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Review

Synthetic detergents: 100 years of history

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ABSTRACT

In the year 2016 the synthetic detergents complete 100 years and in this story they evolved as cleaners. They are already part of the routine of thousands of people worldwide. For a higher power of cleaning of the detergent, today, are added phosphates, the main responsible for environmental problems. After 100 years of synthetic detergents, the effect of the combination of various cleaners on the environment is a gap. Legislation and guidelines about the other components of the formula of cleaners still missing. Even the term biodegradable can be best placed on the diversity of products currently entitled biodegradable. A lot attitudes can still be taken to continuously improve the relationship between the parties involved, animals, plants, waters and men, so that in another 100 years continues to exist this interaction with the environment without destroying it. The marketing used by synthetic detergent companies evolved a lot over the years and showed maturity to deal with changes in theories and strategies for promotion and even with the constant social reform that its consumer lived, accompanying them intelligently to be able to capture their changing needs and desires, and so assemble the best way to connect to them. This paper focuses on the subject synthetic detergents as well as (i) types and applications, (ii) threats, (iii) sustainability, (iv) legislation, (v) packaging and (vi) marketing strategies.

Contents

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1. Introduction

In the year 2016 the synthetic detergents complete 100 years and in this story they evolved as cleaners. Their uses and objectives have been expanded and today it is already part of the routine of thousands of people worldwide.

A detergent is any compound that can be used as a cleaning agent. Although soap is a detergent, this term is generally used to refer to synthetic substitutes of soap.

The soap, called anionic surfactant, of general formula RCOONa, is a salt of carboxylic acid of long chain containing 10–18 carbon atoms, wherein one hydrogen has been replaced by a cation. The long chain of hydrocarbon of the carboxylic acid salts is nonpolar and capable of interacting with nonpolar species as fats and other impurities. The group ionized carboxylic acid, being polar, is able to interact with water molecules. This characteristic explains the interaction of soap with water and fats (Penteado et al., 2006; Cai and Hakkinen, 2014).

Generally, the common soap is a sodium salt, soluble in water. However, salts of Ca^{2+}, Mg^{2+} or Fe^{3+} are insoluble in water. Thus, a soap cannot be used efficiently in a medium containing these ions, in case the hard water (Cai and Hakkinen, 2005).

Water hardness is usually measured as the amount of parts per million (ppm) of calcium carbonate ($CaCO_3$). Water is considered hard if containing amounts of these cations above 150 mg L^{-1}, water is considered soft if the contents are below 75 mg L^{-1} and if they are between 75 and 150 mg L^{-1} water is considered moderate.

The problems related to the use of common soaps in hard water led to the development of synthetic detergents.

Detergents have structural characteristics similar to soaps, polar region and a non-polar long chain and act basically the same way. However, chemical characteristics of the detergent are different and do not precipitate in hard water or acidic solutions, such as soaps.

Anionic synthetic detergents commonly used in cleaning contain alkyl benzene sulphonate of sodium, linear chain. On the market are found as a mixture of alkyl benzene sulfonates, wherein the main component of this mixture is dodecylbenzene sulphonate of sodium, established as standard of biodegradable anionic detergent.

2. Types and applications

Soaps and detergents belong to the same group of chemicals, the surfactants. There are four types of surfactants; anionic, cationic, nonionic and amphoteric (Kemmei et al., 2007).

Soaps and detergents belong to the group of anionic surfactants.

Non-ionic surfactants do not present radicals with electric charges and interact with water molecules by hydrogen bonds.

They are, together with the anionic surfactants, the most appropriate for the removal of dirt by washing, once in the water both surface of the fabric fibers and dirt particles are negatively charged.

The cationic surfactants are often used as bactericides, hair conditioners as well as fabric softener.

The amphoteric surfactants are used in shampoos and cosmetic creams.

3. Threat of synthetic detergents

Before the advent of synthetic detergents, there were problems with the effects of soaps on the ecosystem, once they have left an insoluble film on the surface of the water which, for example, decreased or even impeded the entry of oxygen. Therefore, always existed an environmental concern in relation to cleaning products, the observation of its effects on the ecosystem always existed.

3.1. Phosphates

The sequestering and chelating agents are added for greater cleaning power of the detergent (El-Gawad, 2014), such as phosphates, which remove calcium and magnesium ions that are present in water and can reduce detergent action.

Phosphates are non-toxic, increases the efficacy of the detergent and with them the cost of the final product is low. However, phosphates are largely responsible for problems to the environment (Ashforth and Calvin, 1973).

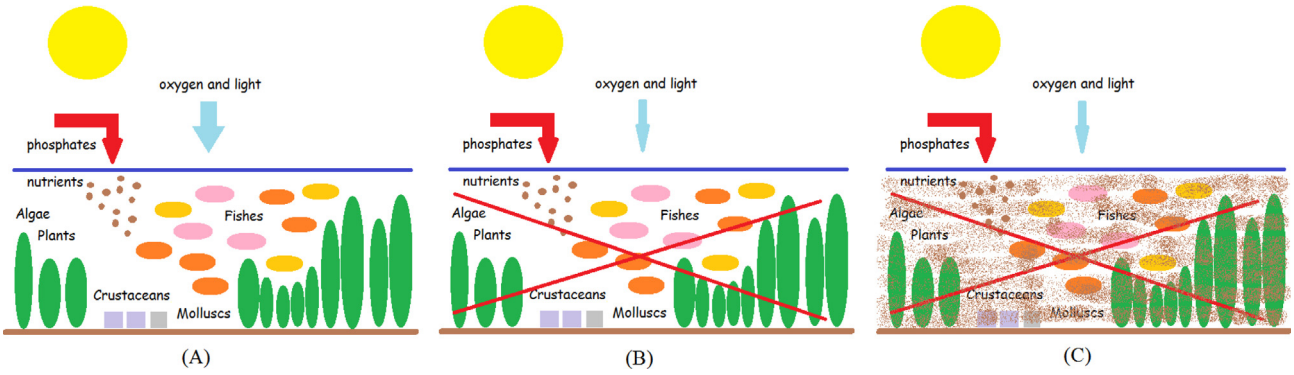

Fig. 1. (A) Addition of phosphate in water causing proliferation of aquatic flora and consequently increase of aquatic fauna. (B) The increase of fauna and flora makes it difficult the entry of light and oxygen, which leads to the death of these species. (C) Water becomes dirty, smelly and improper for use.