

Assessment of Cumulative Release and *In Vitro* Stability of Curcumin Entrapped in Polycaprolactone (PCL) and Polycaprolactone/Poly(lactic Acid) (PLA) Blend Nanofibers

SPPM Perera¹, RM de Silva^{1#}, and KMN de Silva¹

¹Centre of Advanced Material and Devices, Department of Chemistry, Faculty of Science, University of Colombo, Sri Lanka

#rohini@chem.cmb.ac.lk

Localized drug delivery enhances targeted treatments, especially for drugs with low bioavailability or sensitivity to temperature and pH. Nanofibers offer effective drug encapsulation and controlled release, protecting bioactivity from degradation. Curcumin, with antimicrobial, antioxidant, anticancer, and anti-inflammatory effects, holds medical promise but is limited by poor bioavailability and sensitivity. This study explores the release of curcumin encapsulated in nanocarriers made of polycaprolactone (PCL) and a PCL/poly(lactic acid) (PLA) blend. Both polymers are biocompatible and biodegradable, and electrospinning was used to fabricate the carriers. The innovation lies in assessing curcumin's bioavailability and efficacy at lower concentrations. Encapsulated curcumin's stability was evaluated through its antioxidant activity. The loading capacity (LC) and encapsulating efficiency (EE) of curcumin in PCL/PLA blend nanofibers are higher than in PCL nanofibers, as PLA can interact more effectively with curcumin than PCL. (LC of curcumin in PCL is 25.09 ± 4.42 mg/g, and in PCL/PLA blend is 43.67 ± 1.30 mg/g, EE of curcumin in PCL is 64.84 ± 13.09 %, and in PCL/PLA blend is 87.49 ± 2.64 %). The cumulative release of curcumin from both nanocarriers under physiological conditions was examined. The maximum release occurred after 96 hours for PCL nanofibers whereas, it occurred after 23.5 hours for PCL/PLA blend nanofibers. Curcumin entrapped in PCL nanofibers showed 20.11 ± 6.04 % of maximum release compared to 23.70 ± 4.18 % of curcumin release in PCL/PLA blend. The DPPH scavenging assay was conducted for entrapped and released curcumin from both nanofibers. The scavenging percentage of curcumin released from PCL nanofibers was 33.20 ± 8.95 %, while from PCL/PLA nanofibers was 34.15 ± 0.53 %. Hence, the experimental results prove the compatibility and suitability of using curcumin-entrapped PCL and PCL/PLA blend nanofiber mats as medical dressings.

Keywords: *electrospinning, polycaprolactone, poly(lactic acid), nanofibers, curcumin*