Oils and fats from southern countries for oleochemistry

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AT THE BEGINNING WAS THE SOAP

OLEOCHEMISTRY IS EVERYWHERE

TRIGLYCERIDES AS VERSATILE RAW MATERIALS

SEED OIL MARKET, NON-FOOD USES AND SOUTHERN COUNTRIES

FOCUS ON OLEOCHEMISTRY OF TROPICAL OILS AND CASTOR OIL

NEXT CHALLENGES FOR SEED OILS AND OLEOCHEMISTRY

CONCLUSIONS



AT THE BEGINNING WAS THE SOAP...

The word "sapo" is very likely of Gaulish or Germanic origin and was first mentioned by Pliny the Elder (23-79 AD) in its Natural History





"Oleochemistry : physico-chemical (enzymatic) transformation of fats and oils of animal and plant origins"



TRIGLYCERIDES AS VERSATILE RAW MATERIALS

...but also renewable, biodegradable...



ESTER FUNCTION

Hydrolysis Transesterification Halogenation Reduction Amidation...

FA (free, salt, chloride), Glycerides, Esters, Glycerol Alcools Amides/Amines (salts)

DOUBLE BOND

Hydrogenation Ozonolysis Metathesis Halogenation Epoxidation Polymerization...

Paraffins/olefins Diacids, Functionalized oils Polymers...

SIDE FUNCTIONS

Dehydration Pyrolysis Halogenation Esterification Urethane formation...

Functionalized oils Polyurethanes Sebacic, undecylenic ac. Alkyl/Alkylaryl esters...

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D'après Dumeignil F. 2012. OCL, 19(1):10-15

9 Major Vegetable Oils – Golbal production 2011 (million tons - Mt)



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9 Major Vegetable Oils – Golbal production 2011 (million tons - Mt)



Significant growth of oilseed industry with a growth rate of prod. & consump. (\approx 5% pa) higher than that of the wheat market (1.8% pa)

Strong growth in human food consumption

Westernisation of diets in developing nations

Replacement of animal fats with vegetable oils in the developed world

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Strong growth in industrial consumption

Tremendous growth of the biodiesel industry

Share of Southern Countries (SC) in the global seed oil production



Production share (%)

Palm, palm kernel (PK) and coconut oils are exclusively produced in SC vs 42% for soybean oil and 23% for the 4 other vegetable oils (excluding olive)

SC account for almost 60% of the global seed oil production

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Vegetable oil production of SC – Allocation by area and commodities



Limited production from Africa

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Major southern areas of production : Asia (Indonesia, Malaysia, India) and South America (Argentina, Brazil)

Domestic Consumption of vegetable oils of majors producers from SC



Non-food uses of vegetable oils from Southern Countries (SC)



FOCUS ON OLEOCHEMISTRY OF TROPICAL OILS AND CASTOR OIL

	LAURIC oils		PALM oil	
	Coconut oil	Palm kernel oil	Palm stearin	Palm olein
C8-14	79%	70%	1-2%	I-2%
16-C18	11%	12%	50-80%	39-45%
(P)UFA	11%	18%	18-45%	54-60%

- Fatty acids
- flavours and fragrances
- softeners, plasticizers
- candles

С

- cosmetics from CI4-CI8
- Soaps

• Partial glycerides

- -solvents,
- -humectants
- -stabilisers,
- -lubricant,s antifreeze, etc
- **Polymers :** Polyurethanes, polyacrylates

- Fatty esters
- High quality soaps
- surfactants (sulphonated form)
- Biodiesels

• Fatty alcohols derivatives

- Surfactants (sulfates, ethoxylates...)

• Fatty nitrogen compounds

- Surface actives compounds (imidazolines)
- Softeners (esterquats)
- Epoxidized palm oil (EPO)

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FOCUS ON OLEOCHEMISTRY OF TROPICAL OILS AND CASTOR OIL



NEXT CHALLENGES FOR SEED OILS & OLEOCHEMISTRY

- Increase of World population from 7 to 9 billion in 2050
- Westernisation of diet in emerging countries (China, India..)
- Depletion of fossil resources and need of sustainable alternatives

Tremendous increase of food and industrial demands in oils and fats with Competition for land uses, food/non-food uses and beetween non-food uses



How to ensure the development of oleochemistry ?

Shift from FAME-based biodiesels to the 2nd generation biofuels

Ethanol and biogases from lignocellulosics

Improve processes and products Biorefinery, green chem., white biotech... Favor new and non-edible crops in water-limited areas/degraded lands

Jatropha, cuphea, vernonia, black mustard...

Multi-scale innovations

Genetic, agronomy, (bio)chemistry

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CONCLUSIONS

ROLE OF SOUTHERN COUNTRIES

IN OLEOCHEMISTRY AND NON-FOOD USES OF VEGETABLE OILS

• Account for 60% of the vegetable oil production

- \rightarrow 100% of palm, palm, kernel and coconut oils (Indonesia, Malaysia)
- \rightarrow 42% of soybean oil (Argentina, Brazil)
- \rightarrow 23% of rapeseed, cottonseed, peanut , sunflower oils (India)
- \rightarrow modest contribution of Africa

Contrasted situations of domestic consumption (vs production)

- → Indonesia & Malaysia : 72% export, 15% non-food uses (Energy > Chemicals)
- → Argentina &Brazil : 40% export, 33% non-food uses (Biodiesel >> Chemicals)
- \rightarrow India : total consumption of its edible oils but main producer/ supplier of Castor oil

OLEOCHEMISTRY, PRESENT AND FUTURE

- Key sector of global economy covering feed, energy, chemicals, materials....
- Excluding biodiesels, applications depend on oil type (Sat/Unsat, long/medium chains)
- Essentially based on edible oils and linked to their market and availability

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- \rightarrow It will have to face challenges of competition for vegetable oils uses
- \rightarrow it will have diversify its applications and sources of raw materials
- \rightarrow Innovation for green processes and new products of enhanced properties will be crucial

THANK YOU FOR YOUR ATTENTION

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