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Article

Development and Optimization of Dipyridamole- and Roflumilast-Loaded Nanoemulsion and Nanoemulgel for Enhanced Skin Permeation: Formulation, Characterization, and In Vitro Assessment

Abstract:

This study explores developing and optimizing a nanoemulsion (NE) system loaded with dipyridamole and roflumilast, aiming to improve skin penetration and retention. The NE formulation was further transformed into a nanoemulgel to enhance its application as a topical treatment for psoriasis. Solubility studies were conducted to select the oil, surfactant, and co-surfactant. Phase diagrams were constructed using the aqueous phase titration method. All the formulations were in nanoscale, and Formula (F2) (which contains oleic acid oil as the oil phase, a mixture of Surfactant Tween 80 and co-surfactant (ethanol) at a ratio of 1:2 in addition to distilled water as an aqueous phase in a ratio of 1:5:4, respectively) was the selected formula depending on the particle size, PDI, and zeta potential. Formula (F2) has the best ratio because it gives the smallest nanoemulsion globule size (particle size average of 167.1 nm), the best homogenicity (lowest PDI of 0.195), and the highest stability (higher zeta potential of −32.22). The selected formula was converted into a nanoemulgel by the addition of 0.5% (w/w) xanthan gum (average particle size of 172.7 nm) and the best homogenicity (lowest PDI of 0.121%) and highest stability (higher zeta potential of −28.31). In conclusion, the selected formula has accepted physical and chemical properties, which enhanced skin penetration.