DOI: doi.org/10.47363/JMSMR/NanoMaterials2025/2025(6)4

NanoMaterials 2025: Bridging Material Science, Polymers and Chemical Engineering

Conference Proceedings October 30, 2025 - Dubai,UAE (Virtual)

Quercetin-Loaded Banana Starch Nanoparticles: A Novel Anti-Cancer Delivery System

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Abstract

Nowadays, polymeric nanoparticles are one of the most chosen drug delivery systems for the treatment of life-threatening diseases such as cancer. Drug loading, drug entrapment, and drug release have been the challenges in nano formulations till now. Various researchers are working to improve these limitations. Evaluation of drug loading, entrapment, size release, and activity of prepared starch nanoparticles. In the present study, starch was isolated from a novel source, i.e., unripe banana fruit. Banana starch contains amylose and amylopectin in a certain ratio (26-28:72-74). Banana starch was selected as polymer due its unique composition and function Such as amylose is a straight- chain polymer of D-glucose linked by 1-4 glycosidic bonds, while amylopectin is a branched-chain polymer of D-glucose linked by α-1,4 glycosidic bonds and α-1,6 glycosidic bonds. These structural differences impart unique drug release properties: amylose facilitates immediate release, while amylopectin provides sustained release. This dual release capability makes banana starch an intriguing candidate for drug delivery applications. Quercetin-loaded banana starch nanoparticles were prepared using the nano-precipitation method. Drug loading and drug entrapment were determined by different methods. The percentages of drug loading and entrapment efficacy were found to be 51.9 %. SEM analysis of nanoparticles reports the size of nanoparticles from 66.67 nm to 113.33 nm. In-vitro drug release was found to be 44.84 % within the first hour and 96.96 % within 12 hours. Prepared nanoparticles showed a good antioxidant effect against the DPPH radical scavenging model was found 98 percent. Percentage inhibition of cancer cells at different concentrations (0.001, 0.01, 0.1, 1, 10 µg/ml) of prepared nanoparticles and isolated quercetin were found to be 3.11, 11.52, 54.56, 57.21, 83.48, and 2.38, 2.11, 6.22, 36.92, and 72.45, respectively. Histopathological studies of tissues confirmed that burn-created wounds were healed by prepared nanoparticles within 21 days. Prepared nanoparticles suppressed the anti-inflammatory response, as confirmed by the histopathological studies.