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Synthesis and Fourier Transform Infrared Spectroscopy of Polyaniline/Cobalt Chloride Composites

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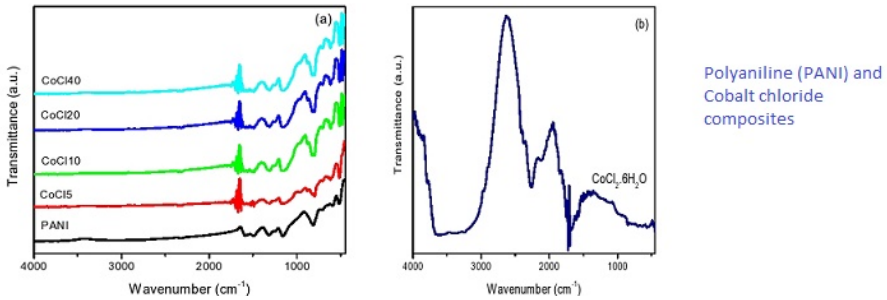
ABSTRACT.



Polyaniline (PANI) and Cobalt chloride composites were synthesized by in situ chemical oxidative polymerization of aniline with $CoCl_2.6H_2O$ using ammonium peroxidisulphate as an oxidant. These composites were characterized by Fourier Transform Infrared (FTIR) Spectroscopy. The FTIR results reveal that some of the bands of $CoCl_2.6H_2O$ are visible separately in PANI/cobalt chloride composites, while some other bands got mixed with PANI. Also there exists small shifting in position of PANI peaks in case of composites. Thus the FTIR result confirms the presence of cobalt chloride in the composites.

Keywords: Polyaniline, Ammonium peroxidisulphate, Fourier Transform Infrared spectroscopy, Cobalt chloride, Composites

INTRODUCTION

For many years chemists and physicists have striven to synthesize organic materials with conducting and properties due to their potential applications in batteries, electrical magnetic shields, sensors and microwave absorbants.[1-3] Several approaches such as electrochemical and in-situ chemical polymerizations have been reported to prepare conducting polymers.[4-7]

Polyaniline (PANI) is one of the most interesting conducting polymers because of its stability and good electrical and optical properties.[8] Potential applications of PANI include lightweight organic batteries,[9] microelectronics,[10] optical displays,[11] chemical sensors,[12] and electromagnetic shielding. It is anticipated that the preparation of PANI will receive and more attention because of its widespread applications. Conducting PANI and its composites are synthesized chemically[13] or electrochemically[14] in acidic solutions. Alternative methods have been designed to improve the properties of the synthesized polymers.[15]

In this paper we report the synthesis of conducting polymer PANI and its composites with cobalt chloride with varying concentration of cobalt chloride by chemical oxidative polymerization method. Also the structural characterization of these polymers and their composites has been done by Fourier transform infrared (FTIR) spectroscopy.

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EXPERIMENTAL DETAILS

SYNTHESIS OF PANI

To prepare PANI, 0.2 M aniline hydrochloride (Aldrich) was oxidized with 0.25 M ammonium peroxidisulphate (Aldrich) in aqueous medium. Both solutions were left to cool in the refrigerator for 2-3 hours and then mixed in a beaker drop-wise, maintained at a temperature between 0-4 ^{0}C in an ice bath, stirred for 2 hours and left for 24 hours at rest to polymerize in refrigerator. Thereafter PANI precipitate was collected on a filter paper and was washed with 1 M HCl and acetone till the filtrate becomes colourless. Polyaniline (emeraldine) hydrochloride powder was dried in air and then in vacuum at 45^{0}C. PANI prepared under these conditions was taken as standard sample.

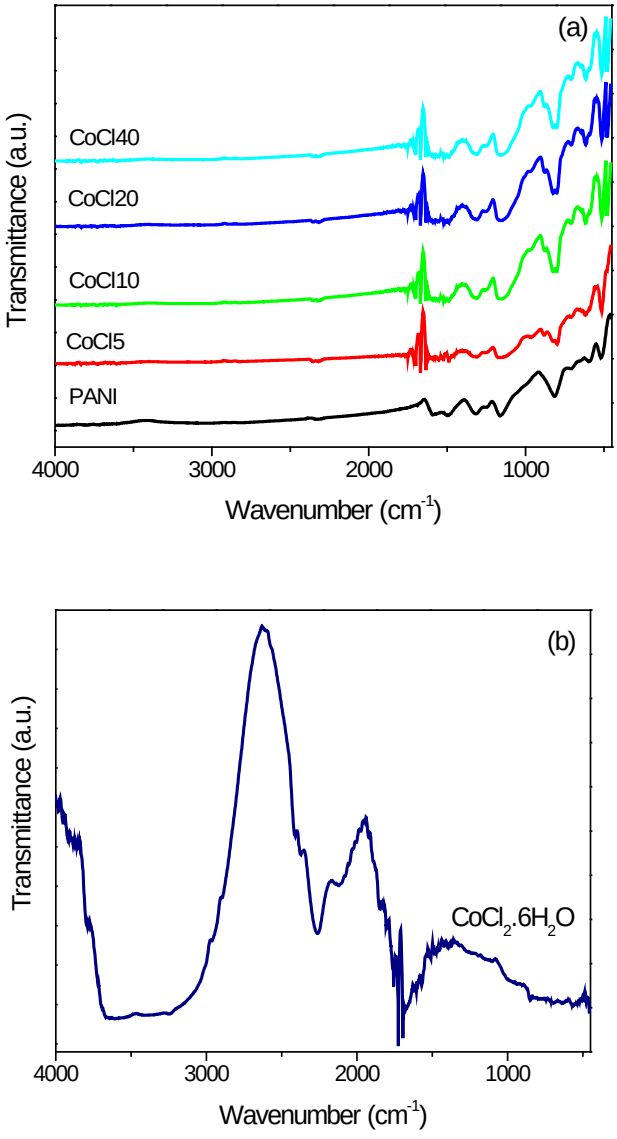

Figure 1. FTIR spectra of (a) PANI and PANI/$CoCl_2.6H_2O$ composites and (b) pure $CoCl_2.6H_2O$

SYNTHESIS OF PANI/COBALT CHLORIDE COMPOSITES

The samples of PANI and cobalt chloride composites were prepared by adding 5, 10, 20 and 40 weight percentage of 0.1 M $CoCl_2.6H_2O$ solution to 0.2 M aniline hydrochloride (Aldrich) solution in distilled with vigorous stirring for 1 hour for proper mixing and by the procedure same as above, four different polyaniline and cobalt chloride composites with different weight% of cobalt chloride (5, 10, 20 and 40) were prepared and named as CoCl5, CoCl10, CoCl20 and CoCl40 respectively.

RESULT AND DISCUSSION

The FTIR spectra of PANI and PANI/$CoCl_2.6H_2O$ composites with varying concentration of cobalt chloride are shown in figure 1.

The FTIR spectrum of PANI shows characteristic vibrations in the region of 1000-1500 cm^{-1}. It shows characteristic bands at 520 cm^{-1}, 815 cm^{-1}, 1163 cm^{-1}, 1317 cm^{-1}, 1495 cm^{-1} and 1589 cm^{-1}. The bands at 520 and 815 cm^{-1} are due to C-H out of plane bending vibration and para-disubstituted aromatic rings, respectively.[16] A band appearing near 1317 cm^{-1} represents the C-N stretching vibrations.[15] In plane bending vibration in C-H occurs[15] at 1163 cm^{-1}. The presence of bands in the range of 1450-1600 cm^{-1} is attributed to non- symmetric C_6 ring stretching modes.[16]

The higher frequency vibration at 1589 cm^{-1} has a major contribution from the quinoid rings, while the lower frequency mode at 1495 cm^{-1} shows the presence of benzenoid ring units. The peak observed at 2300 cm^{-1} is due to aromatic C-H stretching vibrations while the band observed in the range of 2950-3300 cm^{-1} is attributed to N-H stretching of aromatic amines.[17,18]

REFERENCES

1. P. K. Shen, H. T. Huang, A. C. C. Tseug. A study of tungsten trioxide and polyaniline composite films. *J. Electrochem. Soc*. **1992,** 139, 1840–1845.
2. H. Kawaguch. Functional polymer microspheres. *Prog. Polym. Sci*. **2000,** 25, 1171–1210.
3. O. Kalinina, E. Kumacheva. A 'core-shell' approach to producing 3D polymer nanocomposites. *Macromol.* **1999**, 32, 4122–4129.
4. G. Bidan, O. Jarjayes, J. M. Fruchart, E. Hannecart. New nanocomposites based on 'tailor dressed' magnetic particles in a polypyrrole matrix. *Adv. Mater*. **1994,** 61, 52–155.
5. F. Yan, G. Xue, J. Chen, Y. Lu. Preparation of a conducting polymer/ferromagnet composite film by anodic-oxidation method. *Synth. Met.* **2001,** 123, 17– 20.
6. J. Liu, M. X. Wan. Composites of polypyrrole with conducting and ferromagnetic behaviors. *J. Polym. Sci. A: Polym. Chem.* **2000**, 38, 2734–2739.
7. M. Wan, J. C. Li. Synthesis and electrical-magnetic properties of polyaniline composites. *Journal of Polymer Science Part A: Polymer Chemistry*. **2003**, 36, 2799– 2805.
8. A. G. MacDiarmid. Synthetic metals: a novel role for organic polymers. *Synth. Met*. **2002**, 125, 11-22.
9. K. Naoi, S. Ogano, T. Osaka. Effect of anion species on electrochemical behavior of poly(aniline)s electropolymerized in dichloroethane solution. *J. Electrochem Soc*. **1988**, 135, 119-124.
10. S. A. Chen, Y. Fang. Polyaniline Schottky barrier*:* effect *of doping on* rectification *and* photovoltaic characteristics*. Synth Met.* **1993**, 60, 215-222.
11. B. P. Jelle, G. Hagen. Transmission spectra of an electrochromic window based on polyaniline, Prussian blue and tungsten oxide. *J Electrochem Soc*. **1993**, 140, 3560-3564.

12. C. H. Liu, K. T. Liao, H. Huang. Amperometric immunosensors based on protein. *J. Anal Chem.* **2000**, 72, 2925-2929.
13. P. N. Adams, P. J. Laughlin, A. P. Monkman, Synthesis of high molecular weight polyaniline at low temperatures. *Synth Met*. **1996**, 76, 157-160.
14. M. M. Verghese, K. Ramanathan, S. M. Ashraf, M. N. Kamalasanan, B. D. Malhotra. Electrochemical growth of polyaniline in porous sol-gel films. *Chem Mater*. **1996**, 8, 822-824.
15. S. Kondawar, A. More, H. Sharma, S. Dongre.. Ag-SnO2/Polyaniline composite nanofibers for low operating temperature hydrogen gas sensor. *J. Materials NanoScience*, **2017**, 4(1), 13-18
16. K. Gupta, G. Chakraborty, P. C. Jana, A. K. Meikap. Synthesis of copper chloride and cobalt chloride composites of polyaniline and their magnetic and alternating current transport properties. *J. Phys. Sci.* **2009,** 13**,** 251-260.
17. R. Ganesan, A. Gedanken. Organic-inorganic hybrid materials based on polyaniline/TiO_2 nanocomposites for ascorbic acid fuel cell systems. *Nanotechnology*. **2008**, 19**,** 435709-435713.
18. I. S. Ahuja, R. Singh, C. L. Yadava. Structural information on cobalt(II), Nickle(II), copper(II), zinc(II), silver(I) and cadmium(II) nitrate complexes with hexamethylnetetramine from their magnetic moments, electronic and infrared spectra. *J. Mol. Struct.* **1980**, 68**,** 333-338