



# THE EFFECT OF DOPAND ON CONDUCTIVITY OF POLYANILINE AND ITS CHARACTERIZATION

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## ABSTRACT

Chlorinated polyaniline is a scenery-doped conducting polymer. It is water soluble and a relative conductivity that is of concern for elemental and also good for applications areas as rechargeable battery and pH control technologies. We have synthesized a innovative form of chlorinated polyaniline which shows significantly improved conductivity. Characterization of synthesized of Doped PANI. have been done by TGA and XRD and Fourier transforms infrared spectroscopy (FTIR).

**KEY WORDS:-** Conducting polymer, Doping, Chemical Polymerization, HCl

## 1-INTRODUCTION

The fundamental process of doping is a charge-transfer reaction between an organic polymer and a dopant. Usually polyaniline is made conducting via protonic acid doping e.g. HCl, or via oxidation either chemically or electrochemically<sup>1-3</sup>. Conducting polymers are valuable sensing materials for various organic vapors hazardous gases and humidity<sup>4-6</sup>. Conducting polymers shows changes in conductivity when they are exposed to different gases and humidity<sup>7</sup>. owing to elevated conductivity, simple synthesis by chemical polymerization and superior thermal stability polyaniline is preferred as a sensing material. It has also some disadvantages such slow response time and incomplete reversibility of the sensor, so the research was extended to polyaniline (PANI)<sup>8-9</sup>. The properties of the conductive PANI are affected by the type of dopant employed.

## 2-MATERIAL AND METHODS

The synthesis was based on mixing aqueous solutions of Aniline Hydrochloride 0.4M and Ammonium peroxydisulfate 0.5M at room temperature, followed by the separation of PANI hydrochloride precipitate by filtration and drying. More precisely, 0.4M of Anilinium hydrochloride was dissolved in distilled water in a volumetric flask to

50 mL of solution. 11.42 g of Ammonium peroxydisulfate was dissolved in water also to 50 mL of solution. Both solutions were kept for 1 h at room temperature ( 18-24<sup>o</sup>c ), then mixed in a beaker, briefly stirred, and left at rest to polymerize. first day, the resultant shady green PANI precipitate was together on a filter, washed with three 100 mL portions of 0.4 M HCl, and similarly with acetone. Polyaniline (emeraldine) hydrochloride powder was dried in air at 60<sup>o</sup> C. The polymerization is completed within 10 min at room temperature and within 1 h at 0-20<sup>o</sup>C. Oxidation process of aniline is exothermic thus the temperature of the reaction mixture can be used to observe the progress of reaction<sup>10-11</sup>.

### 3-RESULTS AND DISCUSSIONS

**3.1 STRUCTURAL CHARACTERIZATION BY FTIR** the FTIR spectra of polyaniline (emeraldine) hydrochloride shows in Fig.1. The peaks for the polyaniline base and salt appear at the identical region and with alike intensities apart from marginal differences IR spectrum shows principal peak at 1585, 1503, 1307, 1213, 1142 and 833 cm<sup>-1</sup>. The peaks at 1560 and 1503 cm<sup>-1</sup> are related to C-C ring stretching vibrations. The peaks at 1307 and 1213 cm<sup>-1</sup> match to N-H bending and the symmetric module of the C-C (or C-N) stretching modes. The bands at 1142 and 833 cm<sup>-1</sup> can be endorsed to the in-plane and out-of-plane C-H bending modes, in that order.

**TABLE. NO.1- FTIR FREQUENCY**

S.NO	FREQUENCY	VALUES
1	C-C Stretching	1560,1538cm <sup>-1</sup>
2	N-H bending	1307cm <sup>-1</sup>
3	C-N Stretching	1213cm <sup>-1</sup>
4	In-plane C-H Bending	1142cm <sup>-1</sup>
5	Out-of-plane C-H Bending	833cm <sup>-1</sup>
6	C-Cl stretching	1575cm <sup>-1</sup>

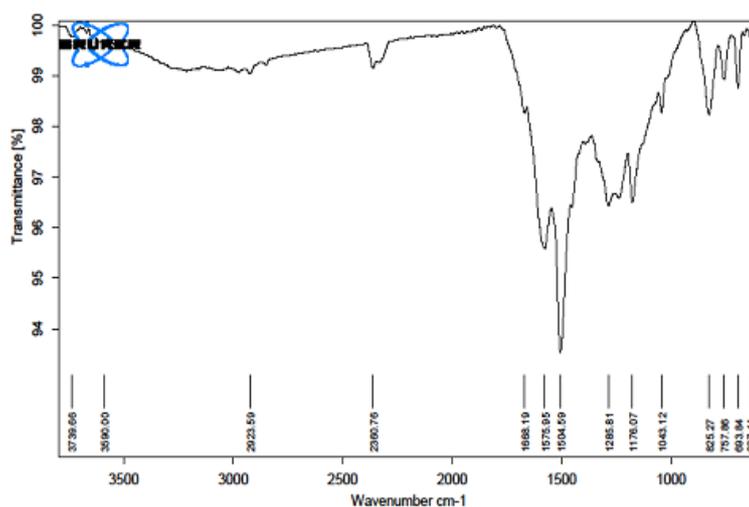


Fig.1: FTIR spectra of: PANI hydrochloride

### 3.2-THE X-RAY DIFFRACTION

pattern, Fig.2 indicates that the chains are strongly disordered, The PANI shows only a broad amorphous scattering around  $2\theta = 25^\circ$ .

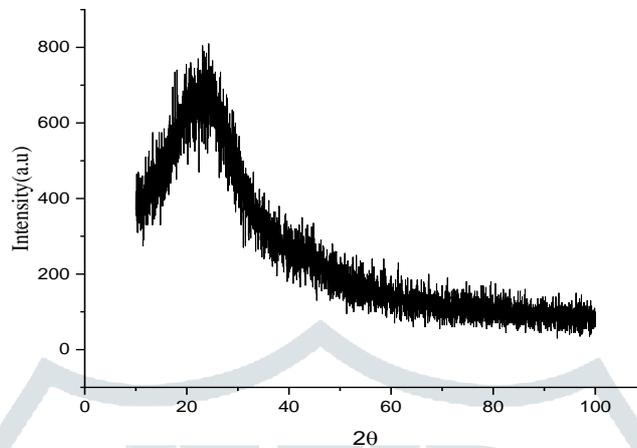


Fig.2: PANI hydrochloride X-ray diffraction pattern.

### 3.4 -THERMAL STUDIES

Thermal activities was deliberate by TGA in the range of 50–500 °C with a heating rate of 5 °C min<sup>-1</sup> under an inactive atmosphere. The initial step of thermal decay is seen at 50–100 °C due to the loss of absorbed water molecules . The second step of thermal decomposition starts at ~150 °C and continued up to 300 °C followed by the third step of the thermal decomposition pattern. The weight loss is mainly due to the loss of a dopant . The third step of thermal decomposition start at 300 °C It is around 98% loss is observed at 300, while it is extended up to 500 °C in HCl-doped

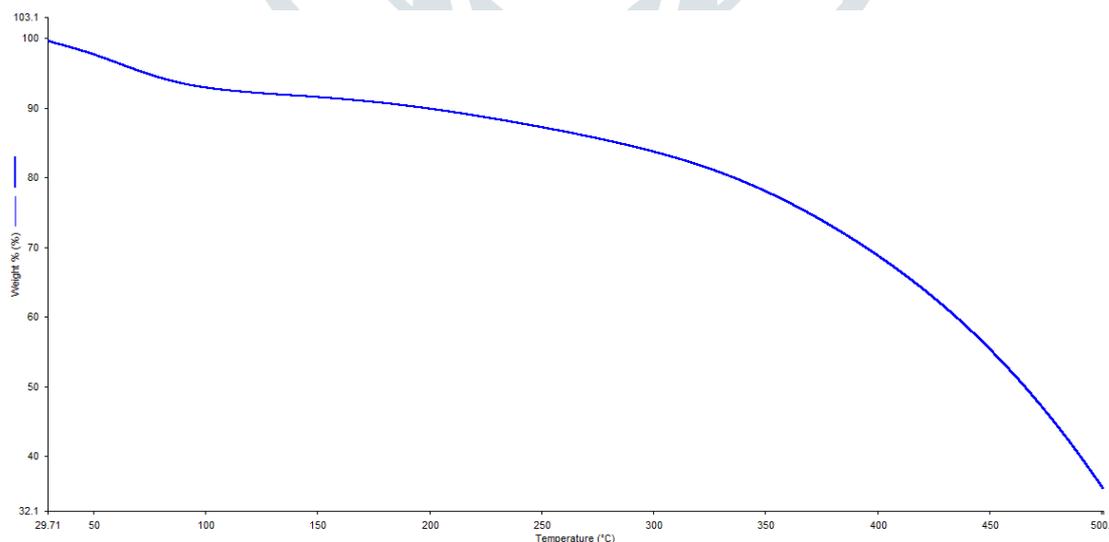


Fig.3 TGA for chlorinated polyaniline

### 3.4 ELECTRICAL CONDUCTIVITY

Conductivity has deliberate at room temperatures by Two-probe method on pellets prepared. The affect of doping on the electrical conductivity of PANI has investigated in the range 9 kHz- 11 MHz.

#### 4 SUMMARY

The doped polyaniline has been effectively prepared by chemical oxidation methods. It observed that these process parameters viz. ratio of monomer, oxidants, doping acids, have significant effect on conductivity.

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