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Structural Characterisation of Ppy/Rhodamine-B Dye Composites Synthesized by Simple Chemical Oxidation Method

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ABSTRACT

In the present research work PPy/ Rhodamine-B 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 0.00001 and 0.0001M concentration of dopant Rhodamine-B. Structural characterization of synthesized composites was carried out by Mass and NMR spectroscopic analysis. These studies suggest that they exhibit amorphous behavior and change in structure due to insertion of dopant.

Key words: PPy, PPy/Rhodamine-B, APS.

I. INTRODUCTION

Until about 30 years ago all carbon based polymers were rigidly regarded as insulators. The breakthrough happened in year 1977 when somewhat accidentally Alan J. Heeger, Alan G. MacDiramid and Hideki Shirakawa discovered that plastics that are generally referred to as insulators can under certain circumstances be made to behave like metals. 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.[1-3]

Among all organic conducting polymers polypyrrole is one of the most promising materials 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.[4-6]

In this present research work conducting polymer PPy/Rhodamine-B 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 fluorescein was varied from

0.00001-0.0001 M. All the composite samples were characterized through Mass and NMR spectroscopic analysis.

II. EXPERIMENTAL

All the chemicals required in the present work like monomer pyrrole, oxidizing agent, ammonium peroxydisulphate and dopant Rhodamine-B are of A. R. Grade. PPy/Rhodamine-B 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/ Rhodamine-B composite was also synthesized. The polymer composite was dried in desiccators and again dried in an oven at 40-500°C. The synthesized product was further characterized by Mass and NMR spectroscopic Analysis.

III. RESULT AND DISCUSSION

The structural characterization of PPy/Rhodamine-B composite was carried out through Mass and NMR spectroscopic analysis.

1. Mass spectrometric analysis

The mass spectra of PPy/Rhd-B dye (0.00001 and 0.0001M concentration) composite gives molecular ion peak at m/z 740 and 745 indicates incorporation of dopant in the polymeric structure of oligomer having 9-10 number of monomer unit. The molecular ion peak gives an idea regarding molecular weight of polymeric composite materials. The abundance of molecular ion peak is very less indicating decomposition of oligomer during spectral analysis. The detail of molecular ion peak is given in the table below.

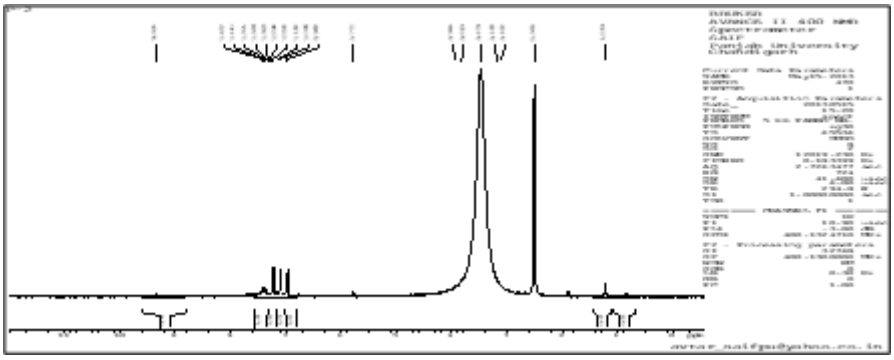
Molecular ion peaks of PPy/Rhd-B composites

S.N.	PPy composite	Molecular weight M^+ (m/z)
1.	PPy	580
2.	PPy/0.00001M Rhd-B	~740 (weak)
3.	PPy/0.0001 M Rhd-B	~745 (weak)

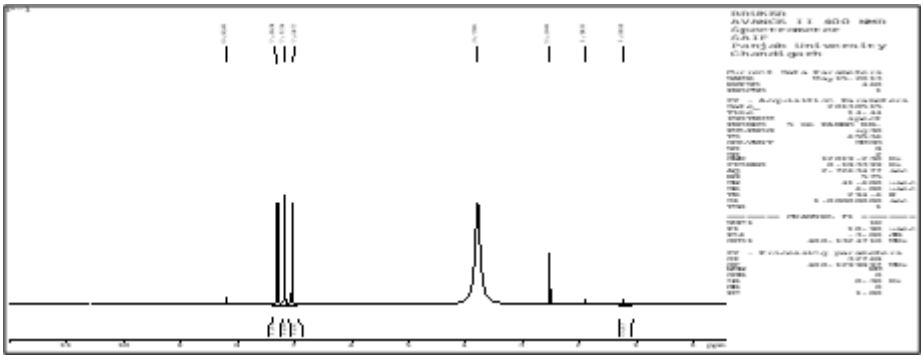
2. NMR spectral analysis of PPy/fluorescein composites

The NMR Spectra of PPy/Rhodamine-B dye composites are given in following figures which revealed that NMR spectrum of PPy, PPy/0.00001 M Rhd-B and 0.0001 M Rhd-B show three distinct peaks. The first peak is obtained for C=C-H proton at δ 2.5082, 2.5344 and 2.5083 ppm for PPy, PPy/0.00001 Rhd-B and PPy/0.0001M Rhd-B composites respectively. The second peak corresponding to N-H proton is obtained at δ

3.9097, 3.7950 and 3.4793 for PPy, PPy/0.00001 Rhd-B and 0.0001M Rhd-B respectively. This peak is deshielded because the proton is attached to more electronegative nitrogen atom. The peaks corresponding to aromatic protons are assigned at δ 7.1535, 7.1754 and 7.3239 for PPy, PPy/0.00001 Rhd-B and PPy/0.0001 M Rhd-B composites respectively.



NMR spectra of PPy/0.00001 M Rhd-B



NMR spectra of PPy/0.0001 M Rhd-B

The specific peak at 8.2030 and 9.3351 (w) is observed in the spectra which may be due acidic proton present in the dye. While higher value of acidic proton in 0.0001 M Rhd-B may be due to increase in hydrogen bonding in high concentration of dye. The presence of such bulkier dye may affect hindrance in conjugation which may become consequence to alter conductivity of the material.

IV. CONCLUSIONS

The PPy/ Rhodamine-B dye composites were synthesized by chemical polymerization method. It is a simple and low cost method for synthesis. The composite formation was confirmed by Mass and NMR spectroscopic analysis. The Mass study reveals that the interaction exists between PPy and Rhodamine-B dye and the dye particles were successfully incorporated in polymeric structure. The specific peaks obtained for NMR spectrum of each composite confirms aromatic and highly conjugated polymeric structure.

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