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REVIEW ARTICLE

Microemulsification of Fish Oil Offering a New Dimension in Fish Processing Technology: A Review on Its Chemical Properties and Ionic Interactions

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ABSTRACT
Microemulsions are transparent and thermodynamically stable mixtures of oil and water stabilized by surfactants. Microemulsions contain extremely high oil/water interfacial areas offering ultra-low interfacial tension (less than 0.1 mN/m). Practical applications of microemulsion systems include enhanced oil recovery (EOR), drug delivery, nanoparticle synthesis food and cosmetics.
Keywords: *Chemical interactions, Fish oil, Microemulsion*

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INTRODUCTION

A microemulsion is a transparent or nearly transparent, quasi-homogeneous, thermodynamically stable mixture of two immiscible liquid stabilized by surfactant (or mixture of surfactant). As pharmaceuticals drug delivery systems, microemulsion have unique properties, including clarity, high stability and ease of preparation [1]. The transparency of microemulsions makes them especially attractive for cosmetic formulations as they give the perception of a clean system. The ultralow interfacial tension between oil and water facilitates the penetration of the production to nanoscale pores of human skin, making microemulsions a candidate for deep-cleansing products [2].

Due to their physicochemical properties, microemulsion often advantages over traditional topical and transdermal drug delivery systems. Moreover, microemulsion dispersion are promising candidates as means for controlled drug delivery, and as drug carriers for oral, topical, and parenteral administration furthermore, microemulsion have been shown to process promising potential in the fields of cosmetic and various consumer products [3].

CHEMICAL PROPERTIES OF MICROEMULSION

Ionic liquids are receiving much attention as environmentally benign media for reactions, separations, and multidisciplinary chemistry, due to their unique physicochemical properties which include non-volatility, high stability, high ionic conductivity, wide electrochemical window and easy recyclability. Microemulsion formulations find their application where ionic liquids are used as oil substitutes, water substitutes, co-surfactants (additives) and surfactants [4].

Microemulsification of triglyceride-based oil is challenging due to the formation of undesirable phases such as macroemulsions, liquid crystals, or sponge phases. This research evaluates the formation of artificial sebum microemulsions using linker molecules, with the addition of co-oil to help enhance sebum solubilization. The microemulsion consists of a lipophilic linker (sorbitan monooleate), a hydrophilic linker (hexylglucocide), a main surfactant (sodium dioctyl sulfosuccinate), a co-oil, and artificial sebum. The effect of adding co-oil to the phase behavior and the microstructure of the resulting microemulsion is described. The effect of several types of co-oil is also studied; the co-oils evaluated here are squalene, squalane, isopropyl myristate, and ethyl laurate. The effect of salinity on the microemulsion phase behavior is also presented. Fish diagrams are obtained by plotting total surfactant/linker concentration as a function of sebum fraction in the oil mixture (co-oil + sebum). Different microemulsion types (Winsor

Types I, II, III, and IV) are formed, depending on the total surfactant/linker concentration and the fraction of co-oil in the oil mixture. Winsor Type IV (single-phase) microemulsions are observed at high surfactant/linker concentrations. These single-phase, isotropic, and low-viscous fluids are particularly useful for cleansing and delivery of functional ingredients in skin care products. Salt addition shifts the fish diagram towards more hydrophobic oil systems and higher surfactant/linker concentrations [8].

Microemulsions as drug delivery system

The oral delivery of hydrophobic drugs represents a major challenge because of the low aqueous solubility. Self microemulsifying drug delivery systems (SMEDDSs) have gained exposure for their ability to increase bioavailability and solubility of poorly soluble drugs. The efficiency of oral absorption of the drug compound from the SMEDDS depends on much formulation related parameters, like surfactant concentration, oil/surfactant ratio, polarity of the emulsion, droplet size and charge, all of which in together grouped to determine the self-emulsification ability. Thus, only very specific pharmaceutical excipient combinations will lead to efficient self-microemulsifying systems. SMEDDS are isotropic mixtures of oils, surfactants/ solvents and co-solvents/ co-surfactants can be used for the design of formulations in order to improve the oral absorption of highly hydrophobic drug compounds. SMEDDS can be orally administered in soft or hard gelatin capsules and form fine relatively stable oil-in-water (o/w) emulsions upon aqueous dilution owing to the gastro intestinal motility of the gastrointestinal fluids. Although many studies have been carried out, there are few drug products on the pharmaceutical market formulated as SMEDDS confirming the difficulty of formulating lipophilic drug compounds into such formulations. The fact that almost 40% of the new drug compounds are lipophilic in nature states that studies with SMEDDS will continue, and more drug compounds formulated as SMEDDS will reach the pharmaceutical market in the future [5].

Microemulsification of fish oil

The novel fish oil O/W microemulsion system is formed with food-acceptable components, Tween 80, ethyl oleate, fish oil and water. We studied the influence of fish oil proportion in the oil phase on the microemulsion regions. We investigated this system using the dynamic light scattering and transmission electron microscopy; the rheological characteristics and release effect were also explored. The obtained results indicated that the particle sizes of spherical droplets in microemulsions depend significantly on the total oil phase content, varying from 5 to 198 nm. The rheological measurements showed that all studied microemulsions followed shear thinning behavior. Well-controlled release profile of the fish oil microemulsions was found in different dialyzate solutions [6].

Benefits for storage and shelf-life

Handling and storage of polyunsaturated lipids is a difficult problem due to oxidation. Oxidation products cause reduction in sensory quality and can also have negative physiological effects, all of which obstruct the use of otherwise nutritionally important compounds. Therefore, it is important to find techniques to prevent this quality deterioration. The oxidation of fish oil can be decreased if the oil is transformed into a microemulsion with ascorbic acid and α-tocopherol used as antioxidants. Tocopherol will be localized in the hydrocarbon chain region, whereas ascorbic acid gets accumulated in the polar parts of the microemulsion [7].

CONCLUSION

Microemulsification technique retards the oxidation of fish oil. The peroxide and anisidine values are both drastically decreased when compared to a pure fish oil, which has been demonstrated by keeping samples at 40°C for 18 days. Furthermore an improved effect was seen when ascorbic acid was solved in glycerol instead of in water.

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