TRADITIONAL USES OF OILS AND FATS IN OLEOCHEMISTRY AND FUTURE PERSPECTIVES ARISING FROM THE BIO BASED ECONOMY IMPLEMENTATION

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FATS IN OLEOCHEMISTRY

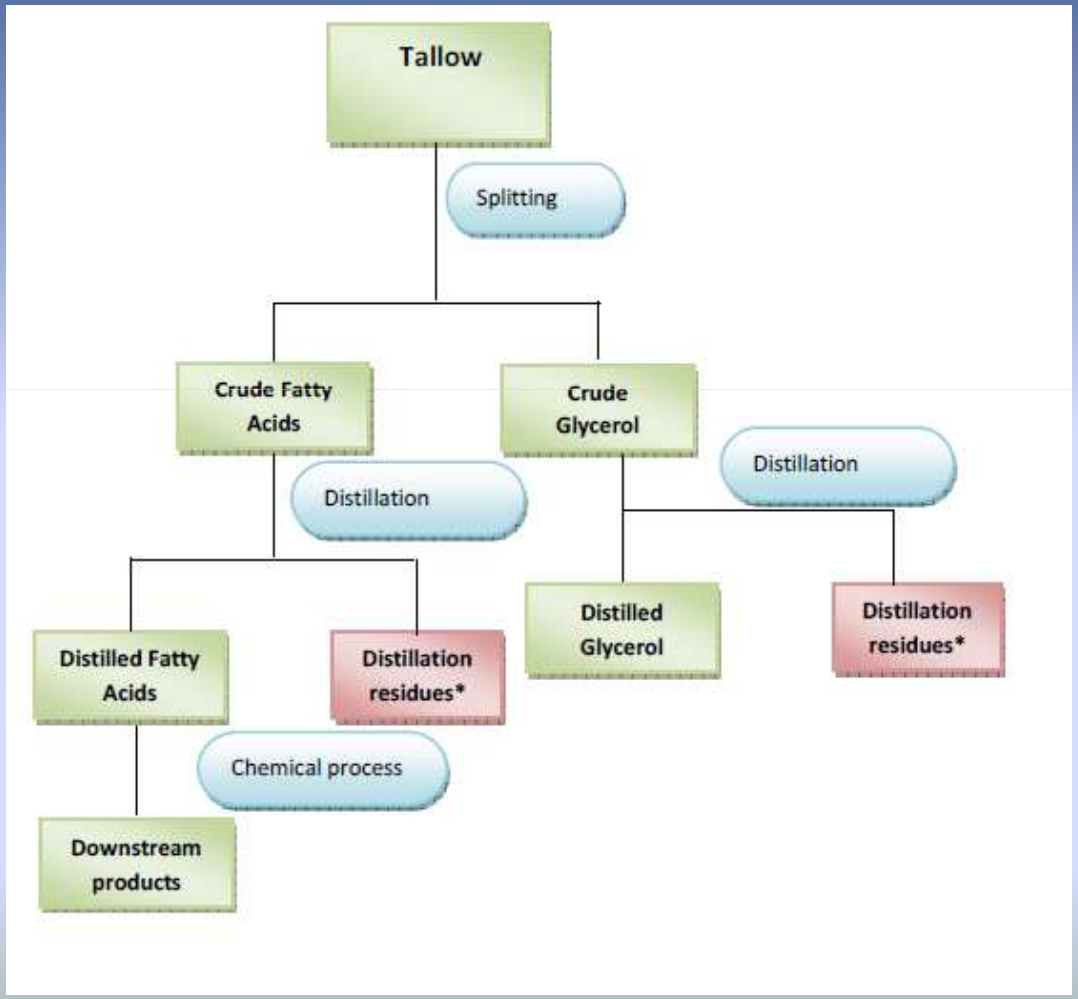
- Tallow, fats: Key raw materials for oleochemistry in the EU.

- Thanks to these raw materials, the EU oleochemical producers were able to survive to the strong competitiveness by the Far East producers, benefiting by a large availability of Palm Oil at low price, besides low costs for manpower and less restrictive laws

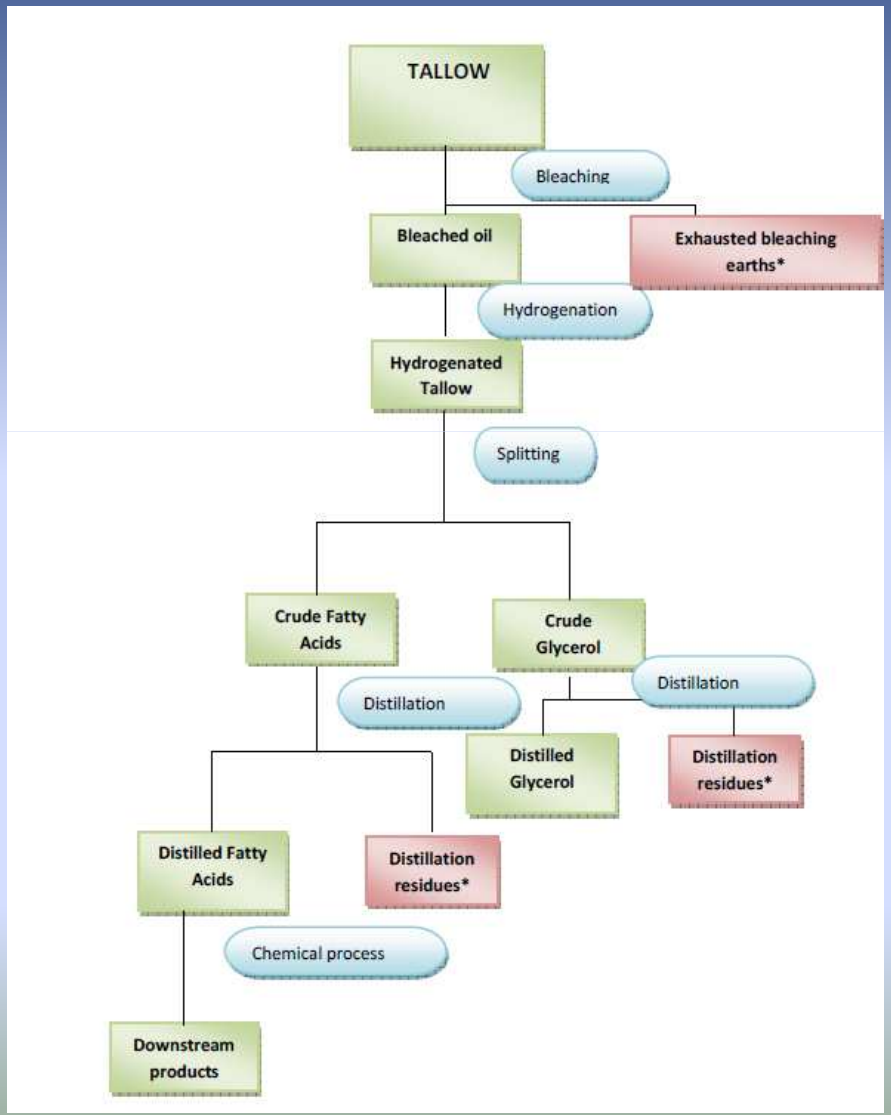
OILS & FATS IN OLEOCHEMISTRY

- Core base Oleochemical processes:
- Two main routes:
  - Splitting to obtain Fatty Acids and Glycerol, followed by distillation, to obtain distilled Fatty Acids and distilled Glycerol. Possible hydrogenation of Fatty Acids, to obtain saturated Fatty Acids
  - Hydrogenation, to obtain hydrogenated Tallow, followed by splitting and distillation, to obtain distilled saturated Fatty Acids and distilled Glycerol (typical Italian process)

OILS & FATS IN OLEOCHEMISTRY



OILS & FATS IN OLEOCHEMISTRY



OILS & FATS IN OLEOCHEMISTRY

- Main derivatives:
- Fatty Alcohols: obtained from hydrogenation of Fatty Acids or Fatty Acids Methyl Esters
- Oleic Acid: obtained via a physical separation of unsatured Fatty Acids
- Dicarboxylic Acids: obtained from ozonolysis or oxydation of unsaturated Fatty Acids
- Fatty Esters: Obtained via Esterification reaction of Fatty Acids + Fatty Alcohols or Alcohols from petrochemical sources

OILS & FATS IN OLEOCHEMISTRY

- Salts of Fatty Acids: obtained by the reaction of Fatty Acids with a Metal Oxide/Metal Hydroxide/Metal Halide
- Fatty Amides: obtained by an amidation reaction of Fatty Acids with an Amine
- Dimer Acids: obtained via reaction of unsaturated Fatty Acids with a catalyst
- Iso Fatty Acids: obtained as by product from a reaction of Fatty Acids with a catalyst
- Transesterification of Fats with Glycerol, to obtain mono and diglycerides

OILS & FATS IN OLEOCHEMISTRY

- Esterification reaction of Glycerol with a Carboxylic Acid, to obtain Glycerol esters
- Hydrogenolysis of Glycerol to obtain Propylene Glycol
- Enzymatic process to obtain Methanol from Glycerol
- Process to obtain Epichlorohydrin from Glycerol

OILS & FATS IN OLEOCHEMISTRY

- Many other possible reactions
- Application fields:
  - Detergents
  - Plastic materials
  - Cosmetics
  - Pharmaceuticals
  - Animal Feeding
  - Lubricants
  - Metal working
  - Paint and varnishes
  - Rubber
  - Textiles
  - Others

OILS AND FATS IN OLEOCHEMISTRY

- Oleochemicals in detergents:
- 50 % surfactants currently based on oils and fats
- Commission Decision 2003/31/EC, Commission Decision 2005/342/EC and Commission Decision 2005/344/EC and their following updates, Commission Decision 889/2008/EC, Commission Decision 2011/263/EC, Commission Decision 2011/382/EC and Commission Decision 2011/383/EC introduce the ecological criteria for the award of the Community eco-label to certain products.

  The level of surfactant based on oils and fats is expected to increase.

OILS AND FATS IN OLEOCHEMISTRY

- Oleochemicals in Animal Feeding:
- Regulation 68/2013/EC:
  - 13.6.2 Fatty Acids esterified with Glycerol
  - 13.6.3 Mono di and triglycerides of Fatty Acids
  - 13.6.4 Salts of Fatty Acids
  - 13.6.6 Crude Fatty Acids from Splitting
  - 13.6.7 Pure distilled Fatty Acids from Splitting
  - 13.8.1 Glycerine, crude
  - 13.8.2 Glycerine

OILS AND FATS IN OLEOCHEMISTRY

- Main Oleochemical additives in Food: Council Directive 95/02/EC:
  - E 422 Glycerin: humectant, sweetener
  - E 470 Magnesium Stearate: emulsifier, stabiliser
  - E 470a Sodium, Potassium and Calcium salts of Fatty Acids: emulsifier, stabiliser, anti-caking agent
  - E 470b Magnesium salts of Fatty Acids: emulsifier, stabiliser, anti-caking agent
  - E 471 Mono- and Diglycerides of Fatty Acids – Glyceryl Monostearate, Glyceryl distearate: emulsifier
  - E 473 Sucrose esters of Fatty Acids: emulsifier
  - E 474 Sucroglycerides: emulsifier
  - E 475 Polyglycerol Esters of Fatty Acids: emulsifier

OILS AND FATS IN OLEOCHEMISTRY

- Oleochemicals for pharmaceutical applications: a huge number. Listed in:
  - Ph Eur, 7° ed 2011
- Oleochemicals for Cosmetics: a huge number. Listed in Commission Decision 2006/257/EC
- Oleochemicals for plastics intended to come into contact with food: a huge number. Listed in:
  - Commission Regulation 10/2011/EC on plastic materials and articles intended to come into contact with food

OILS & FATS IN OLEOCHEMISTRY

OILS & FATS AREVERY VERSATILE AND SUSTAINABLE SOURCE OF HYDROCARBONS, ABLE TO SUBSTITUTE MINERAL OIL AS RAW MATERIAL FOR THE PRODUCTION OF A HUGE NUMBER OF CHEMICAL SUBSTANCES

OILS & FATS IN BIOFUELS INDUSTRY

- Biofuels, Oils & fats derivatives:
  - Traditional Biodiesel, obtained from transesterification with Methanol/Ethanol
  - Biodiesel from Hydrocraking (essentially, Neste Process)
- Oils & Fats are available in limited quantities: strong competition between use in food, oleochemistry and biofuels

RECENT MODIFICATION IN ABPR

- Regulation 294/2013/EC
  - Article 1, (1) (j): Oleochemical products become end poits. Use of Category I Tallow in oleochemical products becomes allowed
  - Annex, (2), (b), (iii): Cat I Glycerol, provided that it is coming from Tallow processed with *Method I, at Annex IV, Chapter III, A. of Regulation 142/2011/EC,* is allowed for:
    - Technical purposes
    - Biogas; the digestion residues may be applied to land within the national territory of the producing Member State, *subject to the decision of the competent authority*
    - Denitrification in waste water treatment plants

RECENT MODIFICATIONS IN ABPR

- Annex, (2), (b), (iv): Cat 3 Glycerol can be used:
  - For technical purposes
  - For biogas, in which case the digestion residues may be applied to land
  - For animal feeding, but not in case it is derived from UCO

ABPR + ANIMAL FEEDING REGULATION

- Consequences:
  - Import of Tallow from USA and Canada allowed *provided that tallow is processed according to Processing Method I at Annex IV, Chapter III, A. of Regulation 142/2011/EC.*
  - According to Art 29 1. (c) of Regulation 1069/2009, need for procedures based on HACCP in place in all Companies working more than one category of Tallow, Renderers, Oleochemical and Biodiesel Companies
  - For those Companies selling in the animal feeding field, HACCP + general compliance to Regulation 183/2005/EC (in particular: Notification to the Competent Authorities + Approval + Registration)

DIRECTIVE 28/2009/EC (RED)

- COM (2012) 595, revising Directive 28/2009/EC (RED)
- Annex IX, Part B: Cat I and II tallow in double Counting
- Currently under discussion. Still to be understood if multiple counting will survive. Possibility of a fixed quota for certain raw materials.
- At the end of the revision process: common list of incentivized raw materials all over the EU

THE BIOBASED ECONOMY

- COM (2011) 112 "A Roadmap for moving to a competitive low Carbon Economy in 2050"
  - Reduction in GHG in the EU:
    - 40 % lower than 1990 levels in 2030
    - 60 % lower than 1990 levels in 2040
    - 80 % lower than 1990 levels in 2050

THE BIOBASED ECONOMY

- COM (2012) 60 "Innovating for Sustainable Growth: a Bioeconomy for Europe"
  - Bioeconomy becomes part of two "flagship initiatives": "Innovation", in "Smart growth" area, and "Resource efficient Europe", in "Sustainable growth" area.
  - It is founded on the seventh framework program for Research and Technological Development (FP7) and on the EU Framework Programme FOR Research and Innovation (Horizon 2020)

THE BIOBASED ECONOMY

- Challenges for the EU:
  - Ensuring Food Security
  - Managing natural resources sustainably
  - Reducing dependence on non-renewable resources
  - Mitigating and adapting to climate change
  - Creating jobs and maintaining European competitiveness
    - *("It is estimated that direct research funding associated to the Bioeconomy Strategy under Horizon 2020 could generate about 130.000 jobs and 45 billions € in value added in bioeconomy sectors by 2025")*

GROWTH EXPECTATIONS IN BIO BASED ECONOMY (CHEMICALS)

Item	Consumption (EU)	2020 estimated consumption	Source
Bio based plastics	210.000 t (2008/2009)	4.050.000 t	EU Bioplastics, Roquette Frères S.A.
Biodegradable bio based Polymers	35.000 t (2010)	333.000 t	BASF SE
Bio lubricants	137.000 t (2008)	420.000 t	Fuchs Petrolub AG
Bio - composites	315.000 t (2010)	830.000 t	The EU Hemp Association
Platform and Fine Chemicals	1.110.000 t	1.340.000 t	Roquette Frères S.A.

The biobased economy

- Besides vegetable oils, Tallow/Fats have to be acknowledged as key raw materials for the biobased economy, in order to secure competitiveness of the EU oleochemical industry
- Building blocks from fats/oils are the most well known raw materials in this field
- In particular, Glycerol is a key raw material for C_3 chemistry
- Hierarchy of use/cascade use need to be promoted, in order to reach the maximum added value in the value chain