Name: Anurakshee Verma

Supervisor Name: Dr. Ufana Riaz

Depatment: Chemistry

Topic: Synthesis and Characterization of Conducting polymer intercalated clay nanocomposites

ABSTRACT:

Polymer nanocomposites have accelerated the development of materials exhibiting enhanced properties by overcoming the inherent limitation of pure materials particularly conducting polymers. Among several inorganic hosts employed to confine conducting polymers, clays are most frequently used. The growth of conducting polymers in the interlayer region of the clays has been shown to dramatically improve the properties of conducting polymers. The review chapter aims at reporting on the recent developments in syntheses, and characterization of conducting polymer intercalated clay nanocomposites with specific focus on the use of different clays for designing these nanocomposites.

Comparative investigation of the in-situ polymerization of poly(o-phenylenediamine) intercalated montmorillonite was carried out via two methods i.e using poly(o-phenylenediamine) as filler for MMT in one case and as matrix in the other. Intercalation and polymerization was confirmed by FT-IR, UV-Visible spectroscopy and XRD studies. TEM and optical microscopy studies confirmed the the self-assembled morphology of nanocomposites while the fluorescence properties revealed that controlled emission could be achieved by confining poly(o-phenylenediamine) in MMT galleries.

Synthesis of montmorillonite (MMT)/ poly(o-toluidine) (PoTD) nanocomposites prepared by confining PoTD in the galleries of MMT. XRD confirmed the intercalation of PoTD at 25oC while exfoliation was observed at higher loading. UV-Visible spectroscopy showed the variation

of polaronic transitions in the polymer. Scanning electron microscopy (SEM) revealed the formation of a coarse granular structure. Rifampicin was chosen as a model drug to study the in-vitro drug release characteristics of these nanocomposites. The nanocomposites revealed a sustained release behaviour which could be utilized to design controlled release anti-tuberculosis drug carriers.

In-situ intercalation and polymerization of o-anisidine within montmorillonite)MMT (clay was carried out via ultrasonication using different loadings of the former i.e., 12.5%, 25 wt.%, and 50 wt.%. FT-IR spectra showed successful incorporation of PAnis in MMT. UV-visible spectra confirmed the polaronic state of nanocomposites while XRD analysis revealed intercalation poly(o-anisidine) in the gallery space of MMT. TEM and optical micrographs showed the nanomorphology of prepared nanocomposites. In-vitro srug release studies were carried out by loading the nanocomposites with Vasograin- an anti-migraine drug in different amounts (80 mg, 40 mg and 60 mg) to investigate its release profiles in gastric fluid)pH 1.2 (and intestinal fluid)pH 7.4 .(The nanocomposites were found to show burst release behavior and hold potential to be used as anti-depressant drug delivery vehicle.

Copolymers of o-anisidine and o-toluidine were sonochemically synthesized using molar ratios: -10:90, 50:50 and 90:10 respectively. Intercalation of copolymer in the interlayer space of Bentonite was also carried out sonolytically. The amount of loading of copolymers in Bentonite was determined by TGA studies, while the copolymer intercalation was confirmed by XRD studies. IR analysis revealed successful intercalation of the copolymer. Morphology of nanocomposites was observed to be in the nano range. Drug release behaviour of these nanocomposites was investigated by carrying out in-vitro drug release studies of anti-tuberculosis drug (Rifampicin) at pH 1.2 and 7.4 corresponding to the pH observed in gastric and

intestinal fluids for a period of 120 h. The release behaviour showed best fit in zero order model and was observed to depend on the feed ratio of o-toluidine and o-anisidine. Hence, this nanocomposite could be used for designing sustained release carriers.

Copolymers of o-anisidine and o-phenylenediamine were sonochemically synthesized using molar ratios: - 10:90, 50:50 and 90:10 respectively. IR studies showed successful copolymerization of the monomers. Intercalation of copolymer in the interlayer space of Bentonite was confirmed by XRD analysis while the amount of loading of copolymers in Bentonite was determined by TGA. In-vitro drug release studies of anti-diabetic drug – Metformin were carried out by loading 100 mg of the drug in the nanocomposites. Nanocomposites, Bent/PAnis: POPD-90:10 also revealed higher adsorption capacity of 11 wt. %. Release behaviour showed best fit in zero order and parabolic-diffusion models and was observed to depend on the feed ratio of o-toluidine and o-anisidine.

Keywords: Polymerization; Ultra sonication; Copolymerization; Intercalation; Conducting polymer; Adsorption Kinetic; Drug release kinetics.