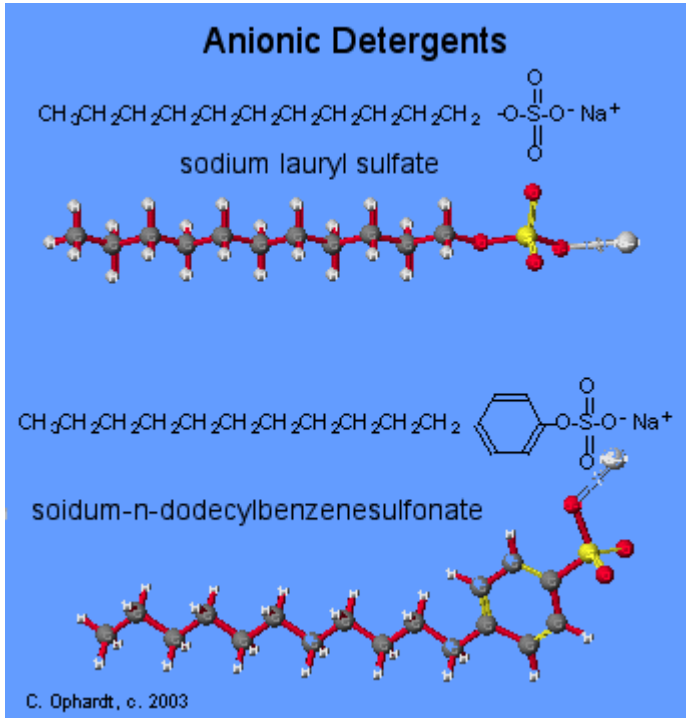
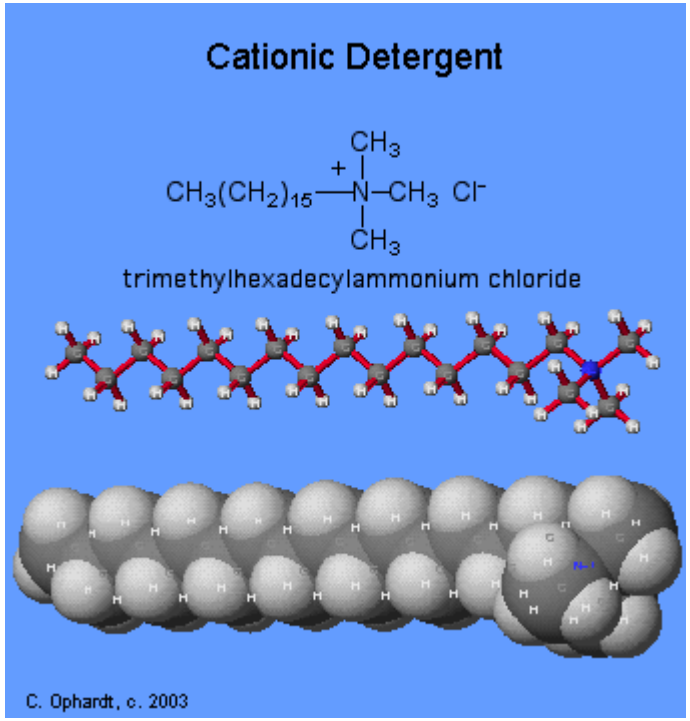


Detergents and Surfactants

Introduction:

Synthetic detergents have similar molecular structures and properties as soap. Although the cleansing action is similar, the detergents do not react as readily with hard water ions of calcium and magnesium. There are over a thousand synthetic detergents available in the United States. Detergent molecular structures consist of a long hydrocarbon chain and a water soluble ionic group. Most detergents have a negative ionic group and are called anionic detergents. The majority are alky sulfates. Others are "surfactants" (from surface active agents) which are generally known as alkyl benzene sulfonates.

Quiz: Which part of the molecule is soluble in water?	Answer
Which part of the molecule is insoluble in water?	Answer
Which part of the molecule is interacts with dirt or oil?	Answer

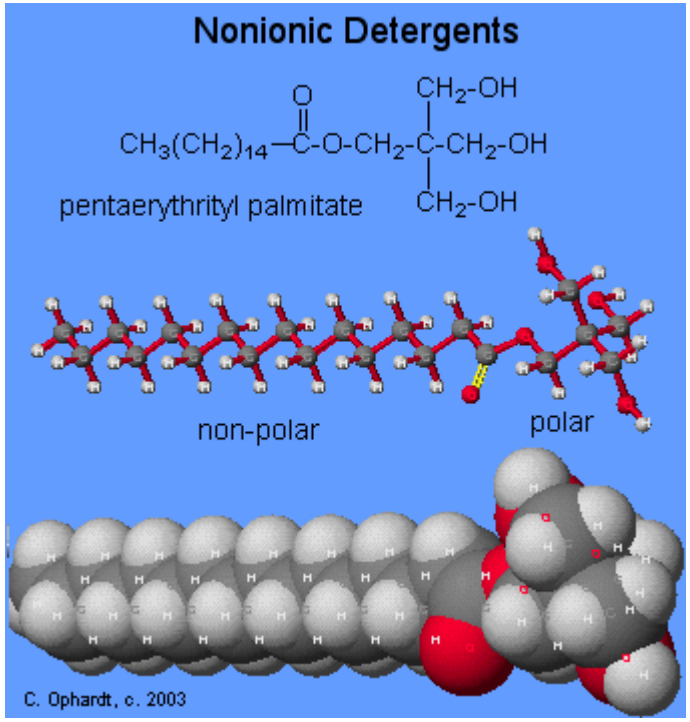


Cationic Detergents:

Another class of detergents have a positive ionic charge and are called "cationic" detergents. In addition to being good cleansing agents, they also possess germicidal properties which makes them useful in hospitals. Most of these detergents are derivatives of ammonia.

A cationic detergent is most likely to be found in a shampoo or clothes "rinse". The purpose is to neutralize the static electrical charges from residual anionic (negative ions) detergent molecules. Since the negative charges repel each other, the positive cationic detergent neutralizes this charge.

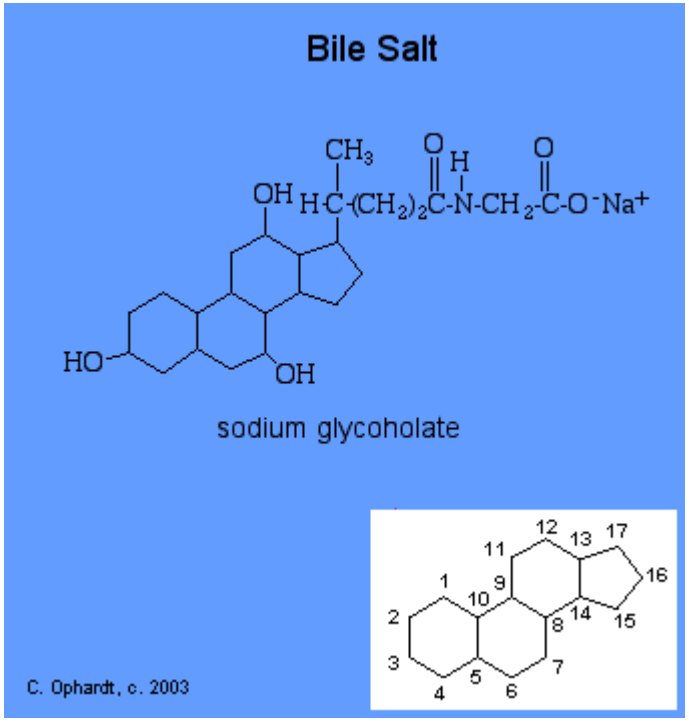
It may be surprising that it even works because the ammonium (+1) nitrogen is buried under the methyl groups as can be seen in the space filling model.



Neutral or non-ionic detergents:

Nonionic detergents are used in dish washing liquids. Since the detergent does not have any ionic groups, it does not react with hard water ions. In addition, nonionic detergents foam less than ionic detergents. The detergent molecules must have some polar parts to provide the necessary water solubility.

In the graphic on the left, the polar part of the molecule consists of three alcohol groups and an ester group. The non-polar part is the usual long hydrocarbon chain.



Bile Salts - Intestinal Natural Detergents:

Bile acids are produced in the liver and secreted in the intestine via the gall bladder. Bile acids are oxidation products of cholesterol. First the cholesterol is converted to the trihydroxy derivative containing three alcohol groups. The end of the alkane chain at C # 17 is converted into an acid, and finally the amino acid, glycine is bonded through an amide bond. The acid group on the glycine is converted to a salt. The bile salt is called sodiumglycoholate. Another salt can be made with a chemical called taurine.

The main function of bile salts is to act as a soap or detergent in the digestive processes. The major action of a bile salt is to emulsify fats and oils into smaller droplets. The various enzymes can then break down the fats and oils.

QUES. Explain how bile salts work to emulsify fats. Talk about the polar and non-polar parts of the molecule.