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SYNTHESIS OF CONDUCTING POLYMER POLYANILINE (PANI) BY INTERFACIAL POLYMERIZATION AND ITS STRUCTURAL VALIDATION BY FTIR

Supriya Vyas*[1] & Ashutosh Shukla[2]

*1&2,Department of Applied Chemistry, Shri Vaishnav Vidhyapeeth Vishwavidhyalay, Indore, (MP),

ABSTRACT

Synthesis of the conducting polymers with ease and cost-effective is the Challenge to the new finders. In this paper, the conducting polymer polyaniline has been synthesized by interfacial polymerization using HCl as a medium. Ammonium peroxydisulphate was used as an oxidizing agent dissolved in HCl. Fourier Transform Infrared Spectroscopy (FTIR) was used to analyze the structure of product which confirmed the formation of polyaniline. The results obtained are promising and enlightened the future prospectus of the synthesis material.

Keywords: *Conducting polymers, Interfacial Polymerization, Ammonium peroxydisulphate, Fourier Transform Infrared Spectroscopy, Polyaniline*

I. INTRODUCTION

Nowadays conducting polymers become more popular due to their unique properties and variety of applications. They could be used in various applications such as sensors, diodes, hydrogen fuel cells, batteries, and anticorrosive coatings. Polyaniline is an intrinsically conducting polymer (ICP) which can exhibit conductivity due to the π - conjugated system present in it. Among various conducting polymers, PANI is more promising candidate for potential applications due to its economical price, good redox properties, and environmental stability. PANI has a unique structure due to existence of an alternate arrangement of nitrogen atoms and benzene ring [1]. Two different routes can be followed to synthesize polyaniline: (a) electrochemical method; and (b) chemical method. So many chemical methods are used to fabricate poyaniline like seeding polymerization, hard template, soft template, interfacial polymerizatin is easy and having large-scale production ability and environmentally benign nature[2]. With this method, high quality polyaniline with control of their morphology, size, and diameter has obtained. The aim of this paper is to synthesize polyaniline using interfacial polymerization and its structural analysis with FTIR technique.

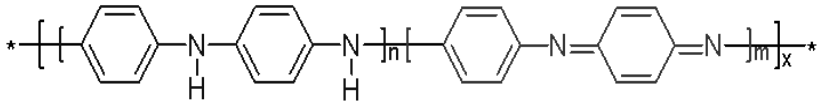

Figure 1: Structure of Polyaniline

II. EXPERIMENTAL DETAILS

(a) Materials and Methods

Hydrochloric acid, ammonium persulfate, and aniline were purchased from Merck, India which were of AR grade. Double distilled water was used for the preparation of all solutions.

Fourier Transform Infrared (FTIR) spectrum was recorded over the range of 400-4000 cm^{-1} using a Perkin Elmer SPECTRUM 1000 FTIR Spectrometer.

(b) Preparation

Polyaniline was synthesized by interfacial polymerization [3] method as follows:

Two types of solutions were prepared:

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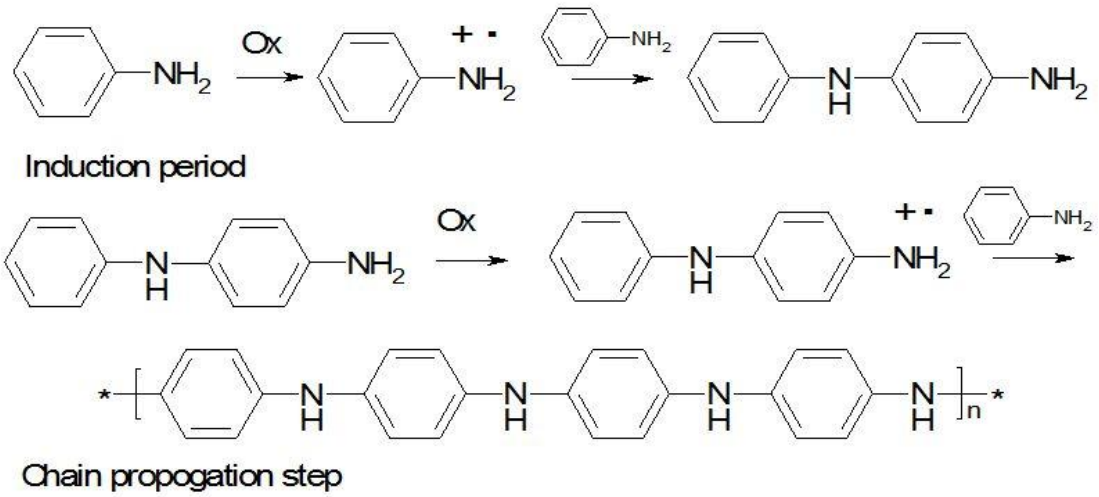
1. 4 mmole ammonium persulfate dissolved in 20 ml hydrochloric acid (1 M); and
2. 4 mmole aniline dissolved in 20 ml chloroform.

Both solutions was stirred with magnetic stirrer for one hour. Ammonium persulfate was act as oxidant. The oxidant based solution was dropwise transferred to aniline based solution. The reaction took place after a short induction time.

Initially polymerization was formed at the interface of the immiscible solutions then increased in amount over time. The black green PANI was filtered and dried at room temperature after 24 hours.



(c) Characterization
The structure of synthesized PANI was analyzed using FTIR Spectroscopy.

III. RESULT AND DISCUSSION

The polyaniline was synthesized using Interfacial Polymerization. Figure 2 shows the FTIR spectrum of synthesized PANI.

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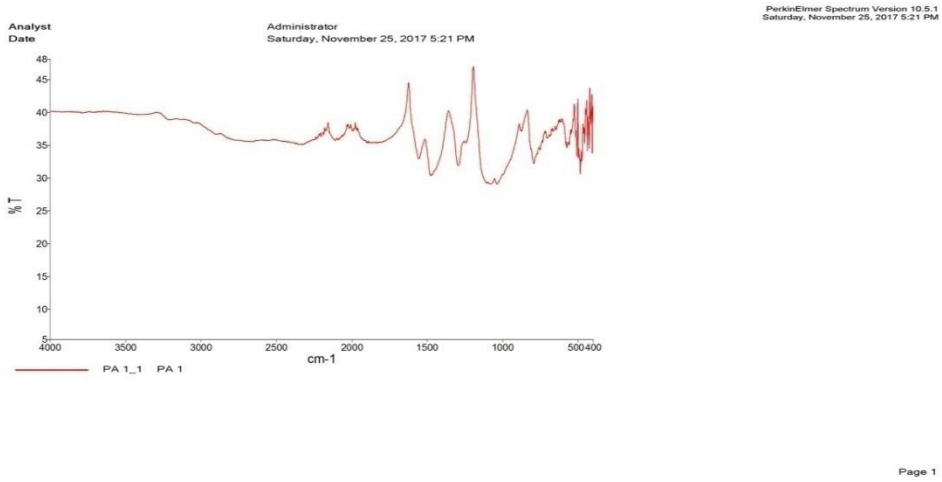

Figure 2: FTIR spectrum of synthesized Polyaniline

The peaks are present at 793, 1292, 1473, 1557 cm^{-1}. The main peaks 1557 cm^{-1} and 1473cm^{-1} represent C=N and C=C stretching vibrations of quinone and benzene ring, respectively.
The peak at 1292 cm^{-1} associated with C-N stretching mode.
The peak at 793 cm^{-1} represent the out-of-plane bending of C-H.
These related peaks confirm the successfully preparation of polyaniline.
Nuclear Magnetic Resonance Spectroscopy will also be performed for the complete structure determination of PANI.

IV. CONCLUSION

There are several methods for preparing PANI, among them a novel, simple, and cheap method was used. The conducting polymers polyaniline was successfully synthesized with the help of interfacial polymerization. The FTIR studies fit all of the available information related to structure of polyaniline. In future, we are going to find out the conducting properties and particle size of sample and can be explore new properties and applications for our benefits.

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