Green Detergents

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How consumers see detergents

Somewhat blind item

- Bright packing
- Clean smell
- Cool advertising
- Price
- Consumer trust

How we should see detergents

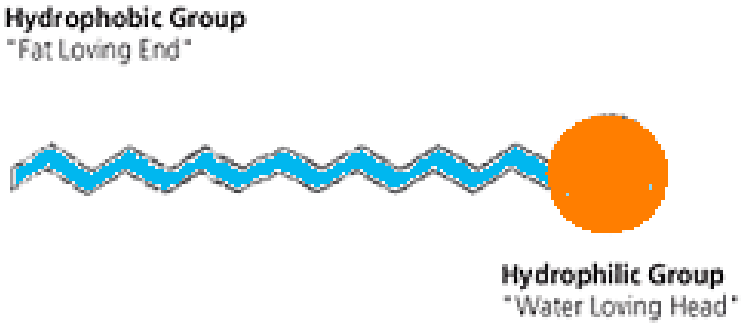
- Complex chemical compositions
- Environmental impacts
- Function
- Energy consumption
- Sustainability

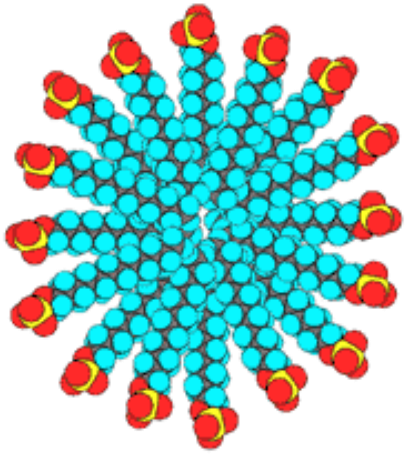
Components of Detergent

- Anti-redeposition agents
- Bleaches
- Bleach activators
- Builders and fillers
- Colorants
- Enzymes
- Process aids
- Buffers
- Soap
- Surfactants
- Stabilizers
- Solvents
- Fabric whitening agents

Surfactants- Surface active agents

- Enable cleaning solution to fully wet the surface to be cleaned
- Remove dirt, oils and stains
- Keeps dirt and oils suspended from surface to be cleaned

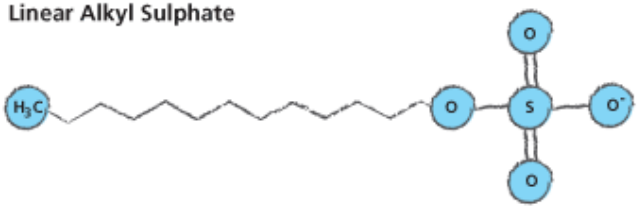




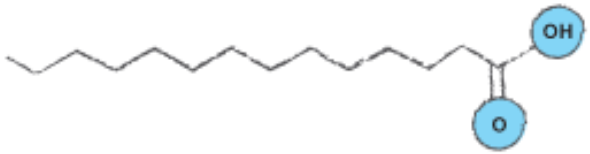
Types of surfactants

- Anionic
  - most common
  - Includes soaps and LAS
  - Works well to keep dirt off clothing
  - Can be partially deactivated by hard water ions

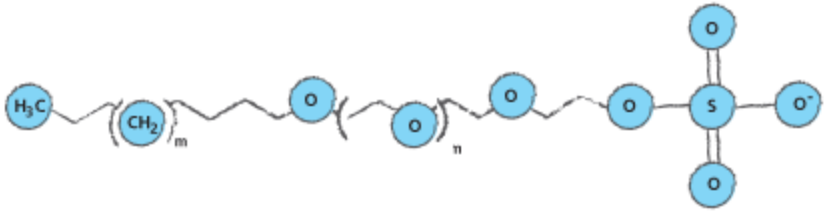
Linear Alkyl Sulphate



Fatty Acids/Soaps



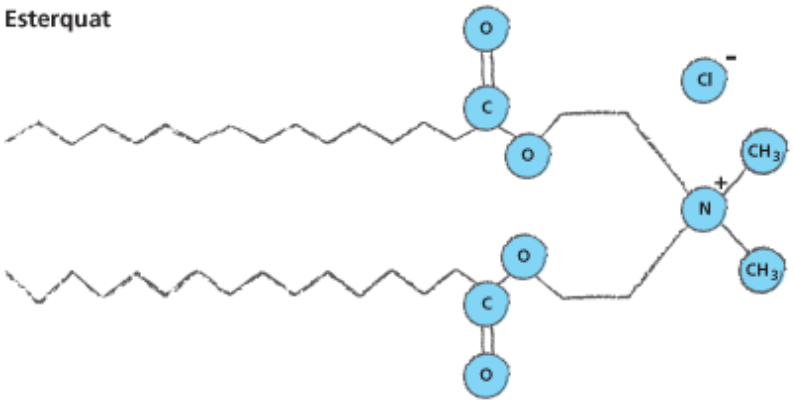
Alkyl Ether Sulphate



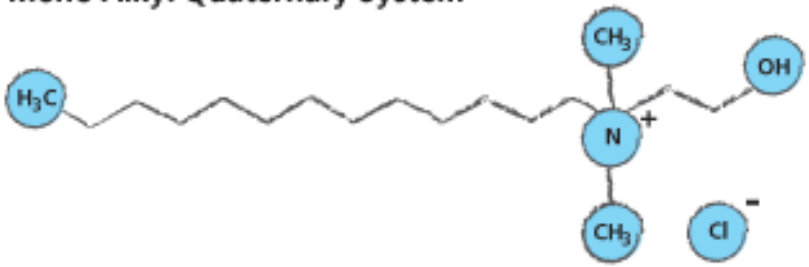
Types of surfactant cont.

- Cationic surfactants
  - Act as fabric softener
  - Helps the packing of the anionic surfactant at the interface
  - Good at removing greasy stains
  - Anti-bacterial properties

Esterquat

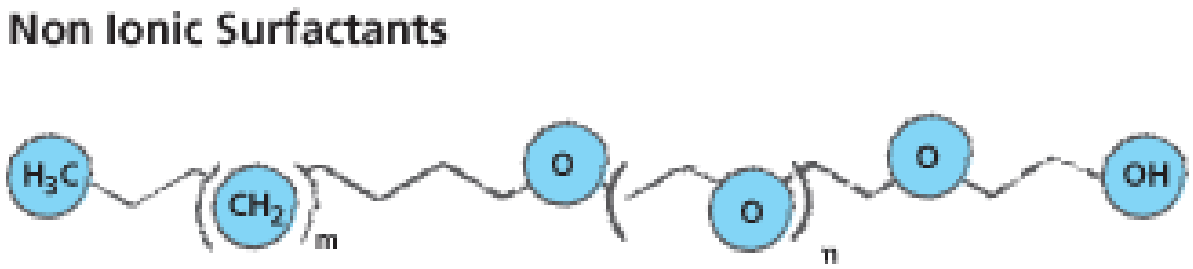


Mono Alkyl Quaternary System



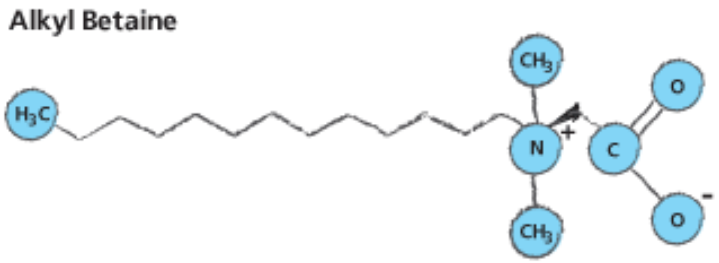
Types of Surfactants cont.

- Non-ionic
  - Resistant to water hardness deactivation
  - Complement cleaning action of cationic and anionic surfactants
  - Widely used in detergents
  - Good at grease removal



Types of surfactants cont.

- Amphoteric/Zwitterionic
  - Charge depends on water pH
  - High foaming properties
  - Gentle formula good for personal care items such as shampoos



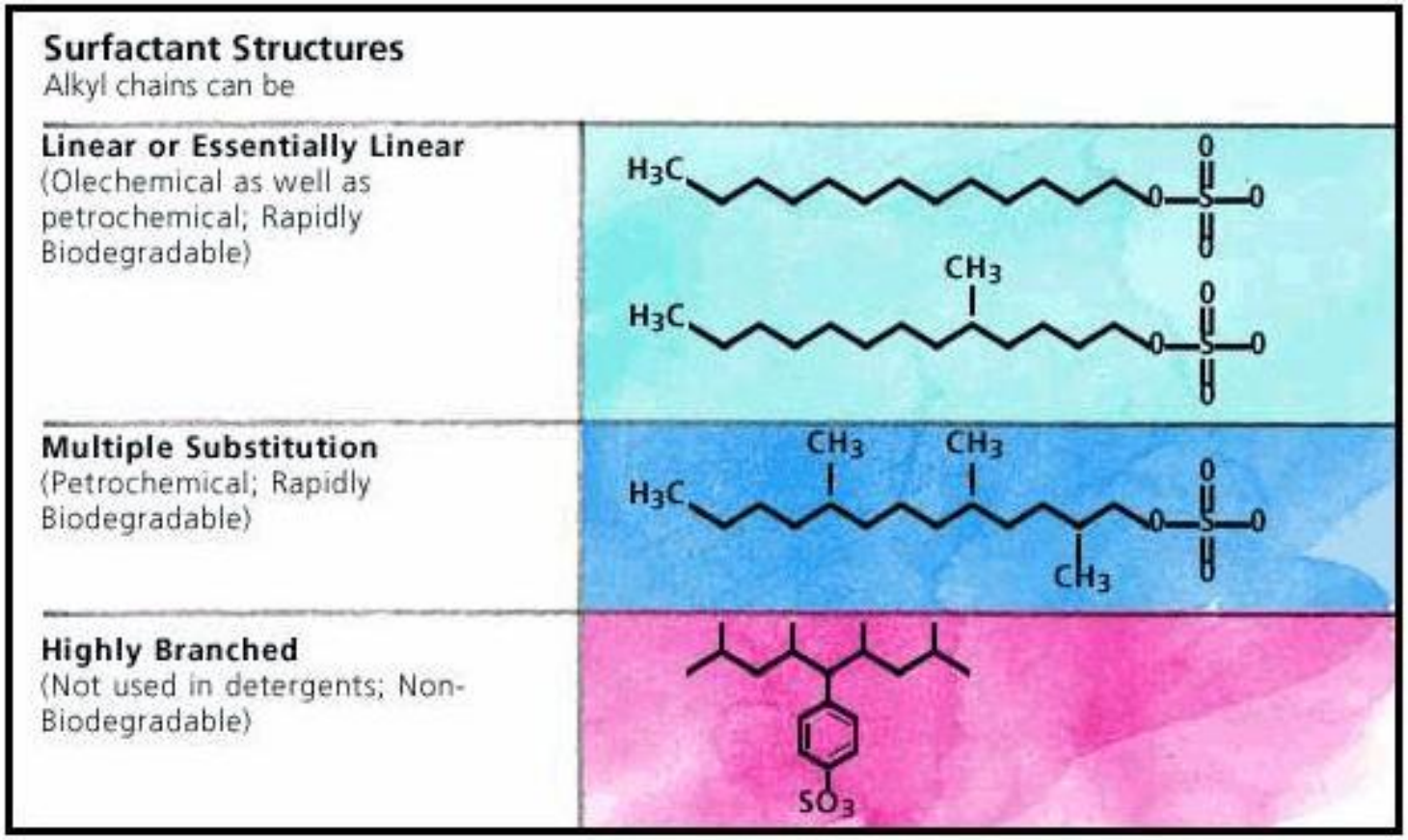
Natural vs. Synthetic

- Natural origin are known as oleo-chemicals (animal or vegetable source)
- Synthetic origin are known as petro-chemicals (petroleum)

From oleo- to petro- to ???

- Even in ancient times natural animal fats were used with lye to make soap
- Shortages of plant and animal fat during WWI along with technology advances allowed for the production of petrochemical surfactants
- Now shortages on oil make us rethink the materials used for creating surfactant

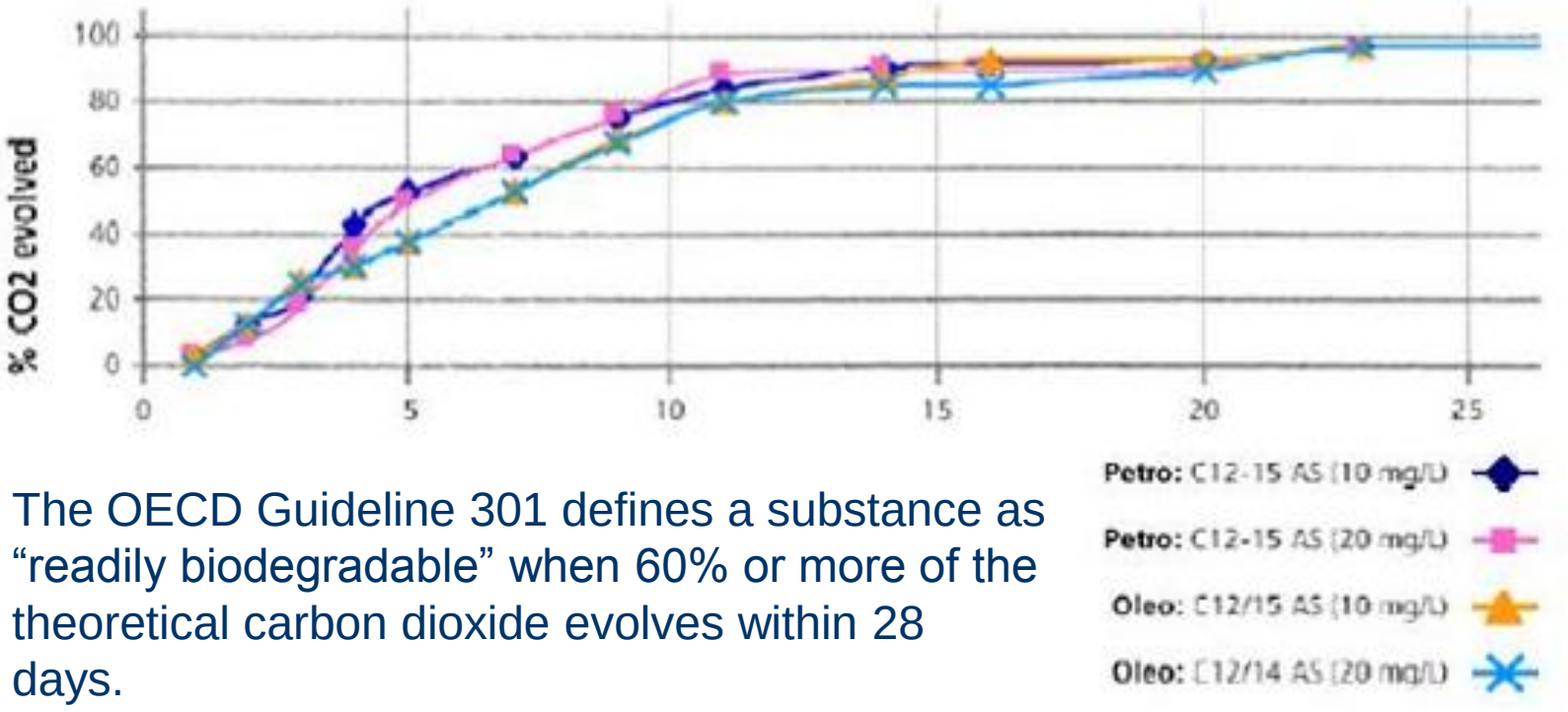
Oleo-chemicals vs. petro-chemicals



ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

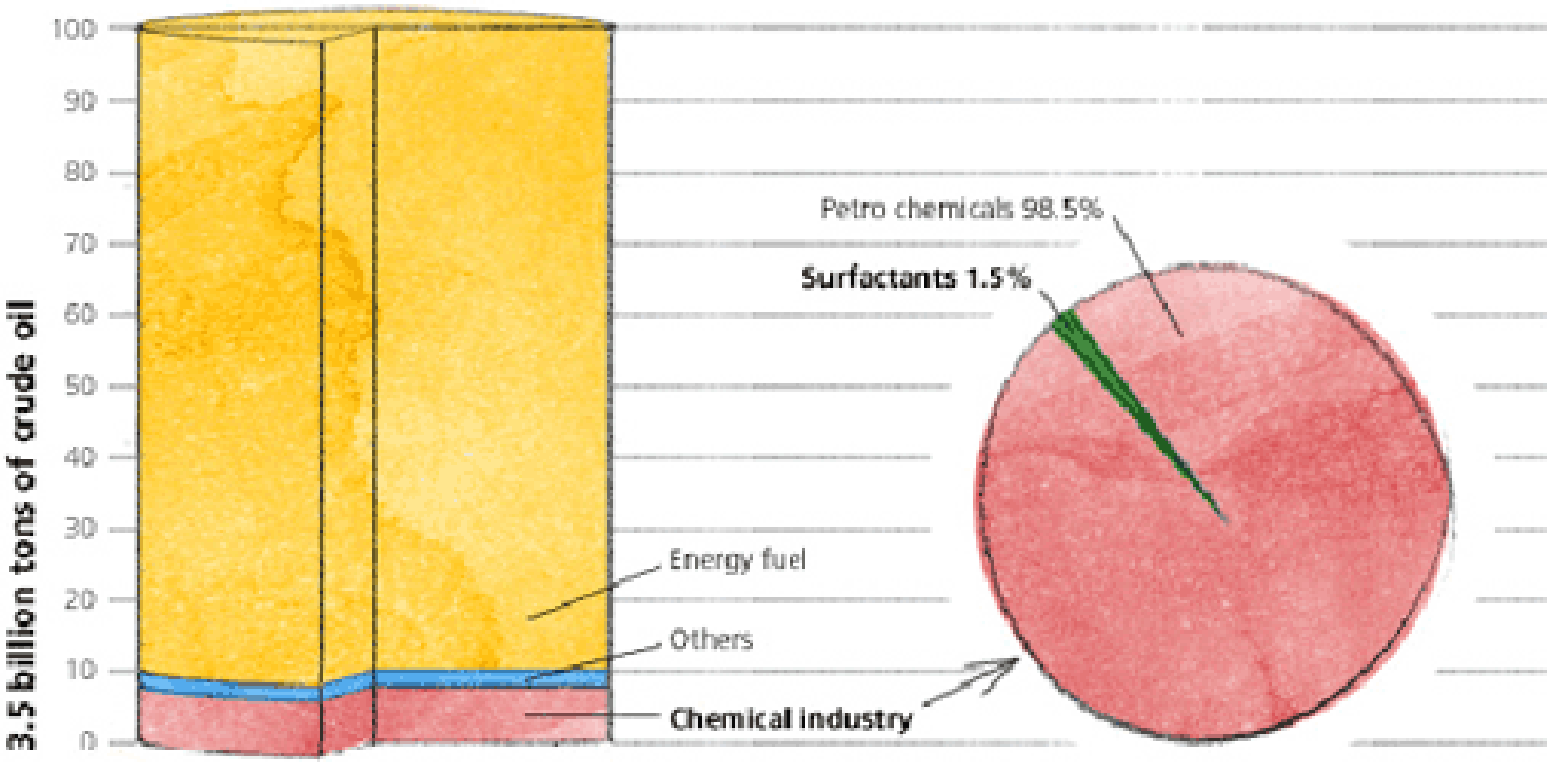
OECD

Biodegradation of Detergent Alkysulphates

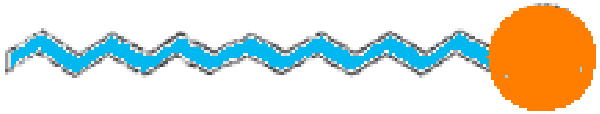


The OECD Guideline 301 defines a substance as “readily biodegradable” when 60% or more of the theoretical carbon dioxide evolves within 28 days.

How much oil are we using on surfactant production?



Waste and Energy consumption



Oleo-chemicals:

- •utilize a renewable resource
- •produce more emissions and solid waste
- •Limited range of structures (even #, no branching)
- •Often require chemical additives and warm water

Petro-chemicals:

- •consume more total energy since they do not use a renewable resource
- •Really don’t consume that much oil
- •Offer flexibility in formulation

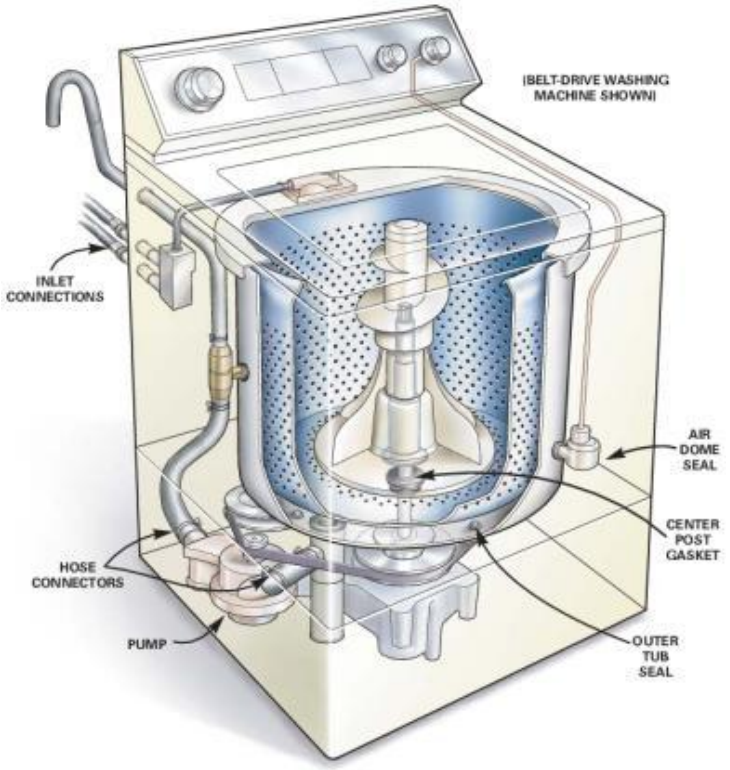
Flexibility in formulation

Switching from petrochemical to oleochemical surfactants would reduce formulation flexibility and may actually lead to increased energy requirements and increased pollution.

Roughly 60-80% of the energy needed for the laundry is for heating the water. The flexibility to utilize a mixture of chemicals to create low temperature washing is important.

Formulations are also altered in order to provide quality cleaning with high efficiency washing machines.

HE Washing Machines



HE washing machines

- HE washers can use anywhere from 20% to 66% less water compared to traditional washers
  - PRO - Less energy to heat less water 20-50% less energy
  - CON -Means the water get dirtier -special formulations needed to hold dirt from redepositing

HE washing machines

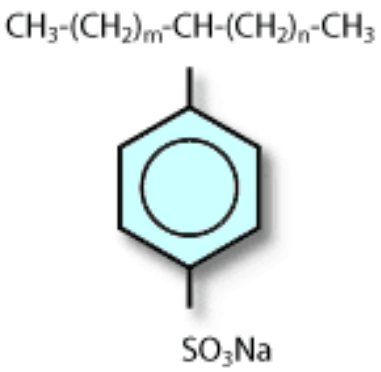
- HE washers use a tumbling motion rather than an agitator
  - PRO – gentle on clothing
  - CON – tumbling creates lots of suds which can cushion clothing – need low suds formula

Energy efficient detergent compositions

Oleochemically derived C12-C14 alkyl sulphates produce high suds

Oleochemically derived C16-C18 alkyl sulphates produce less suds, but are not very water soluble

Petro C11-C13 LAS used with oleo C16-C18 to create a surfactant system



CAS Number : 68411-30-3
EINECS Number : 270 - 115 - 0

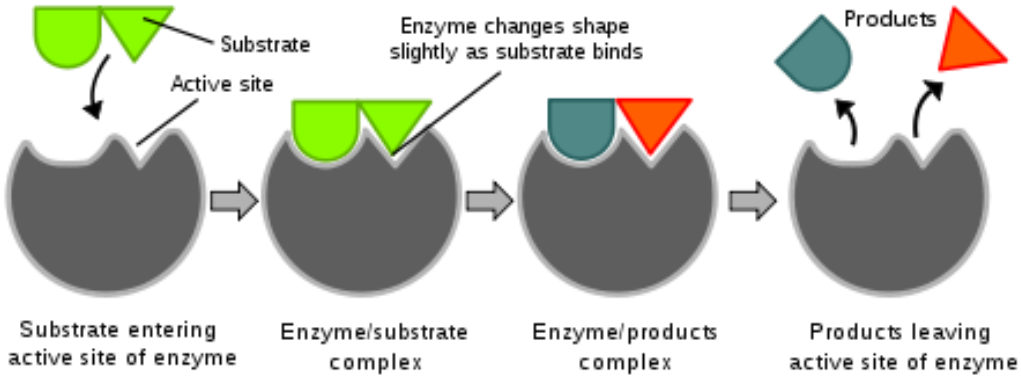
- m+n = 7-10
- Linear Alkyl chain
- Benzene ring randomly distributed in all positional isomers exept 1-phenyl.
- Sulphonate group in *para* position
- Average Molecular Weight = 342

Cold water formulas

- "In Europe,the consumption of energy for laundry washing is equivalent to [the energy produced by] 10 midsized nuclear power plants."
- Lowering washing temperatures to 20 C from 40 to 60 C today would save 80% of that energy

Enzymes

Enzymes are natural, organic molecules that are ubiquitous in the environment. They are proteins and as such they are readily biodegradable and easily removed by wastewater treatment. The environmental concentrations resulting from use in laundry and cleaning products will not impact living organisms



Types of enzymes used in detergents

ENZYME	USE
Protease	pre-soak, removes protein stains
Amylase	Dish washing, removes starch residues
Lipase	Removes fatty and oily residues
Cellulase	Fabric conditioners, anti-pilling

The market for detergent enzymes occupies approximately 40% of the world market for industrial enzymes.

Protease

- First enzyme to be incorporated into detergent in 1931
- Due to alkalinity of detergent pancreatic enzymes did not work well. High-alkaline proteases were created starting in the 1960s.
  - Alcalase® and Savinase® (Novozymes)
  - Maxacal® and Purafect® (Genencor)
  - KAP® (Kao)
  - Blap® (Henkel)
- Companies are continuing to develop protease, as well as other enzymes, that are oxidatively stable in detergents containing bleach.

How we should see detergents

- Complex chemical compositions
- Environmental impacts
- Function
- Energy consumption
- Sustainability

Thanks for listening!

References

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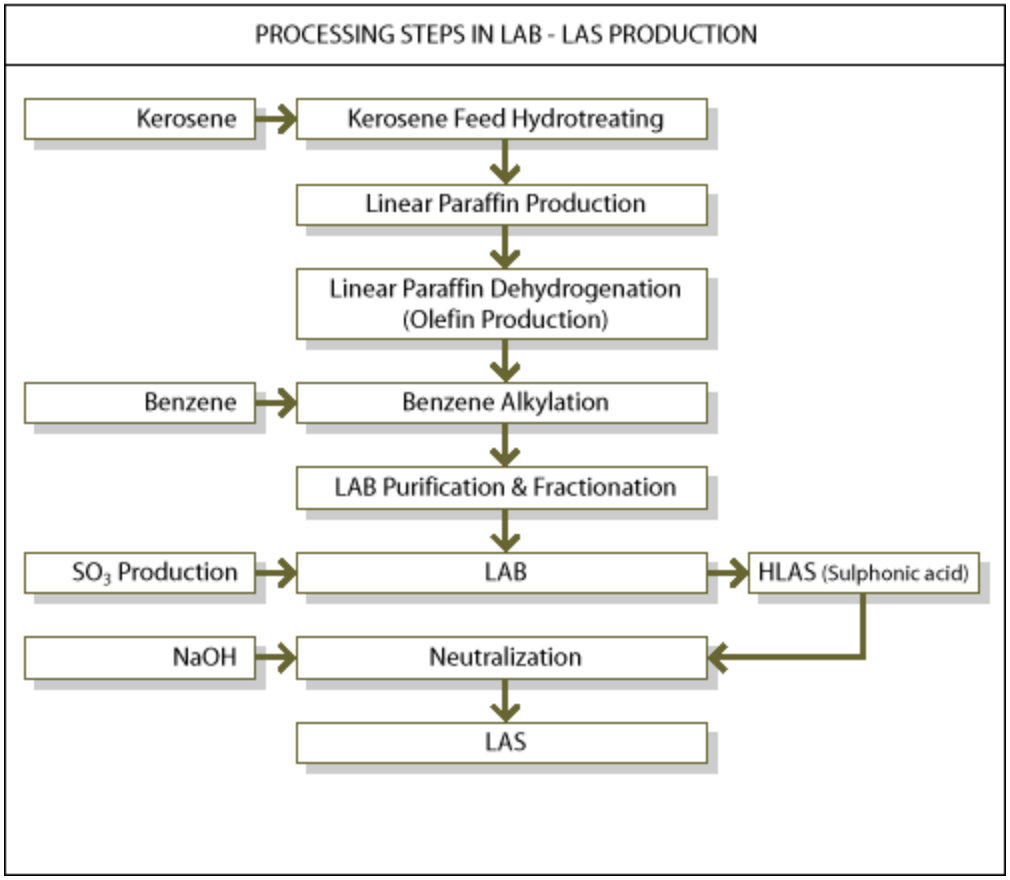
- Many more…

LAS Production



OECD

- **Established:** 1961
  convention
  Location: Paris, France
  map
  Membership:
  30 countries
  Budget:
  EUR 320 million (2009)
  Secretariat staff:
  2 500
  Secretary-General:
  Angel Gurría
  Publications:
  250 new titles/year
  Official languages:
  English/French