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Oleochemicals
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OLEOCHEMICALS IN COSMETICS

Oleochemicals are hugely used in the cosmetics industry, because of their :

- Properties & performances
- Safety for human use
- Ecosafety

Contents of the speech

- The raw materials used for the production of oleochemicals ➔ origin, structure, composition & production.
- The oleochemistry = processes for the obtention of basic oleochemicals hydrolysis/methanolysis/esterification & main applications of the obtained products.
- Why oleochemicals in cosmetics : fatty alcohols, fatty acids, glycerine, esters.

1) RAW MATERIALS

- ***Natural fats and oils***

  The raw materials for oleochemistry are the **natural fats and oils** from both animal and vegetable origin.
  Natural fats and oils are renewable and fully biodegradable.
  Tallow ex-USA : technical applications.
  Sunflower, rapeseed ex-Europe
  Palm oil ex-Malaysia (palm + palmist)
  Coconut oil ex-Philippines.

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- ***World production***

  Ca 100 million tons
  ➔ 20 % tallow
  80 % vegetable oils

  On the figure, we can see the evolution of the production of vegetable oils versus the stability of animal fats production.

- ***Usages of fats & oils***

  5 % for oleochemicals
  10 % feed, soaps
  85 % food.

- ***Chemical structure***

  All the natural fats and oils have the same chemical structure : they are TRIGLYCERIDES ➔ ester of glycerol and fatty acids.

- ***Why physical differences ??***

  ➔ 3 factors influence the physical properties.

  1) Chain length : the longer the fatty chain, the higher the melting point.
  2) Degree of unsaturation : the higher the Iodine value, the lower the melting point.
  3) The distribution of the F.A. on the glycerol.

  Examples

  Stearic acid / Oleic acid

  C_{18} saturated — C_{18} D1

  Solid (MP +/- 50°C) — liquid

- ***Composition***

Natural oils are not based on single fatty acids.
Each oil contains a mixture of fatty acids depending on the source of the oil.
Each oil has its own particularities :

Ex : coco palmist : C_{12} predominates
Tallow, palm : C_{16}/C_{18}
Soja, sunflower : polyunsaturated fatty acids.
Fish : very long chains

2) OLEOCHEMISTRY

- The first step is the treatment of fats and oils, providing the basic raw materials.

  - fatty acids
  - glycerine
  - fatty alcohols

- The second step is the production of derivatives ➔ esters

1) ***Hydrolysis***

The hydrolysis is the treatment of Triglyceride with water at high temperature and pressure, that splits the molecule into 2 :

➔ glycerine
➔ fatty acids

They will be purified, distilled,… in order to meet the requirements in different applications.

➔ Cosmetics & others.

➔ European fatty acid market

Total production = 1.000.000 tons

➔ European glycerin market

Total production = 200.000 tons

2) ***Production of fatty alcohols***

occurs in 2 steps :

a) methanolysis of TG
➔ cuts the TG into ME & glycerol

b) hydrogenation of ME
➔ providing F.A.

Main applications = chemical synthesis, surfactants production
➔ detergency

3) ***Production of fatty esters***

ESTER = product of the reaction of an alcohol + fatty acid.

The interesting thing here is the WIDE RANGE of esters that can be provided by the different possible combinations of fatty acids/alcohols.
➔ different properties
➔ different applications
➔ many developments

Total European production = 275000 T

3) OLEOCHEMICALS IN COSMETICS

What are the main properties of each product and why are they used in cosmetics ?

- ***Glycerin***

Property n° 1 = HYDROSCOPICITY.

This ability to attract water is needed in many different applications because :

- It avoids drying out (of the product) (formulation →

creams, tooth paste).
- It avoids dehydradation (of the skin).

Plasticizing effect → promotes softness, flexibility.
Solvent for hydrophilic ingredients.

- ***Fatty acids***

- Raw material for soaps.
- With an alcali = anionic surfactant for emulsion stability.
- Consistency factor

Stearine	→	emulsions, shaving preparations
Oleine	→	liquid soaps
Coconut	→	soaps, shaving foams.

- ***Fatty alcohols***

In this case, it is to considerate differently the cuts.

Light cut	→	perfumes
Medium cut	→	surfactant production (detergent/foam)
Heavy cut	→	cosmetics

- **Fatty esters**

2 big product groups.

a) esters – emollient
Totally esterified, they don't show any interfacial activity.
They are completely oil soluble → lipophilic.
Emollient = lipophilic material that forms an oily layer on the skin and reduces the epidermal water loss (→ hydratant effect).
Lubricant

Plasticizer

b)esters – surfactants
Partially esterified, they have a hydrophilic part & a lipophilic part → AMPHIPHILIC.

They have interfacial activity = SURFACTANT.
They act as :

- emulsifiers : creams, lotions.
- Solubilizers : oil in water phase.
- Detergents : actives in shampoos.
- Wetting agents : powder in water

Emulsifier

Technologic additive that allows the production and the stability of an emulsion.

➔ particular structure
Hydrophilic head ➔ soluble in water.
Lypophilic part ➔ soluble in oils.

An emulsion is an unstable system that needs to be stabilized to get a reasonable shelf life.

Oils and water are 2 incompatible phases and the tension between both phases is very high. It must be reduced to obtain stability.

Due to its 2 different affinities, the surfactant will form a monomolecular film at the oil/water interface and will reduce the contact between both phases.

Example of form6ulation

Except preservatives, perfumes and hydrophilic ingredients,
all are oleochemicals

Why 2 emulsifiers — L
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Quality requirements

- Organoleptic : odour, colour, taste
- Origin : vegetable
- Specifications ➔ pharmacopoeia