ABSTRACT

The present work in this thesis consists of Synthesis, Characterization and the Applications of newly synthesized Carboxymethyl cellulose based Hydrogels. The prepared hydrogels were characterized by studying their physical properties, swelling behavior, Swelling kinetics, Fourier Transform Infrared spectroscopy (FT-IR), scanning electron Microscopy (SEM), powdered x-ray diffractometery (PXRD), thermogravimeteric analysis (TGA) and atomic absorption spectroscopy to know their ability in removing heavy metal ions from water. In this work, the synthesis of two novel hydrogels, Carboxymethyl cellulose/Potato Starch/Amylum Strach (CMC/PS/AS) based Hydrgel (SAP). Modified Starch (MS) and Modified Starch based Hydrogel (MSAP) were synthesized using Aluminium sulfate octahydrate as a crosslinking agent. By taking into consideration, FT-IR analysis done primarily to evaluate the structure of hydrogels, the structures in results were according to the expected structures of hydrogels. The hydrogels then subjected to the thermal gravimetric analysis to evaluate out the thermal stability of hydrogel i.e. more than its ingredients. Hydrogels were then examined morphologically by SEM. The swelling ability of both hydrogels were more in basic medium rather than acidic, moreover it shows swelling and de-swelling behavior in water, ethanol, acidic and basic buffers and in salt solutions when inferred by the swelling experiment. A high swelling behavior was shown by SAP and MSAP in deionized water, at pH 6.8 and 7.4 while no reasonable swelling at pH 1.2 was observed. Furthermore, its potential as an intelligent drug delivery system was confirmed by a remarkable swelling and de-swelling behavior of SAP in water and ethanol, in acidic (pH 1.2) and basic (pH 7.4) media and in water and normal saline solution. The thermal analysis of SAP and MSAP's major degradation steps those takes place above 200°C represent their extra-ordinary stability. The PXRD anlysis shows that there may be a distortion in the CMC's crystallization and an increase in SAP hydrogel's amorphous region. The possible cause of it can be the chemical crosslinking between the starches, CMC and SAP. These results indicate that due to a reduction in the crystalline behavior during the gel formation. . The success of the reaction in the FT-IR spectrum of SAP was revealed by an ester carbonyl distinct signal's appearance at 2341 cm^{-1} in spectra of CMC which was the major constituent of hydrogel, jumps to a relatively higher wavenumber at 2345 cm^{-1}

soon after the formation of its SAP. It also indicates the absorption of Carbon dioxide at the time of reaction completion.

From the aqueous solution of Cd^{2+}, Pb^{2+} and Fe^{2+} ions, these metal ions were then separated by the hydrogel. The order of selectivity towards different metal ions of the hydrogel as tested was $Cd^{2+} > Pb^{2+} > Fe^{2+}$. The observation revealed the fact that the capacity of the hydrogel to bind with heavy metal ions was dependent on the interaction of metal ions with the hydrogel monomers.