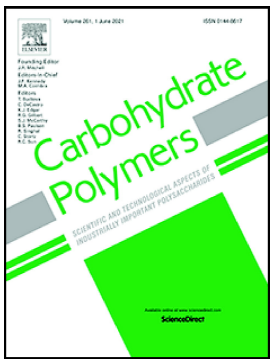

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5‑Fluorouracil loaded magnetic cellulose bionanocomposites for potential colorectal cancer treatment

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Abstract

Magnetic polymer nanocomposites are inherently multifunctional and harbor assorted physiochemical actions for applications thereof as novel drug nanocarriers. Herein, Fe_3O_4-nanoparticles were supported on rice straw cellulose for 5-Fluorouracil carrier abbreviated as MC/5-FU for potential colorectal cancer treatments. Several analyses indicated the

multifunctional properties of MC/5-FU bionanocomposites. Transmission and scanning electron microscopy study demonstrated that Fe_3O_4 nanofillers covered the cellulose matrix. The drug release from MC/5-FU was evaluated under various pH and temperature conditions, showing the maximum release at pH 7.4 and 44.2 °C. In *in vitro* anticancer assay, MC/5-FU exhibited enhanced selectivity and anticancer actions against 2D monolayer and 3D tumour spheroid models colorectal cancer cells. The anticancer effects of MC/5-FU with magnetic targeting and heat induction were also examined. This easily synthesized MC/5-FU indicated the potential in application as a low-cost drug formulation for colorectal cancer treatments.

Keywords: Cellulose; Fe_3O_4-nanoparticles; composites; 5-Fluorouracil; Drug carrier system; Colorectal cancer; Microfluidic; Co-culture.

1. Introduction

Cellulose is a vital component of the plant cell wall and the most abundant biopolymer on earth with a "green fate" manner (Sun et al., 2019). In this manner, the off-field use of rice straw as the second-highest agro waste is intriguing since it contains approximately 45 % cellulose (Yusefi, Bte Rasit Ali, Abdullan, & Shameli, 2020). Cellulose can be isolated from wood-based resources by various methods such as bleaching and delignification to eliminate the amorphous regions and liberate the crystal regions. In addition, cellulose has been treated by for example esterification, etherification, de-polymerization, and alkali treatments to obtain significant surface functional groups, ability to bind with various drugs and metal nanoparticles (NPs), great swelling property, pH gradient, and well biocompatibility (Sun et al., 2019; Yusefi & Shameli, 2021). Hence, cellulose and cellulose-based composites are finding their applications in drug delivery systems.