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The Use of Non-Ionic Surfactants in the Textiles Industry

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Abstract

Surfactants are specialty chemicals that are widely used in food, medicine, textile, agriculture, adhesive, leather, cleaning, and cosmetic industries. Structurally, because surfactants possess both hydrophilic and hydrophobic groups, they easily adsorb at the surface or the interface of a solution when dissolved in solvents such as water and oil. This subsequently reduces the surface or interfacial tension of the solution, imbuing it with unique properties such as wettability, emulsibility, foamability, and dispersibility. Surfactants may also be required for detergency, level dyeing, and other functions, and the selection of a particular surfactant for a given function is based on how well it interacts with the fibers and/or other system components. Unit procedures in textile processing include desizing, scouring, bleaching, dyeing, printing, and the application of functional finishes.

Keywords: Surfactants, Non-Ionic, Textiles, Detergents, Softeners

Introduction

Water, like other liquids, has surface tension at the liquid-air contact and interfacial tension at the liquid-liquid or liquid-solid interfaces. Water cannot penetrate fabrics due to interfacial tension. Because water molecules are dipoles, physical electrical forces (van der Waals and dipole bonds) exist between the molecules and the water, as well as hydrogen bonds. These electrical forces of attraction work in all directions in a body of water, keeping each molecule in equilibrium. However, no forces are operating from the air outside at the water's surface, so the equilibrium is disturbed. Surface tension is the manifestation of the energy collected in the surface molecules of water. As a result, molecules at the surface are pulled inwards until the surface area is minimized. [1]

To get functional textile fabric must go through a series of wet processing operations. Wet processing has been and will continue to be an important operation in the textile value chain; however, economic forces, market demands, and environmental concerns will shape the direction of wet processing in the foreseeable future. Specialty surfactants play an important role in achieving these finished fabric standards during pre-treatment, dyeing, and finishing. [2]

Surface Active Agents

Top tension causes the top of water in a measuring cylinder to have a convex profile, and drops of water to have a spherical shape. Surface tension is measured in newtons per meter, and water has a surface tension of 0.073 N/m. Surface active agents, wetting agents, detergents, and washing-off agents all work to decrease water's surface tension. When these agents are mixed with water, they almost completely blanket the liquid's surface. They are not as powerfully attracted to the inner water molecules as the water molecules were previously, so in the presence of a surface active agent, the surface tension of water is reduced to 0.030 N/m. As a result, surfactants are a vital category of textile auxiliaries. To name a few uses, they are used as

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wetting agents, softeners, detergents, emulsifiers, and defoaming agents. Commercial products are rarely pure compounds, but rather mixtures or blends of surfactants that are tailored to the duties at hand. [3]

Amphiphiles that have hydrophilic and lipophilic properties migrate to the surface or interface more than others. The amphiphilic molecule remains in one of the stages if it is either too hydrophilic or too hydrophobic. A planar monolayer of surfactant molecules forms at the contact if the surfactant molecular structure is linear, as in the case of sodium dodecyl sulfate (SDS).

These kinds of surfactants can create oil-in-water (O/W) and water-in-oil (W/O) dispersions by forming droplet structures called micelles of one phase dispersed within the other with more active shearing and mixing. This behavior is explained by the decrease in surface free energy caused by surfactant saturation and the predilection for a radius of curvature. In such systems, the equilibrium interfacial free energy is extremely low, and the total surface free energy of the micellar structure, while positive, is offset by the entropy of dispersion of the structures within the continuous phase. [4]

Surface active agents have numerous applications in the different unit operations of technical textile processing. From the invention of sulfated oils around 1870 to the present decade, a diverse variety of surface active products has been developed with a focus on specific processing applications. Many processes involve fabric treatments in aqueous solutions during the conversion of textile fibers into different forms of textiles, from scoured fibers or filaments to yarns or fabrics. The use of water as a medium for textile processing necessitates that the liquid wets the fiber surfaces quickly and uniformly, and surfactants can help with this. Furthermore, surfactants may be needed for detergency, level dyeing, and other purposes, and the choice of a specific surfactant for a particular purpose is determined by its ability to interact with fibers and/or other system components. Desizing, scouring, bleaching, dyeing, printing, and the application of functional finishes are all unit processes in textile processing. [5]

Surfactants

The word surfactant is a contraction of the phrase surface active agent.' It was created in the 1950s. A surfactant is a substance that lowers the surface tension of a liquid in which it is dissolved. Because surfactants have additional characteristics, they are frequently labeled according to their primary use, such as soap, detergent, wetting agent, dispersant, emulsifier, foaming agent, bactericide, corrosion inhibitor, anti-static agent, and so on. They are also classified based on their physical shape, such as membrane, microemulsion, liquid crystal, liposome, gel, and so on. Surfactants have an amphiphilic chemical structure, which means that their molecules are made up of two groups with contrasting solubility. When molecules with this structure come into contact with an oil-water interaction, the hydrophilic group is solubilized into the aqueous phase and the hydrophobic group is solubilized into the organic phase. [6]

Surfactants are active ingredients in finishing chemicals for softening, crease resistance, water repellency, and so on. The fact that a finishing compound is surface active has little bearing on its application or usefulness as a finish. To create a cloth water-repellent or to give it a soft handle, long-chain fatty or oily compounds must be added to the fiber surface. Adding a solubilizing group into the fatty molecule is one of the practical ways of depositing and attaching fatty chain compounds to a fiber surface. The resulting compound is then water-dispersible and can be applied in controlled quantities from an aqueous medium. The addition of certain solubilizing groups may even provide substantivity, facilitating and strengthening the finish's attachment to the fabric. [7]

Surfactants are molecules that self-assemble from micelles in a liquid and adsorb to the interface between the liquid and another phase (gases or solids), also known as surface-active agents. While their tails are hydrophobic, their heads are hydrophilic (polar). The two categories of surfactants are ionic (anionic, cationic, and amphoteric) and nonionic surfactants. [8]

Classifications of Surfactants

According to Solubility

Based on their solubility profiles, surfactants can also be categorized. For instance, "hydrophilic" (or "lipophilic") surfactants are those that are soluble in water, whereas "hydrophobic" (or "lipophilic") surfactants are those that are soluble in lipids. Ionic surfactants are hydrophilic in this case, but nonionic surfactants are either hydrophilic or hydrophobic in nature.

The equilibrium between the hydrophilic and lipophilic groups underlies these properties of nonionic surfactants. Typically, this is measured using a hydrophilic–lipophilic balance (HLB) scale. The cloud point for nonionic surfactants (the temperature at which the mixture begins to phase separate and two phases appear, becoming cloudy) and the Krafft point for ionic surfactants (the Krafft point is the lowest temperature at which a surfactant can form micelles) serve as additional indicators. [9]

According to Headgroup Charge

Surfactants are traditionally divided into four categories based on the headgroup charge: anionic, cationic, nonionic, and zwitterionic. The most significant characteristics of surfactants are their interfacial behavior and capacity for self-assembly. While all surfactants exhibit the same general self-assembly properties, cationic and anionic surfactants exhibit very different interfacial behaviors. Since the majority of solid surfaces are more or less negatively charged, cationic surfactants have a higher propensity to adsorb; this is because the two types of surfactants have different applications. Since surface-induced self-assembly frequently controls the adsorption of surfactants on polar surfaces, both the form of the surface aggregates and the amount of surfactant adsorbed will vary significantly. [10]

Anionic Surfactants

When dissolved, the head has a negative charge. They are the most widely used surfactant and account for nearly 50% of global manufacturing. Common examples include soaps and detergents. Anionic surfactants excel in removing oil from surfaces. However, by combining wash water with positively charged calcium and magnesium ions from water hardness, they can also partially deactivate. The more magnesium and calcium molecules there are in the water, the more easily the anionic surfactant system can become inactive. This can be prevented by utilizing builders (Ca/Mg sequestrants) to help anionic surfactants and by utilizing additional detergent in hard water. [11]

Cationic Surfactants

In a solution, these surfactants' heads are positively charged. Due to their potent bactericidal properties, Quaternary ammonium compounds known as cationic surfactants are most frequently utilized as disinfectants and preservatives. They are put on the skin directly to treat burns or open wounds. The most popular cationic surfactant, cetrimide, has traces of tetradecyl trimethyl ammonium bromide and dodecyl and hexadecyl compounds. Other cationic surfactants include cetylpyridinium chloride and benzalkonium chloride. [12]

Amphoteric/Zwitterionic Surfactants

They can be nonionic (chargeless), cationic (positively charged), or anionic (negatively charged) in solution, depending on the pH of the water. The positive group in their cranium is very certainly ammonium, but the negative groups could be various (sulfate, carboxylate, or sulphonate). Amphoteric surfactants are only used in a very small number of industries since they are frequently highly expensive, such as cosmetics and shampoos, where their excellent biological compatibility and low toxicity are essential. They can be used in dishwashing products due to their great foaming characteristics. [3, 6]

Non-Ionic Surfactants

Non-ionic surfactants because they are electrically neutral, they reduce the resistance that the water's hardness presents. Compared to cationic and anionic surfactants, these are less irritating. Due to the hydrophilic nature of their hydrophilic groups (such as phenol, ester, alcohol, ether, or amide), this class does not ionize in aqueous solutions, whereas the hydrophobic part contains saturated or unsaturated fatty acids as well as fatty alcohols. Both emulsifiers and oil removers, work well. The most common examples are ethers and fatty alcohols. [8, 11]

The presence of a polyethylene glycol chain, obtained by polycondensation of ethylene oxide, makes a significant proportion of these non-ionic surfactants hydrophilic. They are referred to as polyethoxylated non-ionics. Because of their low toxicity, glucoside (sugar-based) head groups have been created over the last decade. Propylene oxide polycondensation results in a mildly hydrophobic polyether. This polyether chain serves as the lipophilic component in poly- EOpolyPO block copolymers. [13]

These surfactants have the following properties:

- Ester linkage to solubilizing groups
- Amide linkage
- Miscellaneous linkages
- Multiple linkages.

Nonionic surfactants have the benefit over ionic surfactants in that anything can change the molecular structure, especially the hydrophilic moiety, to produce surfactants with a wide range of HLB. By changing the polymerization level of the polyoxyethylene group in nonionic surfactants of the polyoxyethylene type, the HLB can be changed. Due to this advantage, a large variety of surfactant aggregates, both with positive and negative curvatures, are shown in a phase diagram as a function of the surfactant's HLB number in water/polyoxyethylene-type surfactant systems.

Nonionic surfactants include polyol esters, polyoxyethylene esters, poloxamers, and pluronics. As was already mentioned, nonionic surfactants have a special property called a cloud point. The nonionic surfactant starts to phase separately from the cleaning solution at a certain temperature, known as the cloud point.64 This causes the cleaning solution to become hazy. This cloud point is therefore considered to be the ideal temperature for detergency. Polyoxyethylene esters (PEGs) include a sizable amount of polyethylene glycol.

Ethers of fatty alcohols are nonionic surfactants that are often employed. Nonionic surfactants help to reduce the surfactant system's sensitivity to hardness. Noncharged hydrophilic components of nonionic surfactants include alkylphenol ethoxylates [$RO(CH_2CH_2O)nH$ (R = alkylphenol group), alcohol ethoxylates [$CnH_2+1(OCH_2CH_2)NOH$], and nonylphenols.

Ethylene oxide condensates

Direct oxidation of ethylene by air on a silver catalyst (300°C, 10 atm) produces ethylene oxide. Because of the tensions created within its triangular structure, it is a very unstable and hazardous gas. Its depict some of the major ethylene oxide condensates. These condensates' hydrophilic-lipophilic balance (HLB) variations and applications are shown below:

Range	Application
3.6	Water in Oil (W/O) emulsifier
7.9	Wetting agent
8.18	Oil in Water (O /W) emulsifier
13.15	Detergent
15.18	Solubilizer

Their behavior when added to water (HLB range) is: [14-17]

- No dispersibility 1-4
- Poor dispersion 3-6
- Milky dispersion after stirring 6-8
- Stable milky dispersion 10-13
- Clear Solution +13

The chemical class of industrial softeners that are employed the most frequently is that of non-ionic softeners. They serve as lubricants, softeners, emulsifiers, and stabilizers whether employed alone or in conjunction with other agents. These compounds have the general formula $R(OC_2H_4)nOH$ or $R(C_2H_4)nOOH$, where R is an alkyl. They are based on ethoxylated fatty alcohols, ester alcohols, simply oxidized polyethylene waxes, and ethoxylated fatty acids.

They frequently utilize padding to apply them because of their low polarity. Nonionic surfactants include polyol esters, polyoxyethylene esters, poloxamers, and pluronics. [18]

Nonionic Softeners

(a) Ethoxylates
(b) Esters
(c) Polyethylenes
(d) Silicones
(e) Waxes

Since nonionic softeners don't have an electrical charge, they lack a unique substantivity. These compounds are typically applied forcibly (i.e., during padding mangle treatments). Nonionic softeners are interchangeable, temperature-stable, and do not display yellowing. This is the reason why completing optically brightened, highly white goods is an ideal use for this product class. Pure nonionic products have an average soft handle. A traditional nonionic softener exhibits a higher level of yellowing resistance than cationic softeners. However, compared to cationic softeners, which are often based on ethoxylates and esters, such a product is unfavorable in terms of wash fastness, handling, and exhaustion behavior. [9]

The substances made from fatty esters are most frequently employed. They also offer a significant amount of lubrication in addition to softening.

For ethoxylates, the fatty radical contributes to the handle's softness, while the ethoxylate chain contributes to its absorbency and antistatic characteristics. Unfortunately, things are not quite as straightforward as this. For example, when a fatty acid ethoxylate is applied to acrylic fibers, the molecule will align itself to produce a high level of fiber-fiber static friction, which will provide a very scroopy handle.

Esters, particularly linear esters like methyl stearate or oleyloleate, frequently have excellent lubricating characteristics and lack the drawbacks of ethoxylates. However, they lack antistatic qualities and typically require to be dispersed in an aqueous media since they are nonpolar. [19]

When crease-resistant or wash-and-wear resins are utilized to improve the tensile qualities of cotton and cotton blends, polyethylenes are frequently used. The movement of individual fibers inside the fabric is constrained by the resins' propensity to enhance fiber friction, which the lubricant overcomes. Because they can enclose individual cotton threads and provide this reduction in friction, polyethylenes are a great choice. They also don't interfere with resin-fiber interaction, are stable to heat treatment, and are compatible with routinely used catalysts and resins. The waxes employed in softener recipes are essentially particles that provide the fiber with a certain amount of lubricity. Other waxes that are used frequently include synthetic Fischer-Tropsch waxes and solid esters in addition to paraffin waxes. For knitting or sewing needles, paraffin waxes are used to reduce the dynamic friction between fibers and metal. They can be left on many knitted clothes and give the fabric a "waxy" feel. [9]

The use of paraffin in smoothening agents is well known. Paraffin with a carbon chain length of C24–C32 is particularly fascinating. Shorter C-chain paraffin vaporize quickly, whereas longer C-chain paraffin can only be transformed into useful emulsions under pressure. [18, 20]

All nonionic softeners, except for ethoxylates, provide good lubricity, but none also provide a soft, bulky handle. So, a nonionic agent alone might readily be used to create a product that would offer a fabric strong stability or good physical qualities, but if any degree of softness was desired, an anionic, cationic, or amphoteric component would be necessary.

For nonionic products, the softening effect is provided by a fatty chain with a high molecular weight (i.e., a saturated molecule of C16-C18), and the solubility is produced by condensation with an ethylene oxide chain (EO). [21]

They have the general formula $R(OC_2H_4)nOH$ or $R(_C2H_4)nOOH$ (where R = alkyl), and their active constituents include various nonionic substances such as fatty alcohols, ethoxylated fatty alcohols and fatty amines, paraffin, and oxidized polyethylene waxes. Emulsifiers could be required to create stable emulsions. [22]

The following are a few methods for producing EO condensation:

(1) A soft, silky, scroops handle is provided by the fatty acids that create a fatty acid polyglycol ester (R-COO-(CH_2-CH_2-O)n-CH_2-CH_2-OH).
(2) With the formation of alkylamine polyglycol ether (R-NH-(CH_2- CH_2-O)n CH_2-CH_2-OH) or fatty acid polyglycol ether (R-CONH-(CH_2-CH_2-O)n CH_2- CH_2-OH) by fatty acid amines and amides. These materials offer a much softer handle.
(3) Fatty alcohols have the general formula R-CH_2O-(CH_2-CH_2-O)n CH_2-CH_2-OH and offer intermediate softness.

All types of fibers, including natural and synthetic ones, can be softened with nonionic softeners.

For light hues, they can be applied directly to the dye bath without any additional washing or cationic or anionic product combining. Although they can be used everywhere, they don't soften as much as cationic and anionic products.

By oxidizing polyethylene melt with air under high pressure, hydrophilic groups (like carboxyl) can be added. Alkali allows for the creation of extremely stable emulsions. These inexpensive softeners have great lubricity and are stable in high temperatures and extreme pH conditions, but they are not durable in dry cleaning. They are compatible with the majority of textile chemicals. [21, 23]

Nonionic softeners don't have an electric charge and don't have much of an attraction for fabric. They are typically employed in forced application techniques including padders, sprays, and foaming. They are occasionally employed by exhaust processes in winches, jiggers, and jets, as well as yarn dyeing equipment. They can be mixed with any electric charge-carrying nonionic and ionic active products. They are nearly non-yellowing and stable at high temperatures. They are particularly ideal for white objects that have been optically brightened. They have the best resistance to heavy metal and alkaline earth salts when compared to anionic and cationic softeners. Although pseudo-quaternary compounds do not act entirely like nonionic compounds, they do behave similarly and offer the best balance between softness and bath stability/compatibility. [24-26]

The literature describes a wide variety of nonionic compositions for softening textile textiles. These nonionic textile softening formulations have a lot of benefits, but many of them also have a lot of drawbacks. Many nonionic softeners are waxy or gummy in nature, which makes it challenging to weigh, measure, combine, and disperse them with other textile agents as well as to put them in a form that can be easily handled and applied to textiles, such an aqueous dispersion. To create products with 10–30% activity, many softener compositions are diluted with water, creating viscous liquids or pastes that are challenging to pour or pump and that are difficult to further dilute in cold water. [24]

Many nonionic softeners are easily capable of adding softness to textile material treated with them, but they have the drawback of causing treated textile material to turn yellow over time or when exposed to high temperatures. While many textile compositions don't have the aforementioned drawbacks, they do have another drawback that prevents them from being used in the business, such as being too expensive. Due to these factors, the industry needs a nonionic textile softening composition that is readily dispersible in water, economical, imparts improved softness to treated textile material, and improves resistance to yellowing when heated to high temperatures and aging. [21]

This need may now be satisfied by an improved nonionic textile treating composition made up of the following ingredients:

(1) Between 70 and 80 percent by weight of a blend of linear and branched C18-C32 aliphatic, monohydric alcohols and C24-C40 aliphatic hydrocarbons, said blend having a melting point between 43 and 50 degrees Celsius;
(2) A mix of (1) adequate to supply 1 mol of hydroxyl groups and about 15–25% by weight of the etherification reaction product of 30–50 mols of EO;
(3) A polyoxyethylene ether of oxodecyl alcohol that is 3–10% by weight and has a mole ratio of 5–10 for the oxyethylene to oxodecyl alcohol groups. When applied to textile materials, the nonionic textile treatment compositions of this invention can be made into a fluid, pourable, easily handled dispersions of 10–30% dispersed solids. [24, 27]

Alkyl poly glucosides (APG)

Alkyl poly glucosides are eco-friendly and natural surfactants produced from renewable resources (Persson, Kumpulainen, and Eriksson 2003). They have green chemical characteristics of low toxicity and good biodegradability as they break down into harmless products on degradation without persisting in the environment. They are nonionic in nature containing a spectrum of sugar-based hydrophilic head groups and a hydrophobic hydrocarbon tail with alkyl chain lengths, contributing to their common use in cosmetics, agricultural, household, pharmaceutical, and oil recovery aspects.

APG (Alkyl polyglucoside) is a nonionic biosurfactant that is derived from fatty acids and glucose [3]. These surfactants can be made using starch, glucose, and fatty alcohols as source ingredients. These goods are regarded as renewable because they are made from maize and other grains. A combination of molecules with hydrophilic sucrose and hydrophobic alkyl parts is the result of the reaction utilizing acid catalysts. [4, 5] APG replaces surfactants like lauryl sulfate and lauryl ethoxy sulfate and has a softer effect on the skin when used as a foaming agent in detergents. [6] Biopolymers, which are less toxic and biodegradable, are frequently employed as stabilizers. [7-9]

Many various industries, including the oil industry, the food industry, and the pharmaceutical industry, frequently use modified xanthan gum. By stabilizing and thickening emulsions, modified xanthan gum may solve two issues. The stability of an oil-in-water emulsion is the focus of this work. The emulsion's continuous phase is made up of aqueous solutions of silicon dioxide nanoparticles (SiO_2), alkyl polyglycosides (APG), and modified xanthan gum (XG-g-MMA). Kerosenewas is employed as the dispersed phase. Grafting with methyl methacrylate was used to prepare modified XG to enhance its characteristics. The stratification time was measured, and the rheological characteristics and droplet sizes of emulsions were evaluated to ascertain stability. The outcomes demonstrated that emulsions based on XG-g-MMA and APG have superior qualities than those based on XG and sodium lauryl ethoxy-sulfate (SLES). Emulsions with 0.3% XG-g-MMA, 5% APG, and 0.2% SiO_2 showed stability for up to 2 years, while 0.3% XG-only emulsions were stable for up to 1 year. [27]

Reverse micellar dyeing of cotton woven fabrics using APG (Alkyl polyglucoside) biodegradable nonionic surfactants in D5 siloxane-safe solvent was examined with various functional groups of reactive dyes, and the resulting qualities were compared with those of traditional water-based dyeing method.

The findings of the experiments show that the APG reverse micellar dyeing process is superior to the traditional aqueous dyeing approach in terms of color yield (K/Ssum value) and color reflectivity (better dye uptake). Both approaches often produce fabrics with high washing fastness (ratings 4-5 for color change and stains). [19]

In non-aqueous mediums, hetero-bifunctional reactive dyes provide the greatest amount of color (K/Ssum value), followed by homo-bifunctional and then mono-functional reactive dyes. Homo-bifunctional reactive dyes produce the narrowest range of a* and b* values in terms of CIEL*a*b* value, followed by hetero-bifunctional reactive dyes and mono-functional reactive dyes. Contrary to hetero-bifunctional reactive dyes, which have worse levelness and greater levelness variance, mono-functional reactive dyes and homo-bifunctional reactive dyes typically lead to the best leveling qualities with the smallest levelness variation. After the washing fastness test, the color fading characteristics of colored materials were also assessed.

Color yield (K/Ssum value) of water-dyed and APG reverse micellar-dyed samples generally decreases less than 20% after the test. Reflectance curves of water-dyed and APG-dyed samples shift upward slightly and identically with higher reflectance percentages. Both water-dyed and APG-dyed samples reveal higher L* values and become lighter in shade. The a* and b* values are green-shifted, and blue-shifted, respectively, with lower values. color levelness is least affected by the washing fastness test since most of the water-dyed and APG-dyed samples obtain good to excellent levelness before the test. [28]

Cleaning supplies are essential for maintaining personal and environmental hygiene, and they are used in commercial, residential, and industrial settings. Due to their widespread use and potential long-term environmental effects, detergents are typically made from Nonylphenol ethoxylate (NPE); as a result, raising awareness of the impact of NP as a pollutant is crucial. Additionally, legislation requiring the appropriate use and handling of NPE is strongly advised, particularly in developing nations with no regulatory framework. As a result, a detergent was created employing Alkyl polyglucoside (APG) instead of NPE. The detergent with APG demonstrated decreased surface tension, and CMC demonstrated improved detergent penetration in the studied fabrics. Additionally, it was shown that 64% of the stains studied had improved detergent capacity and that bacteria could be effectively inhibited from growing. Overall findings indicate that NPE can be replaced by APG.

Additionally, this substitution enables a cleaner and more effective manufacturing process, resulting in lower expenses for both the economy and the environment. The development of green technology demonstrated the numerous advantages that natural surfactants provide in terms of accessibility, efficacy, and environmental safety. Additionally, the findings of this study offer fresh and practical data that may be utilized as a foundation for future research and to help businesses produce cleaner detergents. [2]

Glycerol-Based Surfactants

Glycerides, also referred to as acylglycerols, are esters made of glycerol and fatty acids. Three hydroxyl functional groups exist in glycerol, and each of these groups can be esterified with one, two, or three fatty acids to produce a particular monoglyceride, diglyceride, or triglyceride. Triglycerides, which are found in fats and vegetable oils, can be broken down into monoglycerides and diglycerides (also known as partial glycerides) by the action of natural enzymes.

The nonionic surfactant known as pure partial glycerides has no charge. Pure monoglycerides and diglycerides have a wide range of uses since they are excellent and efficient surfactants. As a food additive, emulsifier for oils and waxes, thickening agent, anticaking agent, and preservative, as well as a control release agent and solidifier for medicinal substances, glycerol monostearate (GMS) is a monoglyceride. Seventy-five percent of the food emulsifiers used worldwide are made of magnesium stearate (MG) and its derivatives.

The three main crystalline forms of partial glycerides areα, β, and β′. The most functional crystalline forms, which can be transformed into the most stable and moderately functional forms, are the β form. Glycerol-based surfactants can be created by transesterifying glycerol with natural fats or oils or fatty acid methyl esters or by directly esterifying glycerol with fatty acids. By using inorganic catalysts and high temperatures to glycerolyze fats and oils, mono- and diglycerides can be chemically synthesized. [29]

Bio-based non-ionic surfactants

"Green surfactants" are biobased amphiphilic compounds that can be synthesized from renewable basic materials or derived naturally. They are also referred to as "biosurfactants" on occasion. Direct chemical synthesis or direct extraction from raw materials derived from animals or plants are examples of first-generation biosurfactants. Green surfactants or biosurfactants can be produced by chemically modifying a variety of source materials.54 Triglycerides, carbohydrate sources, and certain organic acids have all proven to be particularly beneficial as building blocks for the creation of green surfactants. Saponins, fatty alcohol sulfates, fatty acid methyl ester sulfonates, sugar esters, alkyl polyglucosides, and alkanol amines are a few examples of non-ionic surfactants made through chemical synthesis. [30]

- Fatty alcohol alkoxylate
- Fatty acid alkoxylate
- Alkyl polyglucoside
- Sorbitan ester
- Alkanoyl-N- methylglucamide
- Alkyl ethoxylated mono- and diglycerides
- Polyglycerol esters

Conclusion

Surface active agents (SAAs), a group of compounds, are found in a variety of products, such as detergents, fabric softeners, soaps, pigments, adhesives, inks, and anti-fogs. There are multiple uses for surface active agents in the various technical textile processing unit operations. With a focus on certain processing applications, a wide range of surface active products have been created from the creation of sulfated oils around 1870 up through the present decade. The transformation of textile fibers into various types of textiles, from scouring fibers or filaments to yarns or fabrics, involves numerous processes that require fabric treatments in aqueous solutions. Surfactants can aid in the rapid and uniform wetting of the fiber surfaces required when using water as a processing medium for textiles.

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6. Author Declarations

The authors declare that the data supporting the findings of this study are available in the article

The authors declare that there is no conflict of interest.

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استخدام مواد التوتر السطحي الغير ايونية في صناعة المنسوجات

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الملخص

المواد الخافضة للتوتر السطحي هي مواد كيميائية متخصصة تستخدم على نطاق واسع في الصناعات الغذائية والأدوية والمنسوجات والزراعة والمواد اللاصقة والجلود والتنظيف ومستحضرات التجميل. من الناحية الهيكلية ، نظرًا لأن المواد الخافضة للتوتر السطحي تمتلك كل من المجموعات المحبة للماء والطارئة للماء ، فإنها تمتص بسهولة على السطح أو واجهة المحلول عند إذابتها في المذيبات مثل الماء والزيت. يؤدي ذلك إلى تقليل التوتر السطحي أو السطحي للمحلول ، مما يضفي عليه خصائص فريدة مثل قابلية البلل والاستحلاب وقابلية الرغوة والتشتت. قد تكون المواد الخافضة للتوتر السطحي مطلوبة أيضًا للتنظيف والصباغة المستوية والوظائف الأخرى ، ويعتمد اختيار الفاعل بالسطح المعين لوظيفة معينة على مدى تفاعله مع الألياف و / أو مكونات النظام الأخرى. تشمل إجراءات الوحدة في معالجة المنسوجات إزالة الشعر ، والكشط ، والتبييض ، والصباغة ، والطباعة ، وتطبيق التشطيبات الوظيفية.

الكلمات الرئيسية: خافضات سطحية ، غير أيونية ، منسوجات ، منظفات