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Commentary

Preparation Methods of Membrane Emulsification (ME)

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DESCRIPTION

Membrane Emulsification (ME) is relatively a new technique to produce all types of single and multiple emulsions for Drug Delivery Systems (DDS), solid micro carriers for encapsulation of nutrients, solder particles for surface mount technology, mono disperse polymeric microspheres, enzyme carriers, and liquid crystal display spacers. It was introduced in Japan by Nakashima and Shimizu in the late 1980s. In this process, the disperse phase is forced through the pores of a micro porous membrane directly into the continuous phase. Emulsified droplets are formed at the end of the pores with a drop-by-drop mechanism. The advantages of Membrane Emulsification (ME) over Conventional Emulsification (CE) processes enables very fine emulsions of controlled droplet size and narrow droplet size distributions. Emulsification can be successfully performed with less emulsifier, energy consumption, and the reduced effect of shear stress, Membrane Emulsification (ME) allows the usage of shear-sensitive ingredients such as starch and proteins.

The membrane emulsification process is generally carried out in a cross-flow mode (continuously) or in a stirred cell (batch wise).It is the process of dispersing two or more immiscible liquids to form a semi-stable mixture. In food applications, these two liquids generally consist of an organic phase (oil) and an aqueous phase (water) stabilized by the addition of a food-grade emulsifier (surfactant). An important limiting factor of membrane emulsification was the low dispersed flux of the phase. In order to expand industrial applications the productivity of this process has to be increased, where some research has been focused on solving this problem along with other problems like membrane fouling.

Liquid emulsion membranes are widely used for recovery of metal ion and organic compound due to the rapid extraction and it is a one-step stripping operation. Liquid emulsion membranes are essentially double emulsions stabilized with surfactants. Emulsification is the process of breaking down the fat into smaller blood cells, which makes it easy for enzymes to digest food. Fat emulsification helps to digest fats into fatty acids and glycerol, which are easily absorbed in the small intestine. Emulsifiers thus form and stabilize oil-in-water emulsions such as mayonnaise also emulsifiers uniformly disperse oil-soluble flavors evenly throughout the product, prevent the formation of large ice crystals in frozen products like ice cream, and also improves the uniformity and fitness of baked products. An emulsion is a stable dispersion of more immiscible liquids held in suspension by small percentages of substances is called as emulsifiers.

Surfactants adsorb at the interface between oil and water and thus reduce the surface tension. An emulsifier is a surfactant that stabilizes emulsions. Emulsifiers coat droplets within an emulsion and prevent them from fusing together. There are three types of emulsions such as temporary, semi-permanent and permanent emulsions. An example of a temporary emulsion is vinaigrette, while mayonnaise is a permanent emulsion that gives the potential for rapid polymerization to produce high molecular weight polymer with low polydispersity. The viscosity of the polymer emulsion is lower than that of straight polymer in melt phase. It is easier to process, but also allows for the production of polymers that are extremely sticky as 100% polymer. Emulsifiers stabilize an emulsion by reducing the interfacial tension between the two liquids that make up the emulsion.

Emulsifier is also called as emulsifying agents, which stabilize an emulsion by reducing the surface energy between the two liquids forming the emulsion by making a film between the medium and the suspended particles. An emulsifying agent is a surface-active ingredient that adsorbs the newly formed oil-water interface during emulsion preparation, and it protects the newly formed droplets from instantaneous recoalescence.

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