**Review Article**

# NANOEMULGEL DRUG DELIVERY SYSTEMS FOR WOUND HEALING APPLICATIONS: FOCUS ON CARVACROL AND ANTIMICROBIAL ACTIVITY

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In this review paper we focused on wound infections remain a major clinical challenge because microbial contamination can delay tissue repair and increase the risk of chronic wounds. Conventional topical formulations such as creams and ointments often suffer from poor drug penetration, low stability, and limited antimicrobial effectiveness. In recent years, nanotechnology-based drug delivery systems have attracted significant attention for improving the therapeutic performance of topical agents. Among these systems, nanoemulgels combine the advantages of nanoemulsions and hydrogels, providing enhanced drug solubility, controlled release, improved stability, and better skin permeation.Carvacrol, a naturally occurring phenolic monoterpene found in essential oils of plants such as Origanum vulgare and Thymus vulgaris, has gained considerable attention due to its strong antimicrobial, anti-inflammatory, and antioxidant properties. These pharmacological activities make carvacrol a promising candidate for the management of infected wounds. However, its clinical application is limited by poor aqueous solubility, volatility, and rapid degradation. Incorporating carvacrol into nanoemulgel systems offers an effective strategy to overcome these limitations by enhancing drug stability, improving bioavailability, and facilitating sustained drug release at the wound site.This review highlights the potential of nanoemulgel-based drug delivery systems for wound healing applications, with particular emphasis on carvacrol-loaded formulations. The article discusses the physiological stages of wound healing, the role of microbial infections in delayed healing, and the advantages of nanoemulgel systems over conventional topical formulations. In addition, formulation strategies, characterization techniques, and in vitro evaluation methods used in the development of carvacrol-loaded nanoemulgels are summarized. Recent advances and future perspectives of nanoemulgel technology in antimicrobial wound therapy are also discussed. Overall, nanoemulgel systems represent a promising approach for improving the therapeutic effectiveness of natural antimicrobial compounds in wound management.

**Keywords:** Nanoemulgel; Carvacrol; Wound healing; Antimicrobial activity; Topical drug delivery; Nanoemulsion; Controlled drug release.

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