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THE EFFECTS OF GUMS AS EMULSIFIER ON THE EMULSION STABILITY IN COSMETIC FORMULATION

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THE EFFECTS OF GUMS AS EMULSIFIER ON THE EMULSION STABILITY IN COSMETIC FORMULATION

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Abstract

This study analysed the effects of gum as emulsifiers on the emulsion stability in cosmetic formulations that were obtained from several articles. Emulsion-based formulations, where surfactants and emulsifiers play a contrasting but equally important role, are widely used in medicines, food and cosmetics. In order to allow droplet dispersion of one phase at a time, both are able to adsorb at the oil and water interface. In cosmetic and pharmaceutical applications, emulsions are commonly used. The emulsions are lotions, creams and certain ointments, gels, as well as pastes. The type of emulsion produced by either oil-in-water or water-in-oil depends primarily on the polysaccharide used in the emulsification process and the quantity of each step that could affect the stable emulsion forming process. Naturally occurring polymers are currently of primary importance, among which polysaccharides, due to their simple accessibility, eco-friendly and non-toxic nature, occupy superior positions. The called microbial polysaccharide gums have a number of cosmetic functions, including emulsion stabilizer, film former, binder, viscosity-enhancing agent, and skin-conditioning agent. Since emulsions are not thermodynamically stable systems, they can be separated by various physicochemical processes, such as gravitational separation, flocculation andcoalescence. The use of stabilizers is therefore required for the formulation of emulsions and for theirlong-term stability. Natural gums are released in tear-like, striated nodules or amorphous lumps from trees and shrubs. Synthetic gums are often taken advantage of by natural gums because they are accepted by clients. A change to a biocompatible oil is appropriate for a cosmetic or pharmaceutical application, but this also causes drastic changes or changes in the stability of the emulsion. The characteristics that have been analysed to measure the stability of the emulsion in gums are particle size, storage state, zeta potential and treatment process. In the result, the stability of the emulsions could be stabilised when particle size is small which lead to decrease in droplet aggregation. Due to the findings, as such, Xanthan Gum is the most stable gum compared to Arabic gum and Guar gum with the droplet size at 2934 nm. Another parameter that is a storage condition that corresponds to one of the variables that increases the stability of the emulsion, which is the size of the droplet emulsion. Emulsion stability is thus achieved as the particle size decreases as the number of days' increases. Zeta potential is an important parameter for stabilising emulsions. The highest value of the zeta potential leads to an increase in the viscosity of the emulsions. Zeta potential value improves more stabilisation of the emulsions by increasing the value of the zeta potential and resulting in high stability of the emulsions.

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1. Introduction

Emulsion consumers are found in many chemical, energy and environmental industries, such as food, health care, chemical synthesis, and firefighting industries. A mixture of two immiscible liquid phases is the emulsion, in which one phase is dispersed into another. Water-in-oil emulsions are formed spontaneously during oil refining when oil and water are mixed together and in the presence of asphaltene as a naturally occurring surfactant. The droplet size variance is an important parameter affecting the stability and rheological properties of the emulsions. (2018, Goodarzi).The emulsion generation method is called emulsification, which needs a large amount of mechanical energy. Emulsification is a complicated and non-spontaneous process and the droplets need energy to be produced. (2018, Akbari). In any emulsion formulation, emulsifiers are one of the most important stabilizers used. The interfacial stress between the two immiscible liquids is reduced by the emulsifiers or stabilizers, reducing the repelling force between the two liquids and decreasing the attraction between the molecules of the same liquid. The theory of plastic or interfacial film explains that the emulsifying agent is located at the water-oil boundary, forming a thin film by adsorption on the surface of the droplets of the internal step. 2017;8(1):39-47). (Sys Rev Pharm).

Polysaccharides, such as gums and mucilage, are functionalized, accessible, easily obtainable and non-toxic substances of native origin compared to synthetic polymers (Albuquerque, 2016). As a principle, gums are complex carbohydrate molecules that have the ability to bind water and form gels at low concentration. There are many gums, such as seed gums, exudate gums, microbial gums, mucilage gums, seaweed gums, etc., of different kinds. Exudate gums are vegetable gums that ooze from leaves as a part of an injury prevention mechanism. Due to its simplicity existence, exudate gums have been used by humans since ancient times for different purposes. The main characteristics that make them ideal for use in various applications are viscosity, adhesive property, stabilization effect, emulsification action and surface active property (ShewetaBarak,2020). They are usually insoluble in hydrocarbons, ether, or alcohols, such as oils or organic solvents. In order to give a viscous solution or jelly, gums are either water soluble or absorb water and swell up or scatter in cold water. The use of gums relies, often at a cost below that of synthetic polymers, on theinherent properties they have (2016, Albuquerque). In so many fields of biotechnology, food, but recently their purposes have been explored as edible coatings to enhance fresh vegetables and vegetable shelf-life, industrial and healthcare areas have recently received a great deal of interest in the prospective use of natural gum polysaccharides. (2017, Saha). As a disintegrant, emulsifying agent, suspending agents and as binders, natural gums obtained from plants have diverse applications in drug delivery. In formulating immediate and sustained-release planning, they have also been found useful.

Synthetic or natural gum elastomers have an adhesive-like character that allows them to adhere to any surface if not properly discarded (Mehta, 2017). The gum bases used today are therefore still of synthetic origin. They are very complex and rely on the interaction of a number of specialised ingredients to ensure the desired results.

Emulsions occur with two immiscible fluids and are stabilised in the interfacial area by the emulsifiers. Emulsion-based systems are widely used as food and cosmetic products and pharmaceutical dosage forms due to their easy formulation and enhancement of active agents and drug solubilisation. (Patel, 2019). The stability of the emulsions during storage is very important. The term 'emulsion stability' therefore refers to the ability of an emulsion to resist this breakdown, as indicated by growth in average size of droplets or change in their spatial distribution within the sample (Wei, 2020). The consistency of the emulsions results in the surface floating of the droplets, the cohesion between the droplets and, eventually, the cremation and separation of the droplets. These systems are usually stabilize by emulsifiers which, in the long term, are increasingly linked to environmental and health concerns (2017, Dickinson). The zeta potential, which is one of the parameters that contributes to the stabilisation of the emulsions, is one of the factors affecting the stability of the emulsion. Zeta potential reveals the existence of the electrostatic potential close to the surface of the droplet.Higher zeta potential indicates higher electrostatic repulsion and separation distance between droplets resulting in reduced flocculation and aggregation. (Thaiphanit, 2016). The highest value of the zeta potential will result in high viscosity. Emulsion stability was more stable with a high value of zeta potential and viscosity.

Pickering emulsions are emulsions stabilised by solid nanoscale and microscale particles. Solid particles commonly used in Pickering emulsions include polysaccharides, proteins and lipids (Wongkongkatep, 2019). Compared to traditional surfactant-stabilized emulsions, Pickering emulsions are extremely stable for Ostwald maturation and coalescence, biocompatibility and environmentally friendly (Zhu, 2019). The two major reasons why solid particles can replace surfactant molecules to stabilise the emulsion are that solid particles with smaller particle diameters produce higher desorption energy for the emulsion, which can require solid particles to adsorb at the oil-in-water interface, and solid particles act as a natural wall between oil droplets to prevent condensation (Nazar, 2020). Advantages of Pickering emulsions have included the ability to stabilise high internal phase emulsions, irreversible interfacial adsorption and excellent stability against coalescence, aggregation and Oswald maturation (Xiao, 2016).

Carboxymethyl starch (CMS) is one of the most important starch derivatives synthesized with carboxymethyl groups (-CH2COOH) by etherification of free starch hydroxyl groups (Zhang, 2017). In addition, CMS has many special properties, such as excellent flexibility, solubility in cold water, enhanced stability and transparency of past storage. Therefore, CMS is biodegradable, hydrophilic and a relatively inexpensive green polymer that has drawn a great deal of research and industry interest. In view of its excellent stabilizing properties, CMS has been used for encapsulating compounds such as isoproturon (Wilpiszewska, 2016).CMS may also be used for colon-targeted delivery as a possible carrier of biologically active compounds (Vashisht, 2015). Starch, safe, non-toxic, biodegradable and inexpensive, is abundant in nature (García-Tejeda, 2018). CMS has the functions of thickening, preservation of water, and emulsion stabilization. It can also replace the more costly Arabic gum, gelatin and protein, simplify manufacturing processes and reduce costs (Mohapatra, 2019). The incorporation of carboxyl groups into natural starch requires both amino and