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SYNTHESIS OF CYCLODEXTRIN-COATED MAGNETITE NANOPARTICLES AS A POTENTIAL DRUG FOR TREATING ATHEROSCLEROSIS

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Cardiovascular diseases derived from atherosclerosis are the most common cause of mortality worldwide. Nevertheless, it has been found that the current drug treatment methods are incapable of regressing atherosclerosis plaques. Some studies have shown that cyclodextrins (CDs) can regress atherosclerosis plaques by dissolving the intracellular and extracellular cholesterol crystals (CCs), which induce an artificial inflammatory response that could destabilize the atherosclerosis plaques. Current work presents a novel synthesis route using the co-precipitation method to synthesize β-cyclodextrin coated magnetite nanoparticles (BCD-MNPs). An inclusion complex (S@BCD-MNPs) was assembled between Simvastatin and BCD-MNPs using the co-evaporation technique to enhance the efficiency of BCD-MNPs performance. Synthesized particles were characterized using powder X-ray diffraction (PXRD), Fourier-transform infrared spectrophotometry (FTIR), scanning electron microscopy (SEM)) and thermogravimetry analysis (TGA). SEM results showed that synthesized BCD-MNPs and S@BCD-MNPs are in the range of (59.51±11.19) nm and (49.41±13.15) nm, respectively. The appearance of characteristic β-CD bands at 1048 cm^{-1} and 3650-3050 cm^{-1}, corresponds to -OC-O-CO- stretching (α-1,4-glycosidic linkages) and O-H stretching (alcohol groups) in BCD-MNPs FTIR spectra confirmed the successful functionalization of BCD-MNPs. Furthermore, TGA data shows 7.18% (W/W) weight loss, corresponding to the thermal decomposition of β-CD in the temperature range of 180-350 °C for BCD-MNPs. Simvastatin loading and Simvastatin releasing profiles in a cholesterol microenvironment were studied with the help of a UV-Visible Spectrophotometer (UV-Vis). Drug loading efficiency was found to be 65.5%. The trend in UV-vis absorbance for the simvastatin release profile in the cholesterol microenvironment shows that the cholesterol content in the medium decreases and the simvastatin content in the medium increases over time.

Keywords: Atherosclerosis, Cardiovascular diseases, Cyclodextrins, Magnetite nanoparticles, Simvastatin