

Formulation And Evaluation of Limonene-Loaded Solid Lipid Nanoparticles against *Candida albicans*

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Abstract:

Limonene-loaded solid lipid nanoparticles (SLNs) represent a promising approach in combating *Candida albicans*, a pathogenic yeast responsible for a wide range of infections. Limonene, a natural monoterpene found in citrus oils, exhibits potent antifungal activity, particularly against *Candida albicans*, a major cause of fungal infections in immunocompromised individuals. Preformulation studies confirmed the identity, purity, and compatibility of the drug with selected excipients. Based on solubility screening, Glyceryl monostearate (GMS) and oleic acid were selected as lipid phases, while Tween 20 and Span 60 served as surfactants. The SLNs were prepared using the high-pressure homogenization technique and optimized via a 2² factorial design using Design Expert® software. In vitro release of limonene from gel was studied using a Franz diffusion cell method, and the recovered samples were analyzed using UV spectroscopy at 280 nm wavelength. The optimized formulation showed favorable particle size, zeta potential, and high entrapment efficiency, indicating good stability and nano-size range. Antifungal activity studies comparing placebo SLNs and limonene-loaded SLNs revealed that the latter exhibited good antifungal activity and efficient diffusion out of the lipid matrix. Limonene-loaded SLNs demonstrated strong potential as an antifungal formulation against *Candida albicans*. However, regulatory and reproducibility concerns remain due to the complexity of the formulation and lack of standardized testing methods. Addressing these challenges requires careful optimization of formulation components, manufacturing processes, and quality control protocols.

Keywords: Limonene-loaded solid lipid nanoparticles (SLNs), antifungal activity, herbal formulation, *Candida albicans*

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