Nanocarrier Applications for Beta-Thujaplicin Encapsulation: Characterization and Stability Insights

Rrona Mehmeti
Stina Morina, Rrona Pozhari, Aida Loshaj- Shala, Toskë Kryeziu, Andreas Zimmer, Mimoza Basholli- Salihu*

University of Prishtina, Faculty of Medicine, Bulevardi i Dëshmorëve, 1000 Prishtina, Kosova
University of Graz, Institute of Pharmaceutical Sciences, Universitätsplatz 1/EG 8010 Graz, Austria

rronamehmeti27@gmail.com
*corresponding author: mimoza.basholli@uni-pr.edu

Abstract

β-Thujaplicin, also known as hinokiiol, is a naturally occurring monoterpenoid found in the heartwood of trees from the *Cupressaceae* family, recognized for its broad-spectrum antimicrobial, antiviral, and antioxidant activities. Despite its therapeutic potential, β-thujaplicin's poor water solubility and degradation susceptibility limit its pharmaceutical applications.

To overcome these challenges, β-thujaplicin was encapsulated into two nanoscale delivery systems—nanoemulsions and nanostructured lipid carriers (NLCs)—to enhance its stability and biological activity.
Nanoemulsions, colloidal systems with oil droplets dispersed in water, improve the solubilization of hydrophobic compounds like β-thujaplicin, offering enhanced absorption and bioavailability. NLCs, lipid-based carriers, allow for controlled drug release and improved drug loading. Both systems provide protection from degradation and enable targeted delivery.

Characterization of the formulations, performed using a Malvern Zetasizer, showed particle sizes between 80 and 140 nm, with polydispersity index (PDI) ranging from 0.10 to 0.20, indicating uniform particle distribution. Zeta potential analysis confirmed good colloidal stability for both nanoformulations. Stability studies revealed minimal changes in particle size and PDI over time, highlighting the long-term stability of both nanosystems. These results suggest that β-thujaplicin can be successfully formulated into nanoemulsions and NLCs, providing promising platforms for enhanced drug delivery. Future research will focus on *in vitro* and *in vivo* evaluation to explore their clinical potential.

Keywords: nanoemulsions, nanostructured lipid carriers, characterisation, stability, β-thujaplicin

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

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