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A Novel Tool for Cosmetic Formulators: Pickering Emulsions

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Introduction

The production of stable emulsions is a significant difficulty for the cosmetics industry, which has sparked extensive research into using colloidal particles in place of traditional molecular stabilisers. By enhancing the stability of the produced dispersions, they enable lowering the dangers and concerns related to the employment of traditional molecular stabilisers. Because they have several benefits over traditional emulsions, particle-stabilized emulsions (also known as Pickering emulsions) may provide new opportunities for cosmetic formulators.

Description

Colloidal dispersions called emulsions are made of two immiscible liquids, one of which is dispersed as a droplet into the other (dispersed phase) (continuous phase). The interface between the two immiscible liquids, however, exhibits considerable surface energy, leading to thermodynamic instability. Emulsion instability results from this, even if it is possible for it to be kinetically stopped for a very long time. Different processes, such as flocculation, creaming, coagulation, coalescence, phase inversion and Ostwald ripening, are some of the processes that can occur. The most widely used technique for stabilising emulsions involves the application of surfactants or amphiphilic polymers, which help to lower the interfacial tension between the two fluids by producing a molecular layer surrounding the liquid droplets [1].

Cosmetic emulsions are frequently extremely complicated polydisperse multicomponent mixes made of two liquids (water/hydrophilic base liquid and oil/hydrophobic base liquid), many active surface molecules (stabilisers) and other additives. The latter can add to the functionality or sensory experience connected with using the formulation, give aroma, or simply improve the quality of the finished product (e.g., increase their stability or modify their viscosity and texture) [2]. The most often used stabilisers of cosmetic emulsions are traditional surfactants, such as tween 80, span 80, sodium laureth sulphate (SLES), sodium lauryl sulphate (SLS), sodium dodecyl sulphate (SDS), cocamidopropyl betaine (CAPB), or polyethyleneglycol ethers.

Ramsdem and Pickering introduced Pickering emulsions more than a century ago and in the past two decades, they have seen a significant development. Pickering emulsions may now be made with specific desired qualities, opening up a wide range of possibilities for the development of new goods in a variety of markets, including the cosmetics market. In fact, the employment of particles enables the modification of the sensory experience during application, the look and texture of the final product and the nature of the emulsions, the organisation of the droplets and viscosity. This enables the creation of cutting-edge cosmetic formulas and multipurpose delivery methods [3].

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Any technique typically utilised for creating surfactant-stabilized emulsions may be used to create Pickering emulsions. However, when Pickering emulsions are taken into account, it is preferable to use high-energy techniques, such as rotor-stator or high-pressure homogenization, or sonication, to make sure that the formation of droplets can occur on a similar time scale as the trapping of particles to the nascent droplet/continuous phase interface. Growing interest has been shown recently in the creation of Pickering emulsions using membrane emulsification and microfluidic methods.

The high-speed rotation of a bladed rotor coupled to a stationary stator results in the formation of droplets, which is the basis of the rotor-stator technique. Therefore, the high-speed rotation of the liquid and the shear forces that emerge between the rotor and the stator combine to produce droplets and this allows for the control of droplet sizes by altering the homogenization time and rotation speed. Due to its simplicity and low cost, this technology opens up a lot of possibilities for the creation of emulsions. Furthermore, the rotor-stator homogenization method for emulsion formation is reasonably quick and adaptable [4].

The multistep procedure known as high-pressure homogenization falls under the category of continuous emulsification. This process starts with a pre-emulsification step those results in the formation of coarse emulsions. These emulsions are then passed through the high-pressure homogenizer's slits, where a fine emulsion is created by combining cavitation, turbulence and shear forces to transform the initial coarse emulsion into a fine emulsion. When using high-pressure homogenization, it frequently results in the generation of more homogenous droplets that are smaller in size than when using rotor-stator homogenization.

By forcing a pure dispersed phase or initial coarse emulsions through a microporous membrane under carefully regulated injection rate and shearing conditions, membrane emulsification creates emulsions. The size of the membrane's pore, the viscosity of the liquid phases and the interfacial tension all affect the characteristics of the resulting emulsions. Membrane emulsification is a low-energy technique that enables the creation of homogeneous droplet emulsions. However, it takes a lot of time and is only effective with low viscosity systems [5].

Conclusion

Due to their improved stability compared to traditional emulsions and a variety of other advantageous qualities for finished goods, Pickering emulsions are gaining popularity in the cosmetics sector. Pickering emulsions, for instance, can make it easier to vectorize certain actives for topical treatments. Pickering emulsion usage in cosmetics also has a number of benefits that can help with the creation of more effective products.

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