Application of Surfactant in various Fields

A short Review

Shital Sonawane [1], Sunita Pal[2] , SindhuTayade[3] , Neeam Bisht[4]

Department of Engineering Sciences and Humanities

[1&2]Saraswati College of Engineering, Kharghar, Navi Mumbai, Maharashtra, India
sunitapal15@gmail.com

Abstract
Natural Surfactant was came in existent in Egyptian era where some of the plant extract was used for cleaning purposes ,later in 20th century after world war II the commercialization of synthetic surfactant take place . In market plenty of surfactants are available from natural and synthetic origin . Surfactants are used everywhere in food, cloths, Pharmaceuticals, and agriculture etc.. The widespread use of surfactant made in concern for its further modification and safe use .This short review will give a overview of applications of these surfactants in various sectors which will help the researchers working in this field.

Key words: Surfactant, Cationic, Anionic,Petroleum

I. INTRODUCTION

Surfactant can be define as 'surface active agents' or an organic compound having at least one lyophilic ('solvent-loving') group and one lyophobic ('solvent-fearing') group in the molecule. surfactants can be used in various solvents, if they are used in water or aqueous solution then term hydrophopic and hydrophilic are used, in simple term a surfactant cotains one polar or ionic and one non-polar or non-ionic group shown in the figure 1.1[1].

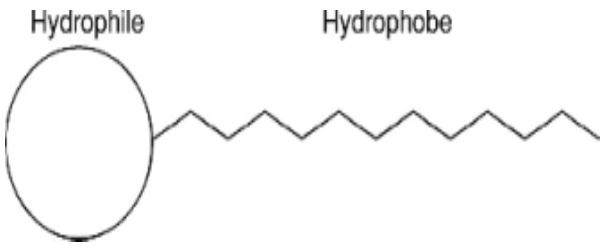


Fig: 1.1 Structure Of Surfactant.Ref[1]

Surfactant are widely used in our daily lives in countless ways and present almost all the sectors like food, water, drinks, the product used to clean ourselves ,our utensils ,our cars , cloths etc. It affects all of us in enormous ways. The widespread use of surfactant in all the fields made it important material for study. Therefore nowdays counteless articles are available how the surfactant can be used in safety ways for varoius purposes. Modern research are concern with the new application of these surfactant in various fields, initially surfactant was used mostly in the soap industry.Fig 1.2 [1]gives the details about the percent use of surfactant in various sectors.

In 2013, theglobal surfactant market had a value estimated to have been worth $26.3 billion.

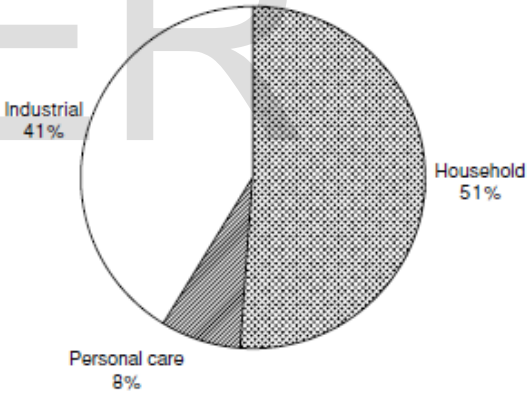


Fig: 1.2 Use of surfactant in Various Sectors[1]

It was found that without surfactant cleaning is not possible because it seems imposible to remove soils from cloths using water as solvent or we can say that cleaning formulations is not possible without surfactant[1-2].

The aggregation of particles is known as Micellisation and aggregate known as Micelles.Micelles formation take place at very low concentration of surfactants called as CMC(critical micelle concentration') examples shown in figure 1.3

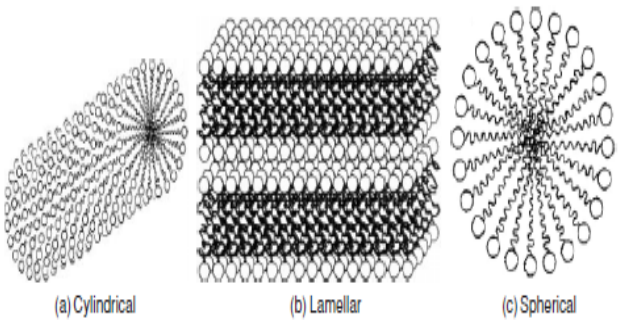


Fig:1.3 -Structures of diffrent Micelle Ref.[1-2]

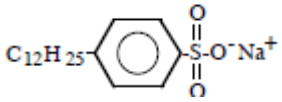
Classification of surfactant:
The oldest surfactant was soap. The synthetic surfactant was produced in 20th centuary later it was commercialised in world war II with development of modern petrochemical industry.There are many ways through which surfactant can be classify but commercially it is classify on the basis of its use or application however later it was found **that** a single surfactant can be use in various fields therefore confusion may arise so that classification was discarded later, it was classify how they dissociate in aqueous solution.

Anionic Surfactants are dissociated in water in an into cation and anion, generally seen in alkaline metals like (Na+, K+) or a quaternary ammonium. They are the most commonly used surfactants. They include alkylbenzene sulfonates (detergents), (fatty acid) soaps, lauryl sulfate (foaming agent), di-alkyl sulfosuccinate (wetting agent), lignosulfonates (dispersants) etc. Anionic surfactants account for about 50 % of the world production.

Nonionic Surfactants
About 45 % used in industry they did not ionise in water or aqueous solution because their hydrophilic group is of a nondissociable type, example C_2H_5 OH , phenol, ether, ester, or amide. These non ionic can be made ionic by adding polyethylene glycol chain, which can be obtained by the polycondensation of ethylene oxide. They are called polyethoxylated nonionics.

In the past decade glucoside (sugar based) head groups, have been introduced in the market,because of their low toxicity. As far as the lipophilic group is concerned, it is often of the alkyl or alkylbenzene type, the former coming from fatty acids of natural origin. The polycondensation of propylene oxide produce a polyether which (in oposition to polyethylene oxide) is slightly hydrophobic. This polyether chain is used as the lipophilic group in the so-called polyEOpolyPO block copolymers, which are most often included in a different class, e.g. polymeric surfactants, to be deal with later.

Cationic Surfactants are dissociated in water into an amphiphilic cation and an anion, most often of the halogen type. A very large proportion of this class corresponds to nitrogen compounds such as fatty amine salts and quaternary ammoniums, with one or several long chain of the alkyl type, often coming from expensive than anionics, because of a the high pressure hydrogenation reaction to be carried out during their synthesis. As a consequence, they are only used in two cases in which there is no cheaper substitute, i.e. (1) as bactericide, (2) as positively charged substance which is able to adsorb on negatively charged substrates to produce antistatic and hydrophobant effect, often of great commercial importance such as in corrosion inhibition. When a single surfactant molecule exhibit both anionic and cationic dissociations it is called **amphoteric** or **zwitterionic**. This is the case of synthetic products like betaines or sulfobetaines and natural substances such as aminoacids and phospholipids[2].



Sodium Dodecyl BenzeneSulfonate

The past two decades have seen the introduction of a new class of surface active substance, so-called **polymeric surfactants** or **surface active polymers,** which result from the association of one or several macromolecular structures exhibiting hydrophilic and lipophilic characters, either as separated blocks or as grafts. They are now very commonly used in formulating products as different as cosmetics, paints, foodstuffs, and petroleum production additives[4-7].

Application in petroleum industry

A number of petroleum, industry use surfactant for oil recovery which include micellar alkali/ surfactant/polymer and gas(hydrocarbon, N_2, CO_2 or steam flooding.The concentration of surfactant is more than CMC (critical micelle concentration) to remove oil from industry[2].

Application in Pharmaceutical Industry

surfactants are widely used in pharmaceutical industries because of their antibacterial, antifungal and antiviral properties. These combating properties can be used in many diseases. In addition to this their role as antiadhesive agents against several disease causing pathogens makes their utility as suitable in various pharmaceutical, biomedical and therapeutic perspectives. most of these surfactant are amphiphilic compounds which produced mostly by microbial cell surfaces and can be excreted extracellularly. The resultant contains both the hydrophobic as well as hydrophilic groups which accumulates the fluid phases together. most of the biosurfactant are used in bioremediation of pollutants in low cost. It is of mainly two types low molecular and high

molecular weight compounds which have anti cancer, bubbles stablisation and anti HIV sperm immobilizing activity, immunomodulatory and various therapeutic activities[3-8]

Use of Surfactants as flocculating agents: To retard sedimentation of the flocculates a suspending agent is frequently added .The agents like carboxy methyl cellulose, , or bentonite , carbopol 934, veegum, tragacanth employed either alone or in combination. This may lead to incompatibilities,depending on the initial particle charge and the charge carried by the flocculating agent and the suspending agent. Flocculating a positively charged particles are done by the addition monobasic potassium phosphate an anionic electrolyte.[9]

Surfactants in Polymer synthesis

In surfactant emulsion and micro emulsion systems the generation of polymer latexes is not considered. The generation of polymers with unique architectures that are obtained as a result of synthesis in surfactant systems.
Monomers are doped into surfactant systems; the resulting polymerization often leads to phase separation and morphologies independent of the surfactant assembly. Polymerization surfactants appear to hold promise as structure preserving systems[8]. Ionic surfactants enhance transdermal absorption by disordering the lipid layer of the stratum corneum and by denaturation of keratin. Enhancers may increase drud penetration by causing the stratum corneum to swell and/or leach out some of the structural components, thus reducing the diffusional resistance and increasing the permeability of the skin[9].

Surfactants in microbiology:

The activity of a drug or drug action may be affected by surfactant., The penetration of hexyl resorcinol into the pinworm Ascaris is increased by the using a low concentration of surfactant. This activity is due to a reduction of interfacial tension between the liquid phase and the cell wall of the organism. It result, the adsorption and spreading of hexyl resorcinol over the surface of the organism is facilitated. And excess concentration form micelles, the rate of penetration of the anthelmentic decreases to zero, because the drug is partitioned between the micelles and the aqueous phase. In biochemistry, the practical as well as theoretical importance of surfactants may be illustrated with the following examples: Surfactants have allowed the investigation of molecular properties of membrane proteins and lipoproteins, acting as solubilizing agents and as probes for hydrophobic binding sites[10].

Application in Nanotechnology

Surfactants Play major roles in the formation of nano-emulsions. By lowering the interfacial tension, laplace pressure P (the difference in pressure between inside and outside the droplet) is reduced and hence the stress needed to break up a drop is reduced. Surfactants prevent coalescence of newly formed drops. Nano-emulsions are transparent or translucent systems mostly covering the size range 50-100 nm . Nano-emulsions are attractive for application in personal care and cosmetics as well as in health care[11]

conclusions

A host of interesting features of biosurfactants have led to a wide range of potential applications in the various fields like pharmaceutical, biomedical polymer synthesis, petrochemical etc. They are useful as antibacterial, antifungal and antiviral agents, and they also have the potential for use as major immunomodulatory molecules adhesive agents and in vaccines and gene therapy. Successful .

Refrences

[1]Chemistry and Technology of Surfactants by Richard J. Farn, 2006, ISBN-13: 978-14051-2696-0

[2]Surfactants: Fundamentals and Applications in the Petroleum Industry: Laurier L. Schramm 2000,Cambridge University Press, ISBN 0 521 64067 9

[3] Rath Kalyani, Mishra Bishwambhar and Vuppu Suneetha, Recent potential usage of surfactant from microbial origin in pharmaceutical and biomedical arena: a perspective;international research journal of pharmacy (8) 2011 11-15;

[4]Karanth NGK, Deo PG, Veenanadig NK. Microbial production of biosurfactants and their importance. Current Science, 1999, 77:116–123.

[5] Banat IM, Makkar RS, Cameotra SS. Potential commercial applications of microbial surfactants. Applied Microbiology and Biotechnology, 2000, 53: 495–508.

[6] Cameotra SS, Makkar RS. Synthesis of biosurfactants in extreme conditions. Applied Microbiology and Biotechnology,1998, 50:520–529.

[7] Mulligan CN. Environmental applications for biosurfactants.Environmental Pollution, 2005, 133:183–198

[8]Ref 4.Vijay T. Johna,_, Blake Simmonsa, Gary L. McPhersonb, Arijit Bosec Recent developments in materials synthesis in surfactant systems Current Opinion in Colloid & Interface Science,2002. 288_295