Optimising the Baking and Frying Process Using Oil Improving Agents

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„Within food companies, trans reduction is always a top-three priority item.“

Dr. Willie Loh, National Sales Manager, Cargill Speciality Canola Oils

- **Reduction of trans fatty acids**
- **Reduction of acrylamide level**
- **Reduction of total fat content**

Use of additives may be a possibility to solve some of these problems

Legal Definition of Additives or Agents

- An ingredient of a food not normally of itself consumed as a food

  and

- having a function useful in the food

Additives in Deep Frying Fats

- Organic Acids (Citric acid and salts)
- Antioxidants (BHT, BHA, Gallates, TOC)
- Antifoam (DMPS)
- Anti-spattering agent (Lecithin)
- Emulsifiers (Fatty acid esters or citric esters of mono-und diglycerides)

Purpose of Additives

- **To delay the chemical degradation of the fat (FFA, Colour, Polar Materials)**
  - Antioxidants, Citric acid, Adsorbens
- **To change the physical properties of fat (viscosity, heat transfer, interfacial tension)**
  - Antifoams, Emulsifiers, Filter Aids, Absorbens

Aim of the Use of Additives

Oil:

- **Better heat and oxidative stability**
- Constant oil quality
- Shorter heating time and lower temperature
- Replacement of unhealthy hardened fats with **trans free oils**

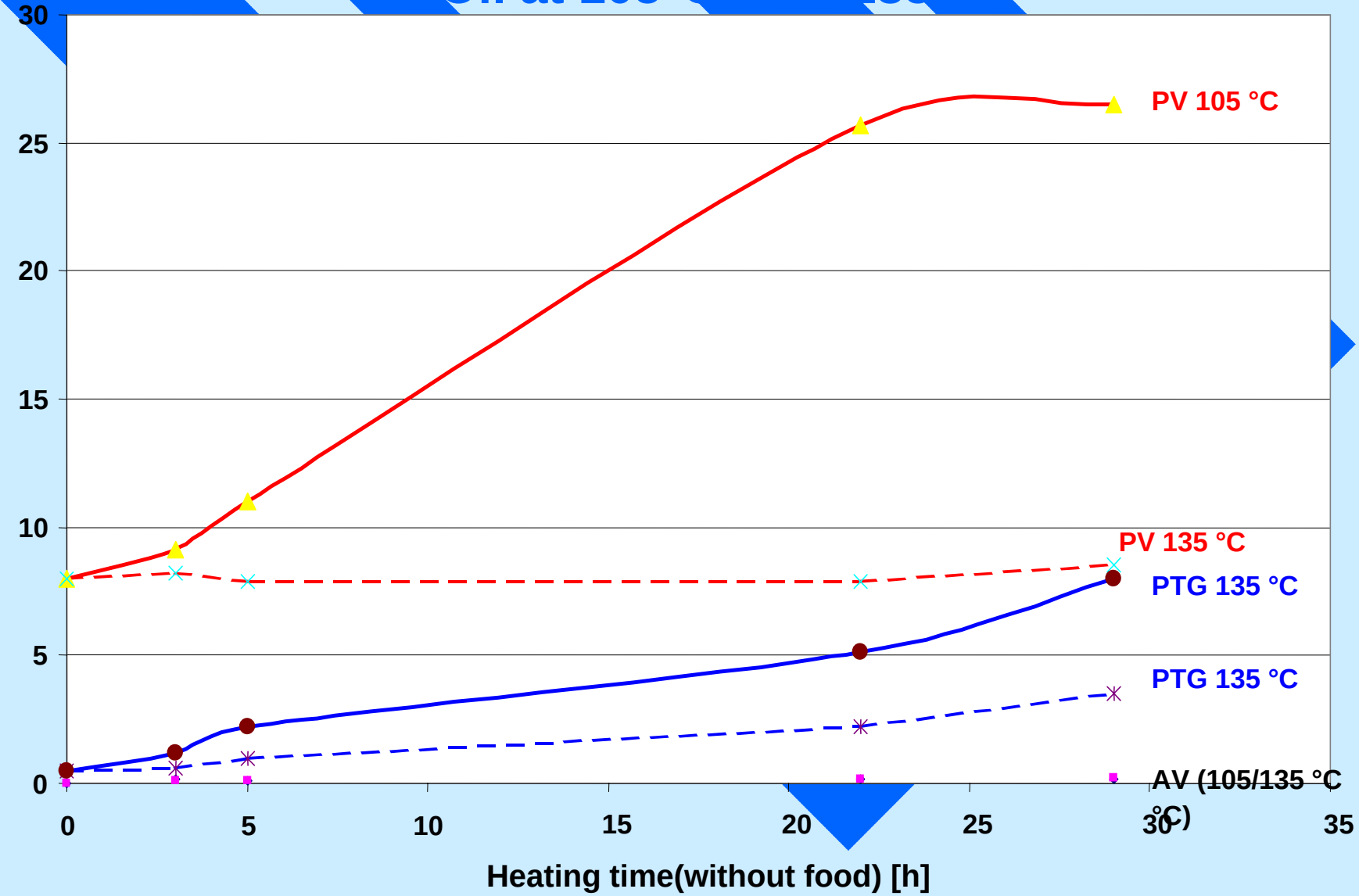
Product:

- Better taste and texture
- **Less oil uptake by the foods**
- Lower level of toxic substances

Reducing Oil-Uptake

- Frying temperature and duration
- Prefrying treatments (blanching et drying)
- Coating

ging PV, AV and ... during Heating of Sunflower Oil at 105° ... 135 ...



Stabilizing Agents for Deep Frying Fats and Oils

- **< 130 °C**
  - Antioxidants as radical scavengers
  - Phenolic compounds forming quinones (BHT, BHA, TBHQ, gamma-and delta tocopherols)

- **> 130 °C**
  - Antipolymerising agents:
  - Compounds, forming dimeric products by proton catalysed reactions (dehydratisation)

Antipolymerising agents

Substance	Reaction product	Temperature (°C)
Sesamolin	Sesamol, Sesamin, Sesaminol	130 °C
Phytosterols	Steradienes	150 °C
Ascorbic palmitate	Dehydro-Ascorbic Palmitate	150 °C
Alpha Tocopherol	Tocopherol-Trimer	160 °C
Squalene	Tetracyclo-squalene	170 °C

Natural Antioxidants/Agents

- **Unsaponifiables isolated from**:
  - olive
  - corn
  - wheat germ

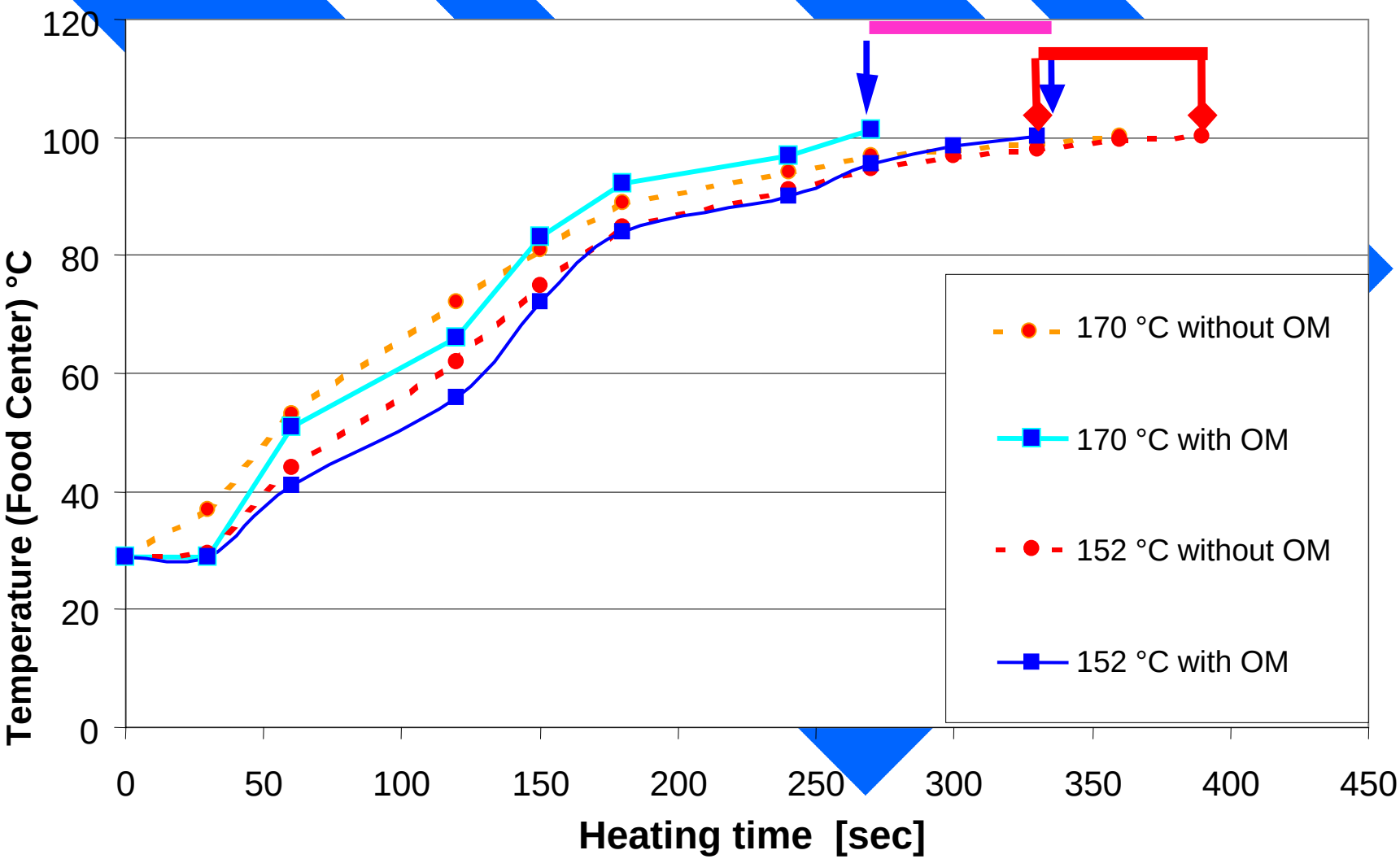
- **Extract (ethanolic, petrolether) from:**
  - rosemary
  - oregano
  - sage
  - savory
  - oat

Water Containing Agents

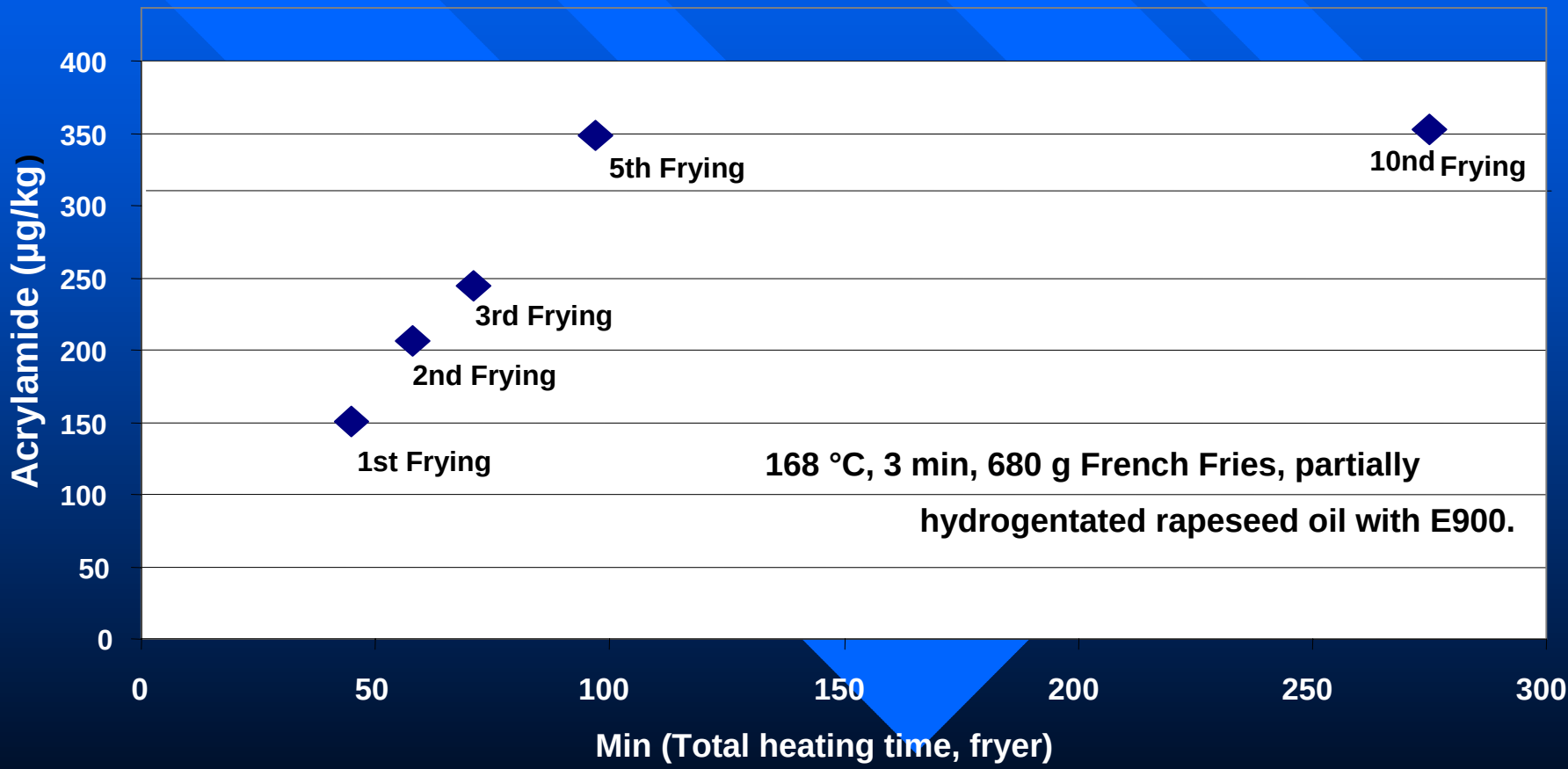
Product	Type	Water content	Antioxidants
Oilmaster	Emulsion (W/O)	Ca. 20 %	ACP, TOC, Citric Acid
Miroil Frypowder	Powder (Perlite)	Ca. 50 %	Citric acid
Miroil Fryliquid	Emulsion (O/W)	Ca. 50 %	Rosemary extract, Citric acid

Improvement of the Heat Transfer with Oilmaster

(Test:: crude potatoes, 15*15*600 mm; Frying oil: Sunflower)



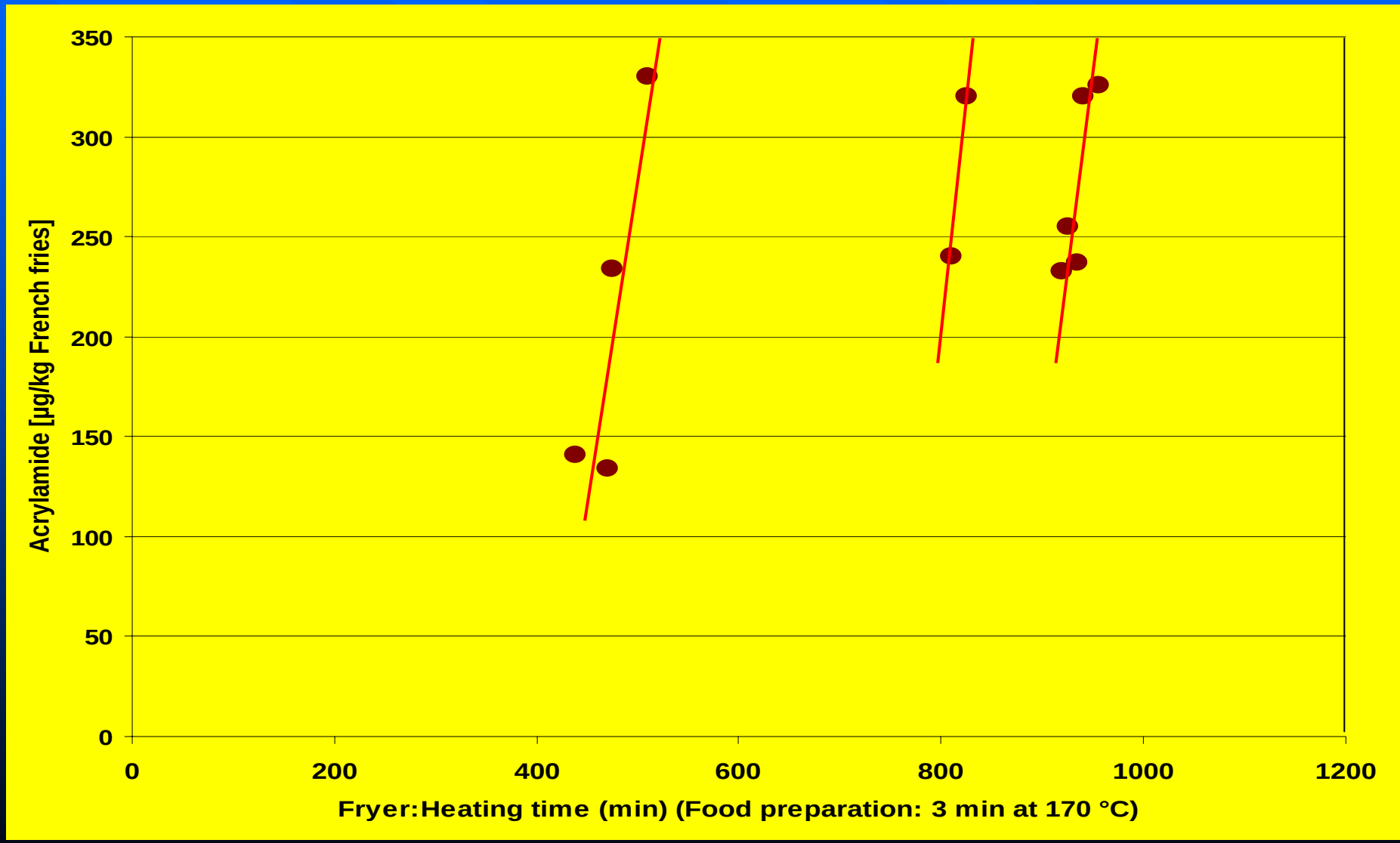
Accelerated formation of acrylamide in French Fries with increasing usage of the frying oil



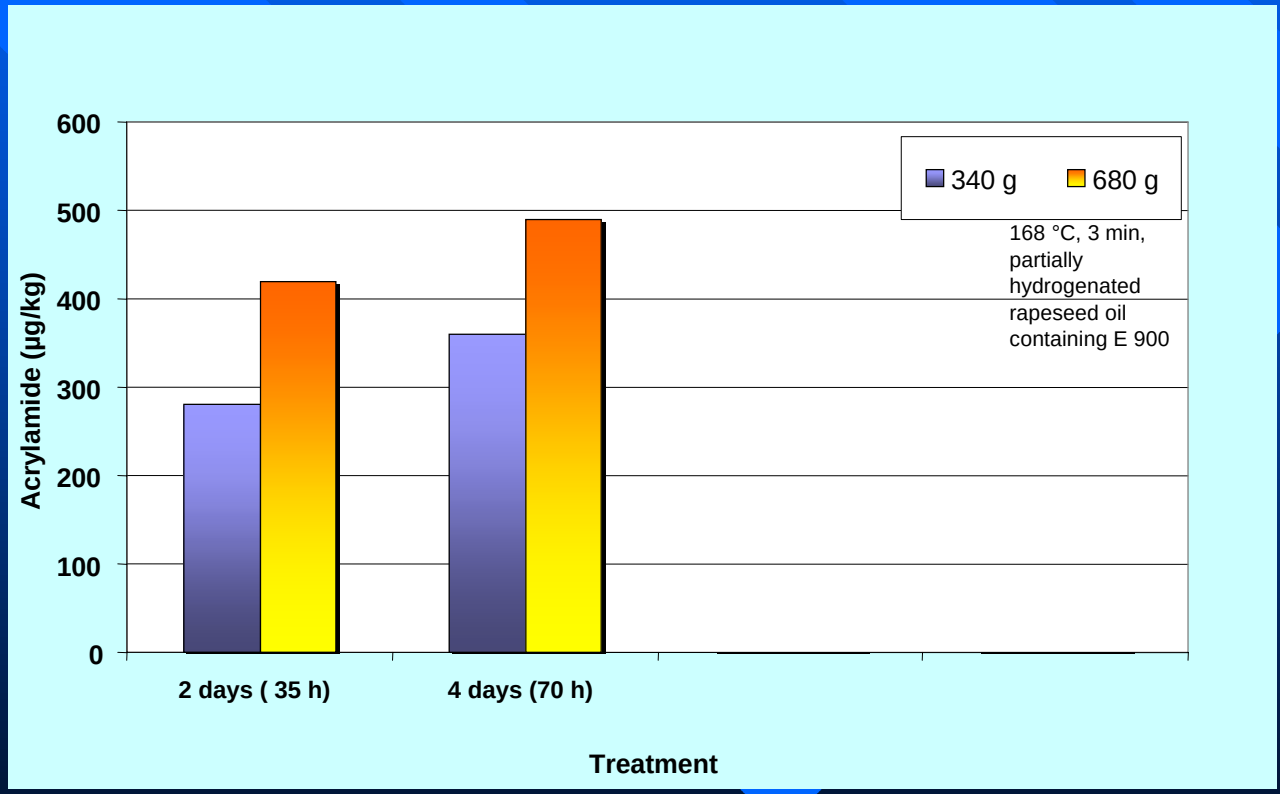
(Data Source:K.Franke et al.Lebenmitteltechnik 3 (2003) 60-62

Accelerated formation of acrylamide with increasing number of batches

in DMPS containing frying oils



Formation of acrylamide with increasing weight of fried French fries and heating time of the deep-frying oil



Emulsifiers

- Fatty acid ester of mono-, and diglycerides
- Citric ester, Lactic ester, Tartaric ester of mono- and diglycerides
- Polyoxi ethylene sorbitan monoleate
- Polyglycerolester
- Lecithine

Role of Emulsifiers

- Improving interaction food-fat
- Improving texture of the fried food
- Reducing spattering tendance
- Reducing foaming

Disadvantage often:

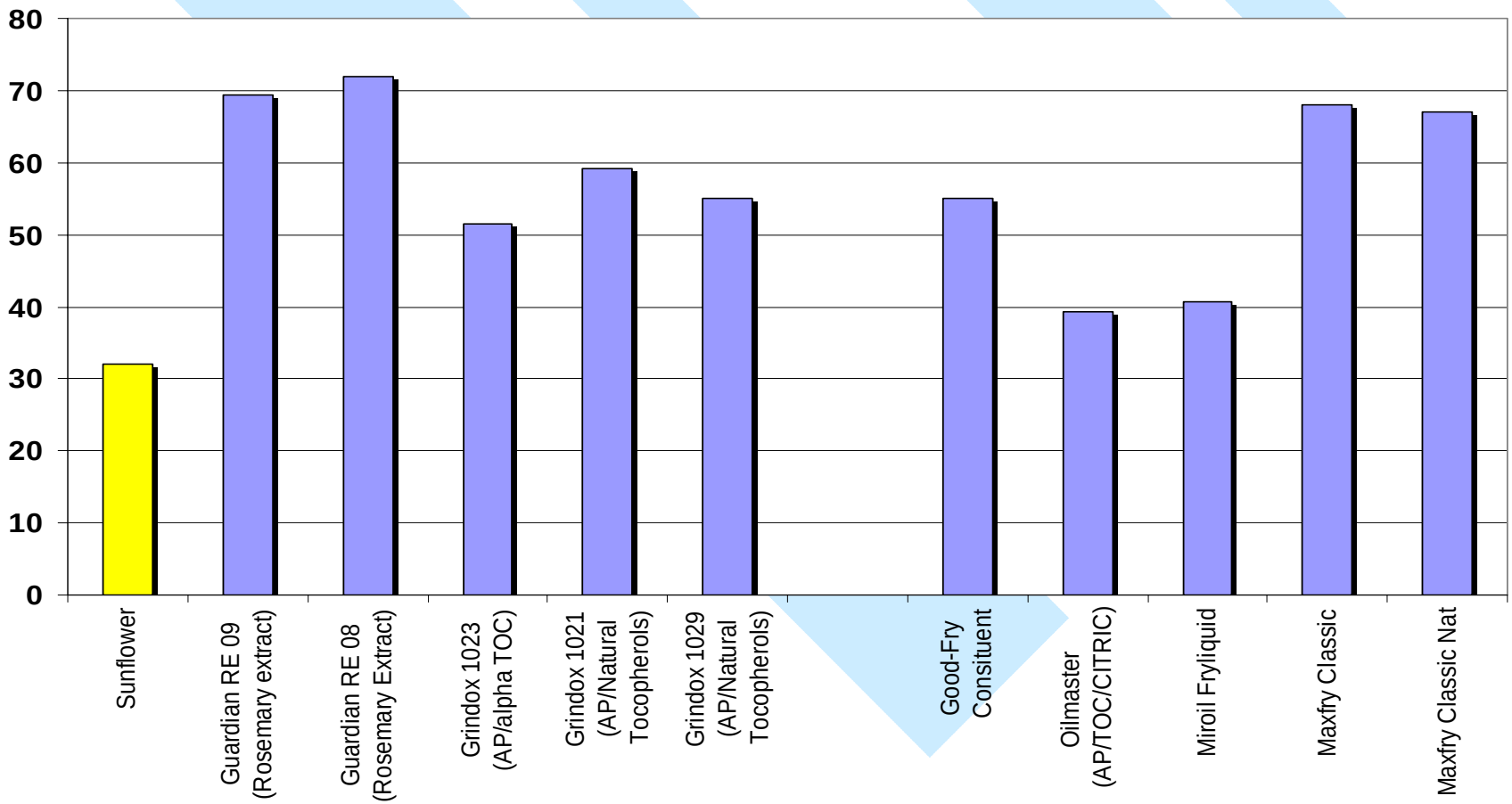
Increasing oil uptake of the food

Quality Improvement by Treatment with Sprayable Oils Containing Emulsifiers

Commercially Available Frying Oil Stabilising Formulations

Guardian RE 08	Rosemary extract, E472c, E471
Guardian RE 09	Rosemary extract, Polyoxy-ethylene sorbitan monooleate, E472c, E471
Grindox 1021	ACP, Tocopherol extract, E472c, E471
Grindox 1029	ACP, E472e, E471
Good Fry Constituents	Rice bran, Sesame oil
Oilmaster	ACP, TOC, E471, E472c, Citric acid, Water
Miroil Fryliquid	Citric Acid, Water, Rosemary extract
Maxfry Classic nat	Tocopherol extract, Rice bran, Sesame oil, E471, E472 b, E472c, Citric Acid
Maxfry Classic	ACP,Tocopherol extract, Rice bran, Sesame oil, E471, E472 b, E472c, Citric Acid

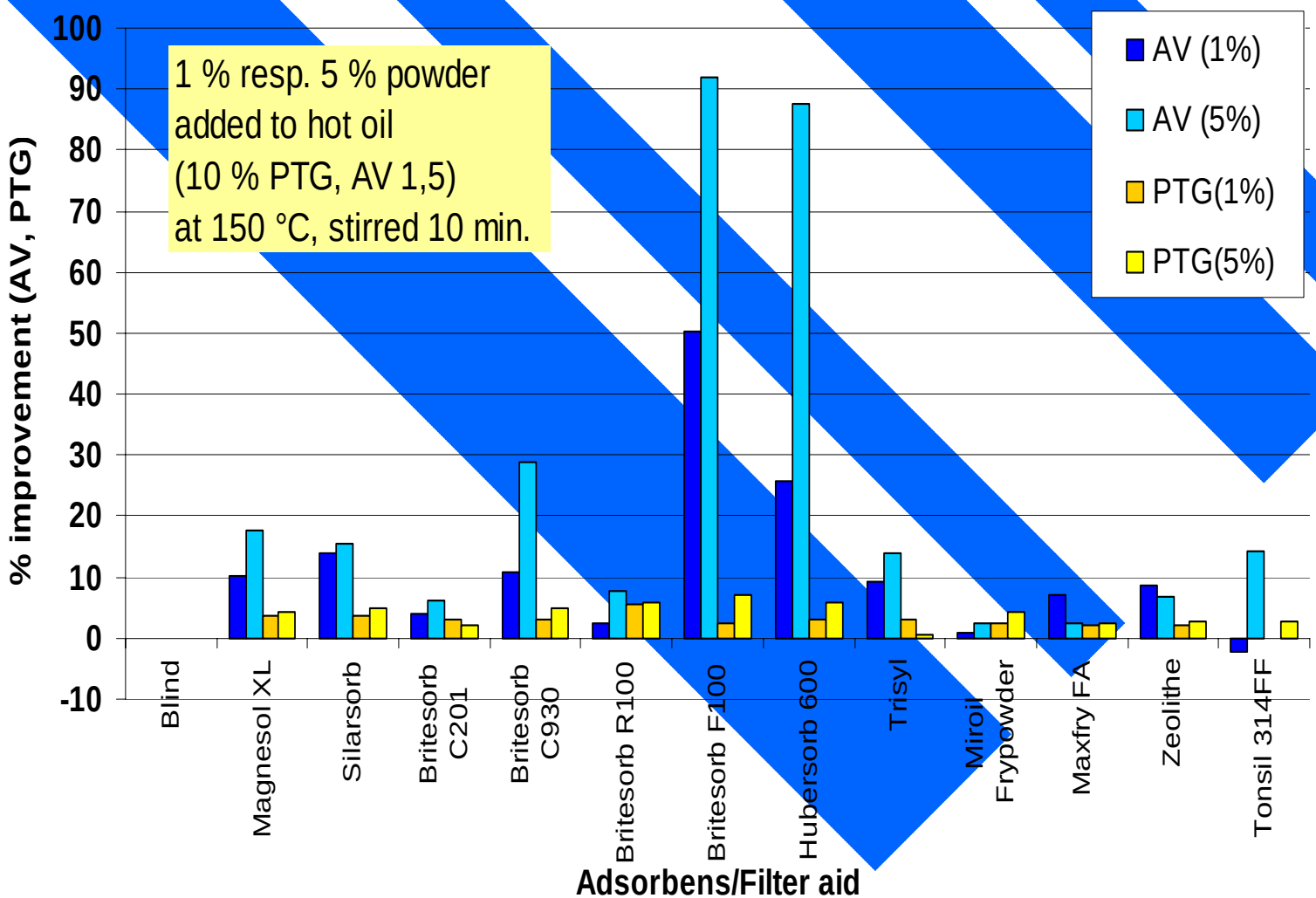
Effectiveness of Some Formulations
(OSET-Test, 2h, 170 °C)



Filter Aids and Absorbents

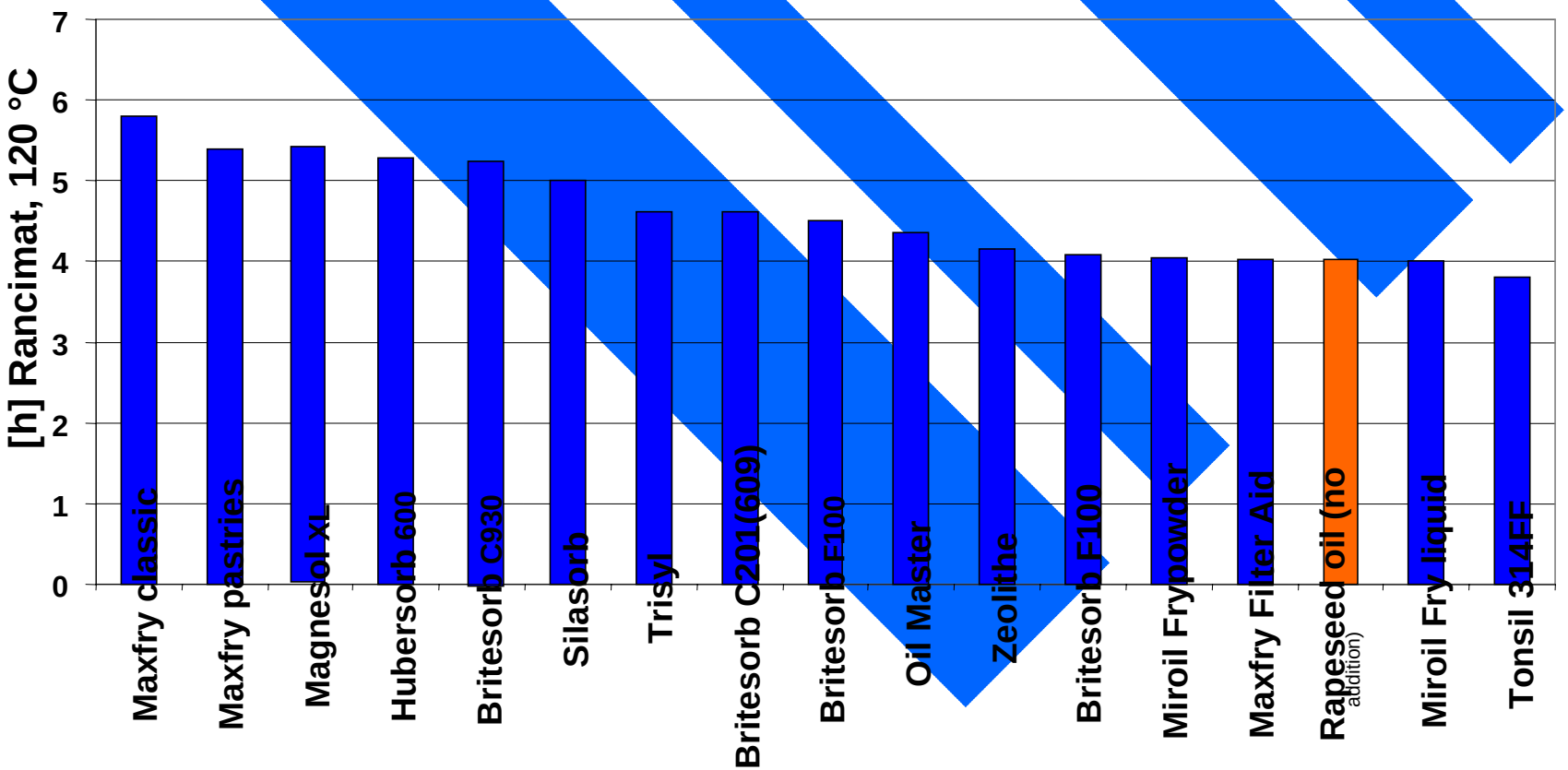
- **Minerals**
  - Calcium silicate — Silarsorb, Hubersorb
  - Calcium carbonate (Pekmez earth)
  - Magnesium silicate — Magnesol
  - Sodium silicate — Britesorb
  - Perlite — Frypowder
  - Silica — Trisyl
  - Bentonite — Tonsil
- **Organic materials**
  - Celluose — Maxfry Filter Aid
  - Citric acid — Frypowder

Effectiveness of solid additives after addition to used deep-frying oils



Influence of Some Additives on Oxidative Stability (measured by Rancimat)

*Data Source: B.Matthäus, Bundesanstalt f. Fettforschung 8/2003



Evaluation of Effectiveness of Additives in the Frying Process

- Oil Usage
- Oil Life
- Fryer condition
- Food safety and quality
- Handling
- Costs
- Analytical criteria evaluating oxidation and polymerisation processes (Rancimat,OSET)

Conclusions

- Filter Systems and frying additives have a potential to enhance food quality and extend oil life

  But

- It is an error to believe that by filtering, treating or adding of special additives the oil can be used indefinitely.