

International Conference on Nurturing Sustainability through Innovations in Science and Technology for Global Welfare



Contribution ID: 29

Type: Poster

Synthesis and characterization of biopolymeric k-carrageenan based Hydrogel/ Silver Nanogel as smart carrier of 5-FU in cancer therapeutics

k-Carrageenan, a red seaweed polysaccharide, offers mucoadhesive, gelling properties for regulated medication release, with pH-sensitive release capabilities. In general, polysaccharide gels are highly desirable for drug delivery due to their ability to react to environmental stimuli like pH, temperature, and enzyme activity. This responsiveness enhances drug delivery precision, selectivity, and therapeutic results, reducing off-target effects and improving therapeutic outcomes. As in chemotherapy, has several challenges, including low drug solubility, non-specificity towards cancer cells, severe side effects, burst release of drug and multidrug resistance of tumor cells. 5-Fluorouracil, is a chemotherapy medication widely used to treat gastrointestinal cancers. 5-FU mimics uracil, a RNA component, disrupting cancer cells' RNA production and DNA synthesis, leading to cell death when incorporated into rapidly dividing cells.

Carrageenan hydrogels and silver nanogels were developed using KCl as a crosslinking agent. The characterization data revealed that the hydrogels/nanogel exhibited excellent swelling capacity, highly porous in structure, and contained a silver nanoparticle. 5-FU was loaded successfully into the gels with high entrapment efficiency. The drug release kinetics of the samples were monitored in a pH-2 buffer system mimicking the gastrointestinal tract environment. Furthermore, hemolytic assay of the gels showed a low hemolysis rate, indicating good biocompatibility. Consequently, the study provides encouraging results for the development of carrageenan hydrogel/ silver nanogel systems as 5-FU delivery carriers, especially under specific pH conditions, with potential applications in biomedical and pharmaceutical research.

Keywords: glyco nanogel, k-carrageenan, chemotherapeutic studies, drug delivery, pH-sensitive release.

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Track Classification: Innovation and Technology for Sustainability