

Abstract

Formulation and Characterization of Annatto Oil and Curcumin Nanoemulsions with Wound Healing and Antimicrobial Potential [†]

Gabriella O. Silva ^{1,2,*}, Patrícia A. Oliveira ², Mosar C. Rodrigues ³, Paulo H. Oliveira ^{2,4}, Sebastião W. Silva ¹, Graziella A. Joanitti ^{1,2} and Marcella L. B. Carneiro ^{1,2}

¹ Department of Nanoscience and Nanobiotechnology, Institute of Biology, University of Brasília, UnB, Brasília 70910-900, Brazil; swsilva@unb.br (S.W.S.); gjoanitti@gmail.com (G.A.J.); marbretas@gmail.com (M.L.B.C.)

² Laboratory of Bioactive Compounds and Nanobiotechnology, University of Brasília, UnB, Brasília 70910-900, Brazil; patriciaoandrade@gmail.com (P.A.O.); paulohenriquedeoliveira135@gmail.com (P.H.O.)

³ Department of Genetics and Morphology, Institute of Biology, University of Brasília, UnB, Brasília 70910-900, Brazil; mosarcr@gmail.com

⁴ Department of Biomedical Engineering, Faculty of Science and Engineering Technologies (FCTE), University of Brasília, UnB, Brasília 70910-900, Brazil

* Correspondence: gabriella-oliveira.go@aluno.unb.br

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Introduction Nanoemulsions (NEs) are promising systems to improve the solubility and bioavailability of poorly water-soluble compounds. They consist of two immiscible liquids, typically oil and water, stabilized by surfactants and characterized by high kinetic stability. The aim of this study was to develop and characterize three nanoemulsion formulations, with particular focus on one containing the bioactive compound curcumin. Methodology Three formulations were prepared using a high-energy ultrasonication method: (1) a nanoemulsion containing curcumin, annatto oil, and sunflower oil (NEC); (2) one with annatto and sunflower oils only (NEOL); and (3) one with sunflower oil only (NEB). All were stabilized with 9.0% Kolliphor® ELP of Sigma-Aldrich (St. Louis, Missouri, EUA). Characterization included particle size by Dynamic Light Scattering (DLS) and Transmission Electron Microscopy (TEM), Polydispersity Index (PDI), Zeta potential, pH, density, and Fourier-Transform Infrared Spectroscopy (FTIR). Results All formulations were homogeneous and exhibited hydrodynamic diameter (DH), PDI, and Zeta potential (PZ) values consistent with nanoemulsions. NEC showed values of 263.03 ± 47.94 nm, 0.15 ± 0.13 , and -28.76 ± 2.24 mV, respectively. All formulations displayed acidic pH and similar densities. TEM revealed predominantly spherical particles with dimensions between 50 and 200 nm, while FTIR confirmed the incorporation of curcumin into the NEC formulation. Conclusion In the curcumin formulation, the presence of the bioactive compound did not compromise dispersion or morphological uniformity, ensuring desirable properties such as physicochemical stability and bioavailability, supporting its potential for wound healing and antimicrobial applications.

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