

Enhanced transdermal delivery and therapeutic effect of caryophyllene oxide via topical application in a transethosomal system

This study presents the development and evaluation of a transethosomal formulation to enhance the topical delivery and analgesic efficacy of caryophyllene oxide. Nanovesicles containing various concentrations of the active compound were prepared and optimized, with the final formulation characterized by atomic force microscopy and dynamic light scattering, confirming spherical vesicles averaging 450.7 nm in size. In vitro skin permeation studies using porcine ear skin and Franz diffusion cells revealed that the transethosomal system significantly outperformed a conventional emulsion in both skin penetration and retention of caryophyllene oxide. In vivo testing using a mouse pain model showed markedly higher analgesic activity for the transethosomal formulation, achieving an 80.5% Maximum Possible Effect compared to 24.7% for the conventional formulation. Furthermore, mechanistic in vitro assays demonstrated that caryophyllene oxide selectively inhibited COX-2 and modulated AMPA receptor subunit activity, suggesting dual mechanisms for its analgesic effect. These findings highlight the potential of the transethosomal delivery system for effective topical pain management and support further exploration of caryophyllene oxide as a therapeutic agent targeting both COX-2 and AMPA receptor pathways.