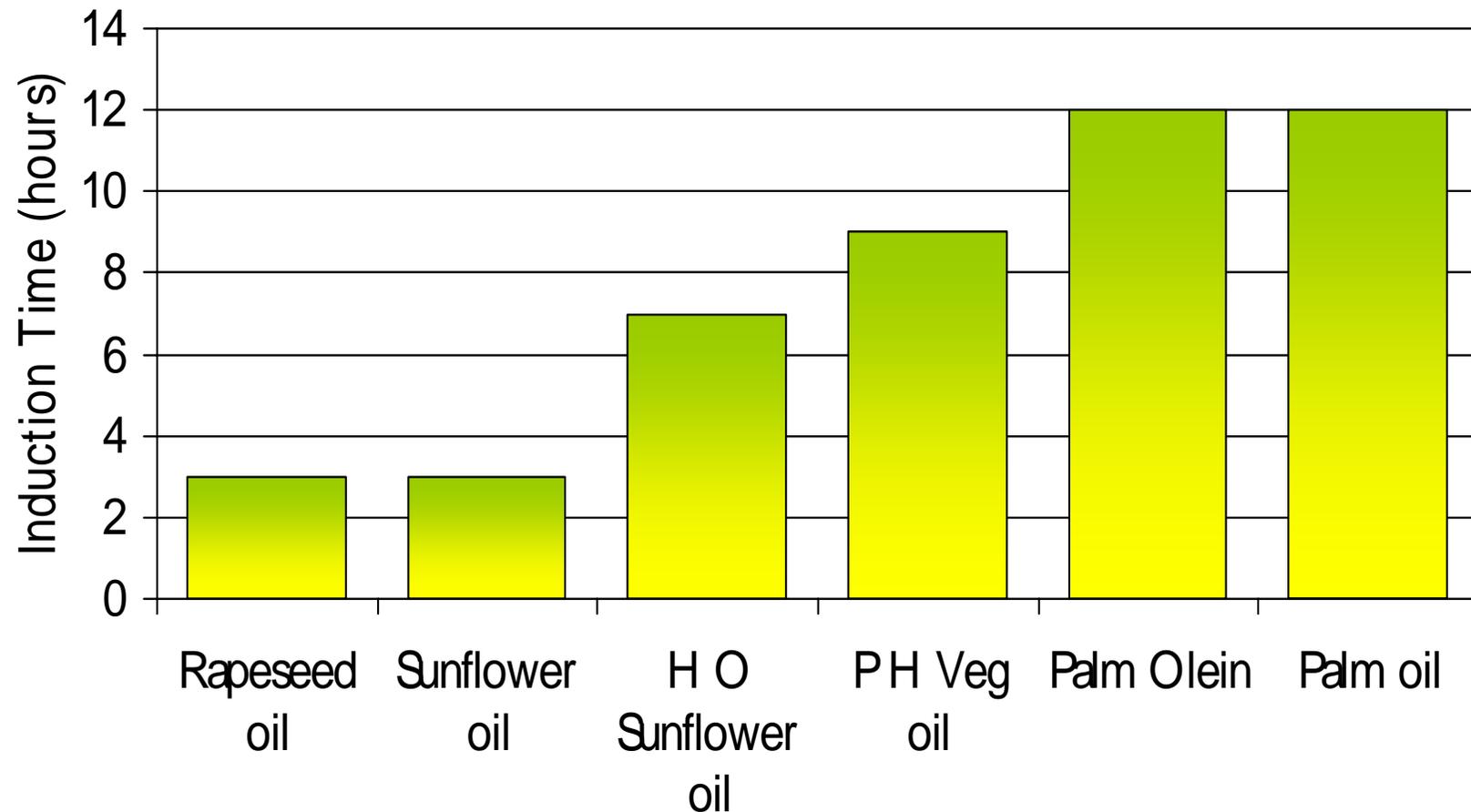


# Nutritional Profiles of oils and fats





## Rancimat values as a comparison (120C)





# Oxidative Stability

The greater the degree of unsaturation, the greater the potential for oxidation during frying resulting in Lipid Oxidation Products (LOP's)

## **Detection And Toxicological Properties Of Dietary Lipid Oxidation Products**

**Supervisors: Dr. Martin Grootveld and Professor Richard Iles**

The generation of toxic lipid oxidation products (LOPs) in polyunsaturated fatty acid (PUFA)-containing culinary oils and foods during commercial or domestic frying/cooking episodes poses health hazards that have recently attracted much public and clinical interest.



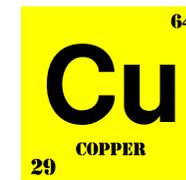
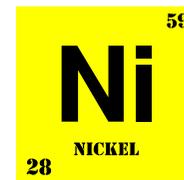
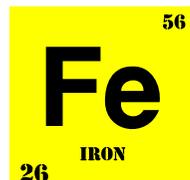
## Trace Elements

Fresh Oil                      100%

1ppm Iron            7% (reduction of 93%)

1ppm Nickel        85% (reduction of 15%)

1ppb Copper        30% (reduction of 70%)





# Fryer requirements

Fryer design varies, numerous types and sizes available

Must be sized to fit the needs of the business – minimum turnover time

Direct heating or via a heat exchanger (indirect)

Fitted for automatic 'top up'

Continuous filtration





## Turnover time - example

- Capacity of fryer – 1.5 tonnes
- Product throughput – 1000 kilos per hour
- Average oil absorption on product – 12%
- Turnover time =  $1000 \times 0.12 = 120$ ,  $1500 / 120 = 12.5$  hours  
( i.e. the oil is replaced by fresh oil every 12.5 hours )
- *Most available oil types can be used if the fryer turnover time is less than 8 hours, if not a more robust oil may be required or better filtration or the use of additives.*



## Typical absorption rates in some fried foods

- Crisps 30 – 40%
- Fries (par-fried) 5 – 10%
- Fish for freezing 10 – 15%
- Doughnuts 15 – 20%

*Oil absorption rate is affected by cooking temperature and dwell time.*

*Oil content can be reduced by introduction of an 'air knife' or steam 'blowing' stage.*



## Extending fry-life by use of antioxidants

### 'Synthetic'

- Traditional antioxidants
  - BHA (E320)
  - BHT (E321)
  - Propyl Gallate (E310)
  - TBHQ
- Di Methyl Polysiloxane (E900)
  - Reduce the surface tension of the oil
  - Form a monomolecular barrier at the oil surface
  - Foam suppressant

### 'Natural'

- Tocopherol rich mixture (E306)
  - Effective during idling period
  - Gamma homologue is most effective
- Rosemary antioxidant
  - No 'E' number declaration as its primary use is as a flavour
- Other natural antioxidants
  - Rice Bran Oil
  - Sesame



# Customer requirements

- Maximum fry-life at minimum cost
- 'Trans free' – (non hydrogenated)
- Nutritionally balanced formulation (reduced saturates)
- Convenient to use
- Optimum food quality (appearance and taste)



Thank you for your attention

Questions ?

