Oleochemistry

Surfactant

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Student should be able to understand and compare:

- The classes of surfactants
- The main example of every classes of surfactants
- The applications of the surfactants

Definition….

- **Surfactants** are compounds that lower the surface tension of a liquid and lowering of the interfacial tension between two liquids, or between a liquid and a solid. Surfactants may act as detergents, wetting agents, emulsifiers, foaming agents, and dispersants.

Surfactant classes

- ANIONICS
- AMPHOTERICS/BETAINES
- CATIONICS
- NONIONICS

Anionics

Definition: The anion portion of the molecule is lipophilic.

Example: Sodium Lauryl Sulfate:

Cation: Sodium (hydrophilic)

Anion: Laurylsulfate (lipophilic)

Most commonly used anionics

1. Alcohol Sulfates.
2. Ethoxylated Alcohol Sulfates.
3. Sulfosuccinates.
4. Linear Alkylbenzene Sulfonates.
5. Alpha Olefin Sulfonates.

Alcohol sulfates

- History: Commercial usage began in the mid 1940's.
- Made by the reaction of a fatty alcohol (C8-C18) with sulfur trioxide.
- The alcohol sulfuric acid is neutralized with sodium or ammonium hydroxide, or an amine.

Characteristics of alcohol sulfates

1. C12 (Lauryl) provides the highest foam.
2. Hydrolyzes at pH < 4.5.
3. Can be readily thickened when combined with alkanolamides, betaines, amine oxides etc.
4. Thickening can be greatly enhanced by the addition of electrolytes
5. (NaCl, KCl etc.).
6. Light color.
7. Bland odor.

Major applications

- Shampoos
- Body Wash
- Liquid Hand Soap
- Bath Products
- Facial Cleansers
- Syndet Bars

Properties of amphotericsfor hi&i applications

- Stable in alkaline and acid conditions.
- The propionate and dipropionate type are excellent for HI&I cleaners.
- Low and high foaming is dependant on the molecular weight of the fatty moiety.
- A C8 will be a low foamer, whereas, a C12 is a high foamer.

Examples of caustic solubility

Compound	%NaOH
Coco Dipropionate	41
Caprylic (C8) Dipropionate	38
Caprylic (C8) Propionate	30
Caprylic (C8) Diacetate	28
Coco Propionate	25
Octyl Betaine	23
Sodium Xylene Sulfonate	22

Comparative foam heights

Compound	Foam Ht.
Cocamidopropyl Betaine	210
Coco Propionate	155
Coco Dipropionate	145
Octyl (C8) Betaine	50
Capryl (C8) amidopropyl Betaine	30
Caprylic (C8) Diacetate	10

Properties of amphoterics for personal cleansing

- Stable over a wide pH range.
- Mild to skin and eye.
- Reduce irritation of ether sulfates.

Cationic surfactants

Definition: The cation is the lipophilic portion of the molecule.

Types:

- Quaternary Ammonium Compounds
- Amine Salts

Properties of quaternary ammonium compounds

- Lower molecular weight are typically used as biocides.
- Higher molecular weight (C18) are excellent hair conditioners.
- Most are incompatible with anionic surfactants.
- Low foaming.
- Extremely sensitive to hard water and usually require a chelant.

Major uses of “quats”

- Biocides.
- Fabric Softeners.
- Hair Conditioners.
- Antistatic Agents.
- “Cheater” Wax.
- Corrosion Inhibitors.
- Leather Softening.
- Pigment Dispersants.
- Sewage Flocculants.

Biocides

The most commonly used for household and industrial applications:

Lauryl dimethyl benzyl ammonium chloride

Biocidal “quats”

MODE OF ACTION

1. Reduce surface tension at interface.
2. Attracted to negatively charged surfaces, including microorganisms.
3. Denature protein of bacterial or fungi cells.
4. Affect the metabolic reactions of the cell.
5. Vital substances leak out.
6. Causes death.

Fabric softeners

Most widely used

- Distearyl dimethyl ammonium chloride.
- Dialkyl imidazolinium methyl methoslfate.

MOST WIDELY USED "QUATS" USED IN HAIR CONDITIONERS

- Cetrimonium Chloride
- Stearalkonium Chloride
- Distearyldimonium Chloride

Nonionics

- Alkanol Amides.
- Amine Oxides.
- Ethoxylated Nonyl Phenol or Alcohols.

Preparation of alkanol amides

Made by the reaction of a mono or diethanol amine with a fatty acid, methylester or fatty glyceride, (e.g., coconut oil).

Alkanol amides

- Most cost/effective thickener and foam stablizer available.
- History: Commercially available in the mid 1940's.
- Diethanolamides are being phased out of formulas due to reported "cancer link".
- They are being replaced by: Betaines, Amine Oxides, Monoethanolamides and Monoisopropanolamides.

Some new guys on the block “natural surfactants”

- Decylglucoside: Derived from sugar and coconut oil.
- Cocoyl Glutamate: Derived from glutamic acid (amino acid) and coconut oil.
- Cocosulfate: Derived from coconut oil.

Current trends and limitations

- Natural.
- Certified Organic.
- Animal friendly.
- DEA Free.
- Formaldehyde Free.
- Nitrosamine Free.
- Sulfate Free.
- Low Dioxane.

Conclusion

- Surfactants have four classes
- Every classes have particular properties
- Natural surfactant is the emerging research in surface chemistry

Chapter description

All pictures/photographs/diagrams/figures used in this chapter is subjected to common creative that for education purposes