

Advancements in Nanoformulations of Thymol and Chlorothymol: Characterization, Comparative Studies and Stability Enhancement

Fatbardha Halilaj¹

Rrona Pozhari¹, Stina Morina¹, Rreze Bajselmani¹, Toskë Kryeziu¹, Aida Loshaj-Shala¹, Andreas Zimmer², Mimoza Basholli-Salihu^{1*}

¹University of Prishtina, Faculty of Medicine, Bulevardi i Dëshmorëve, Prishtina, Kosovo

²University of Graz, Institute of Pharmaceutical Science, Universitätsplatz 1/EG, Graz, Austria

fatbardha.halilaj1@student.uni-pr.edu

*mimoza.basholli@uni-pr.edu

This research investigates the formulation and characterization of nanosystems, specifically nanoemulsions and nanostructured lipid carriers (NLCs), incorporating the active compounds thymol and chlorothymol. Various formulations were developed through high-pressure homogenization, utilizing both nanoemulsions and NLCs.

The study compares two types of NLC formulations—one with 1% surfactant and the other with 4%—combined with varying concentrations of thymol and chlorothymol. Comprehensive characterization techniques were employed, including particle size analysis, zeta potential, and morphological assessments, along with dissolution profiles, rheological properties, and surface tension measurements. Stability studies conducted over 1 day, 2 weeks, and 4 weeks provided insights into the physicochemical properties of these nanoformulations.

The results indicate that tailored nanoformulation strategies can significantly enhance the stability and therapeutic potential of thymol and chlorothymol in targeted applications.

Both thymol and chlorothymol nanoformulations produced nano-sized particles. Nanoemulsions had particle sizes of 70-120 nm, NLCs with 1% surfactant ranged from 60-80 nm, and those with 4% surfactant were around 200 nm.

These findings suggest that the stability and therapeutic potential of thymol and chlorothymol can be greatly enhanced by customized nanoformulation techniques.

Keywords: nanoemulsions, nanostructured lipid carriers, high-pressure homogenization, stability, thymol, chlorothymol.

Mimoza Basholli-Salihu, Aida Loshaj-Shala, Toskë Kryeziu, Fatbardha Halilaj, Rrona Pozhari and Stina Morina are members of NANOALB research group.

References

[1] Talesh AA, Amiri S, Radi M, Hosseinfarahi M. Effect of nanocomposite alginate-based edible coatings containing thymol-nanoemulsion on microbial and physicochemical properties of carrot. *Int J Biol Macromol.* 2024 Jan. <https://www.sciencedirect.com/science/article/abs/pii/S0141813023060956>

[2] Amiri S, Sepahvand S, Radi M, Abedi E. Comparative study of thymol-nanoemulsion vs. thymol-loaded nanostructured lipid carriers. *Curr Res Food Sci.* 2024 Jan 1. <https://www.sciencedirect.com/science/article/pii/S2665927124000303>

[3] Folle C, Marqués AM, Díaz-Garrido N, et al. Gel-dispersed nanostructured lipid carriers for thymol in dermal pathologies. *Int J Nanomedicine* <https://www.tandfonline.com/doi/full/10.2147/IJN.S433686>