Synopsis of Original Research Paper

Precise prediction of the kinetic analysis of destabilization of pharmaceutical emulsions using magnetic resonance imaging and time - temperature superposition principle

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The time–temperature superposition principle (TTSP) was applied to the destabilization kinetics of an emulsion. A cream preparation that is clinically used for the treatment of dermatological diseases was tested as the model emulsion. After storage at temperatures ranging from 30 to 45 °C for designated periods, the emulsion state was monitored using magnetic resonance imaging, and then the phase separation behaviors observed were analyzed according to the Arrhenius approach applying TTSP. The Arrhenius plot showed a biphasic change around 35 °C, indicating that the separation behaviors of the sample were substantially changed between the lower (30–35 °C) and higher (35–45 °C) temperature ranges. This study also monitored the coalescence behavior using a backscattered light measurement. The experiment verified that the destabilization was initiated by coalescence of oil droplets and then it eventually led to obvious phase separation via creaming. Furthermore, we note the coalescence kinetics agreed well with the phase separation kinetics. Therefore, in the case of the sample emulsion, the coalescence behavior has a dominant influence on the destabilization process. This study offers a profound insight into the destabilization process of pharmaceutical emulsions and demonstrates the promising applicability of TTSP to pharmaceutical research.