RESEARCH PAPER

Synthesis of PPy/Fluorescein dye composites by simple oxidative polymerization method and its structural characterisation by FTIR spectroscopic analysis

N.S.Dxit[1], V. M. Raut[2], A.S. Dixit[3], S.G.Khobragade[4], A.S.Durani[1]

Abstract:

In the present research work PPy/Fluorescein dye composites were synthesized by using simple oxidative polymerization method by using ammonium peroxydisulphate as an oxidizing agent with simultaneous doping during the synthesis at 0.01 M and 0.2 M concentrations of dopant fluorescein. Structural characterization of synthesized composites was carried out by FTIR analysis. These studies suggest that they exhibit amorphous behavior and change in surface morphology due to insertion of dopant.

Key words: PPy, PPy/fluorescein, APS.

Introduction:

Organic conducting polymers and their composites have become increasingly important for technical applications and the use of organic or inorganic fillers (dopants or composites) can prepare a new polymeric material with interesting combinations of physical mechanical and electrical properties. Among all organic conducting polymers polypyrrole is one of the most promising material for multifunctionalised applications. For the commercial use of this conducting polymer, a complete understanding of its properties is necessary. The conducting properties of PPy are not only depend upon nature ,concentration and oxidation state of dopant but also on doping level with type and concentration of different types of oxidant used. The properties of the polymers can be modified by adding various concentrations of different types of dopant to their structure.[1-3]

In this present research work conducting polymer PPy/Fluorescein dye composite was synthesized through chemical oxidative polymerization route by using ammonium peroxydisulphate as an oxidant at low temperature. The monomer to oxidant ratio was 1:1M. The concentration of CeCl3 was varied from 0.00001-0.0001 M. All the composite samples were charactrised through FTIR analysis.[4-7]

Experimental:-

All the chemicals required in the present work like monomer pyrrole, oxidizing agent,

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ammonium peroxydisulphate and dopant Fluorescein are of A. R. Grade. PPy/fluorescein composites were synthesized by simple chemical oxidative polymerization method. The aqueous solution of 0.1 M Ammonium peroxydisulphate was prepared. To this solution 0.00001 M aqueous solution of dopant was added with constant stirring. After a vigorous stirring at 50°C drop by drop 0.1 M solution of monomer pyrrole was added. The reaction was stirred for few hours on magnetic stirrer which gives rise to formation of precipitate of polymer composite. This reaction mixture was allowed to stand for 24 hours in order to complete polymerization process. The resulting product was vacuum filtered. The precipitate was washed with copious amount of triply distilled water. Until the washing was clear. Similarly 0.0001 M PPy/Fluorescein composite was also synthesized. The polymer composite was dried in desiccator and again dried in an oven at 40-500°C. The synthesized product was further characterized by FTIR Analysis.

Result and discussion:-

The structural characterization of PPy/ Fluorescein composite was carried out through FTIR spectroscopic analysis. FTIR spectroscopy is an important tool for determination of functional groups present in the compound.

The FTIR spectrum of PPy/Fluorescein composites is given in following figure 1 and 2.

The characteristic vibrational frequencies for PPy/ fluorescein dye composites are given in table 1.

Table 1: Vibrational Frequencies of FTIR spectra For PPy/Fluorescein dye composite

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Polymer Composite	Position of absorption maxima (cm^{-1})					
	N-H Str.	Ar-H Str.	C=C Str.	C-C Str.	C-N Str.	C=C-H (Bending)
Pure PPy	3400	3120.42	1563.23	1206.27	1050.32	929.31
PPy/ 0.00001M Fluorescein	3123.18	2217.23	1572.4	~1200 weak	1052.11	793.22
PPy/ 0.0001M fluorescein	3115.38 Broad	2214.47 Broad	1601.0 Broad	~1200.0 Broad	~ 900 Broad	745.8 Broad

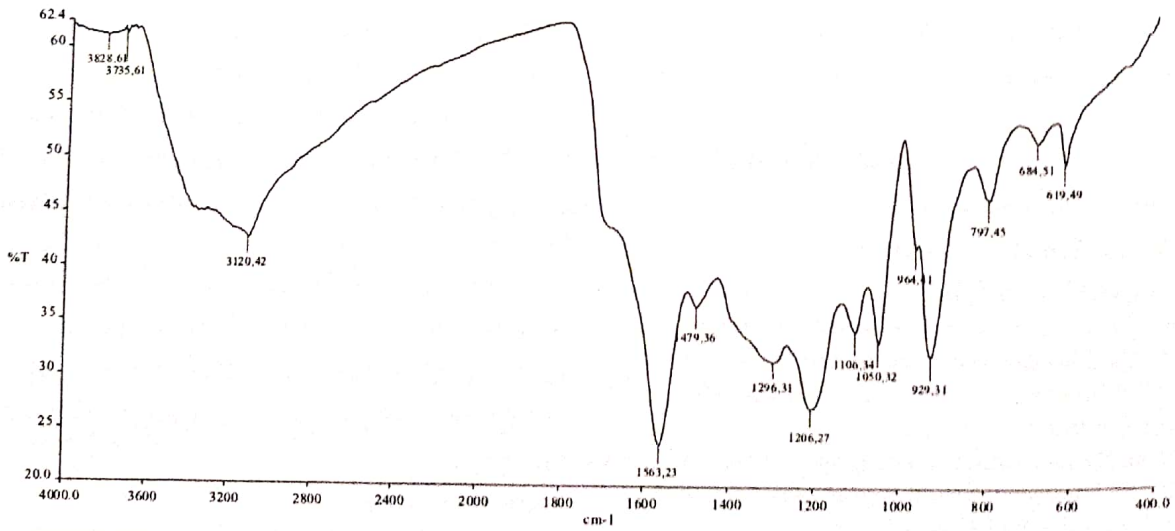

Fig 1: FTIR spectra of Polypyrrole

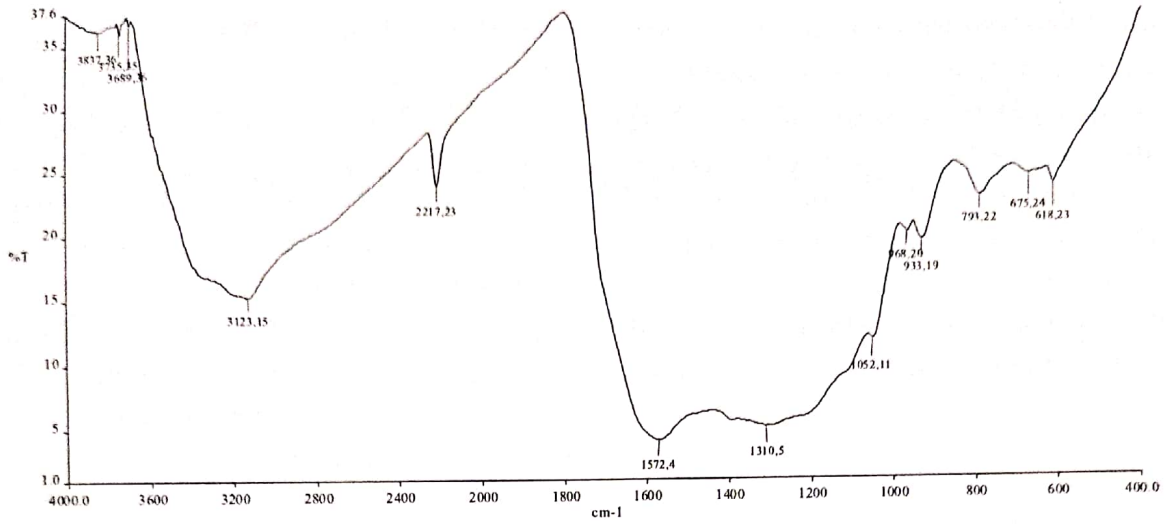

Fig 2: FTIR spectrum of PPy/0.00001 M fluorescein dye composite

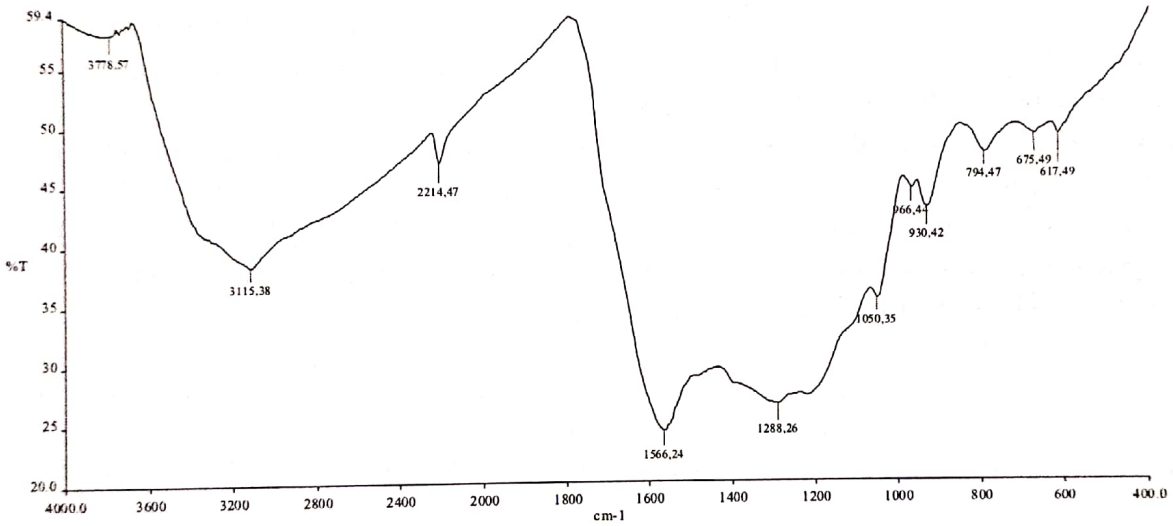

Fig 3: FTIR spectrum of PPy/0.0001 M fluorescein dye composite

The FTIR spectrum of PPy/fluorescein composite shows six principle bands characterising succcessful formation of basic polymer chain with N-H, Ar-C=C-H, C=C, C-N and C-C bonding in the molecule. A very broad peak near 3600-3700 cm^{-1} and 3778.57 cm^{-1} indicates –COOH group of Fluorescein dye. The broadening in the peaks may also explained by formation of hydrogen bonding in chain due to acidic group of dye. The peak near 1310.5 cm^{-1} and 1300 cm^{-1} indicate C-O linkage present in the dye. The FTIR peak is broadened after increasing dopant concentration indicates that intensities of most of the bands affected by doping this can be explained on the basis of constrained growth and restricted modes of vibrations in PPy chain due to interaction of dopant ions.

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Conclusions:

The PPy/Fluorescein dye composites were synthesized by chemical polymerization method. It is a simple and low cost method for synthesis. The composite formation was confirmed by FTIR analysis. The IR study that the interaction exist between PPy and fluorescein dye and the dye particles were successfully incorporated in polymeric structure. The six principle bands obtained IR spectrum of each composite confirms aromatic and highly conjugated polymeric structure. The FTIR peak is broadened after increasing dopant concentration indicates that intensities of most of the bands affected by doping with fluorescein dye.

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