Effect of gelation and storage conditions on the oxidative stability of microemulsion and nanoemulsion delivery systems

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Effect of gelation and storage conditions on the oxidative stability of microemulsion and nanoemulsion delivery systems

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Abstract

Increased interest in the use of microemulsion and nanoemulsion delivery systems for medical, cosmetic and food purposes, promotes the development of research on their physical and chemical stability, and the safety of use. Here, we have for the first time evaluated the oxidative stability of linseed oil dispersed in the microemulsion, nanoemulsion, and their gelled systems, stored under different conditions, and compared to the bulk oil. Oxidative stability was determined by measuring the peroxide value and p-anisidine value of the oil phase. All systems had an identical proportion of oil to surfactant mixture and were obtained by low energy methods. Carbopol 940 was used as the gelator. The influence of sunlight in ambient conditions, elevated temperature, oxygen presence and UV radiation on the oxidation of oil in emulsions was determined. The results indicate different influence of the analyzed conditions on the oxidation stages of individual emulsions. Due to the high transparency and small particle sizes, micro-, nanoemulsions, and particularly their gelled forms were the most sensitive to UV radiation. However, the gelation process inhibited the oxidation caused by temperature and the presence of oxygen. In addition, the results show a counter-intuitive result in that, under all test conditions, the oxidative stability of the oil was higher in emulsions compared to bulk oil.

Keywords: microemulsion, nanoemulsion, gelled emulsion, lipid oxidation, linseed oil

1. Introduction

Lipid oxidation is a complex phenomenon, described as a free radical chain reaction divided into three stages: initiation, propagation, and termination. It is one of the major causes of reduced quality of products containing lipids. Reaction of oxidation leads to formation of complicated products with various reactivity, hydrophobicity and even surface activity