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Synthesis and Characterization Conducting Poly (O-Toluidine)

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Abstract

Poly (o-toluidine) (POT) as an electrically conducting polymer, which is emerging as a promising synthetic metal. The POT is one of promised polymer because of used it in various area of applications such as Light Emitted Diode (LED), Filed Effect Transistor (FET), Solar Cell and Sensors. The Polymeric materials have many physical properties, which make them mostly used in microelectronic devices. Electrical conductivity of the polymer materials can be investigated either by the synthesis of a polymer of definite chemical structure. The principal use of POT worldwide is in the manufacture of dyestuffs, although it is also use in the production of rubber, chemicals also used as a corrosion inhibitor in paint formulations has limited uses in analytical laboratory procedures. Attention of many researchers is due to its ease of synthesis, processibility, good thermal stability and good environmental stability. In this work POT was prepare by chemical oxidation method in the presence of ammonium persulphate (APS) as an oxidizing agent. The process was carried out in an acidic medium (1M H_2SO_4). The Prepared conducing polymer was characterize by ultra violet-visible absorption spectroscopy (UV-Vis). The structure of the sample examined by X-ray diffraction (XRD) and Surface morphology determined by Scanning Electron Microscope (SEM). From this study, it is clear that Poly (o-toluidine) shows amorphous structure and shows similar behaviors of polyaniline.

Keywords: Conducting polymer, Poly (O-Toluidine), XRD, SEM. UV-Vis

1. Introduction

Among the conducting polymers, polyaniline and its derivatives studied in the last decade. Polyaniline has been widely studied in industrial applications of polyaniline are restricted due to infusibility and insolubility in most common solvents and the poor electro activity at high ph. The problems have partly been remove by using substituted derivatives of aniline such as toluidine and anisidine. Poly (o-toluidine) is one of polyaniline derivatives that have received focused attention in many technological areas such as sensors, smart windows, rechargeable batteries, electrochromic display devices, molecular devices and energy storage devices. In recent years, poly (o-toluidine) has excited wide interest to study rare earth have special properties because their electronic transitions are relatively insensitive to perturbations in their chemical environment. The structure of poly (o-toluidine) is similar to that of polyaniline. Poly-(o-toluidine) doped with rare earth ions may bring the similar effects. Poly (o-toluidine) can used for enhancing quantum yield in organic light-emitting devices [1]. Polymers have different processes such as carry out doping chemical and electrochemical. Recently metal salt doping in Poly (o-toluidine) has been reported [2]. Among these polymers, Poly (o-toluidine) has attracted. Many researchers attention is due to its ease of synthesis, processibility, good thermal stability and good environmental stability. MacDiarmid *et al.* [3] investigated Poly (o-toluidine) as an electrically conducting polymer, which is emerging as a promising synthetic metal. The possibility of synthesizing and doping of Poly (o-toluidine) with photonic acid dopants containing different types of counter ions is one of the key factors responsible for the versatility of this class of polymers. POT is a PANI derivative, which contains the $-CH_3$ group in the ortho position of the aromatic ring of the aniline monomer. Among the ring-substituted PANI derivatives, POT has been probably the most widely PANI derivatives, POT has been probably the most widely studied one. Indeed, Ram and Borole [4, 5] as well as other authors [6] have studied the electro polymerization of o-toluidine using various electrolytes with different concentrations these works revealed that POT have interesting electro-optical properties and can used as electro chromic and electronic devices [7].

The structural formula for *o*-toluidine is

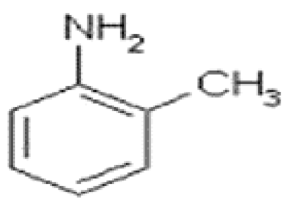

Fig 1: Chemical structure of o-toluidine

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2. Experimental

Poly (o-toluidine) was synthesized by chemical oxidation polymerization method as 100 ml pre cooled (room temp.) solution of 0.4M ammonium persulphate $(NH_4)_2S_2O_8$ was added drop wise to 100 ml pre cooled (room temp.) solution of 0.4 M toluidine with constant stirring for one hour [8-11]. After complete addition of the oxidant, (ammonium persulphate) stirring was continued for another 8-10 hours at room temp to ensure completion of the reaction. During polymerization, the sequence of coloration of the reaction mixture was light blue, blue green and finally greenish black precipitate. The reaction mixture was kept overnight at room temperature [12-13]. Then precipitated emeraldine salt was filtered, washed with distilled water until the filtrate become colorless and finally with methanol. The precipitate kept in oven at 70ºC to 80ºC for overnight and ground in fine powder. The resulting emeraldine salt of Poly (o-toluidine) dried at the room temperature.

3. Results And Discussion

a) UV-Vis Absorption Spectra

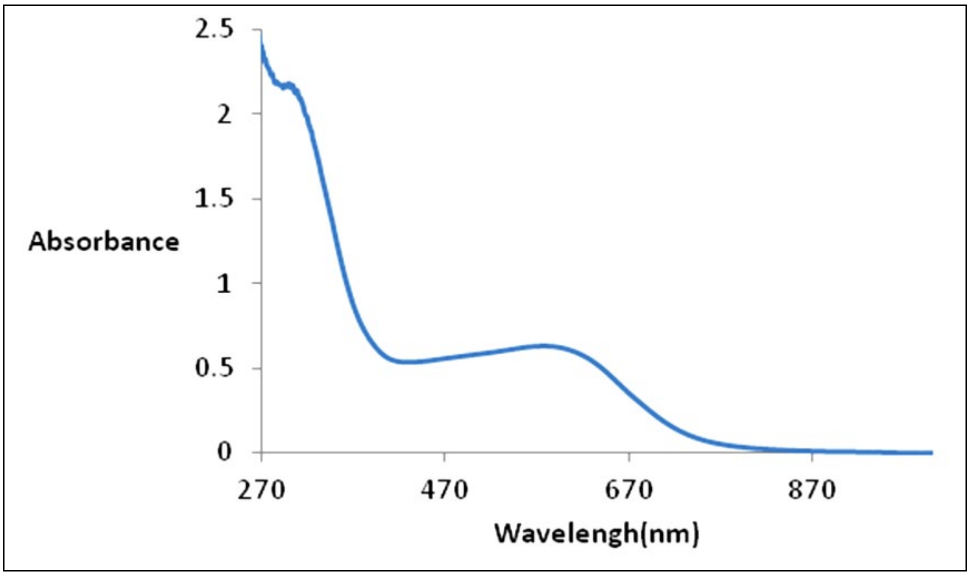

Fig 2: UV-Vis absorption spectra of POT

UV-vis absorption spectra of DMF solution of H_2SO_4-POT is shown in Fig. 2 The absorption peak in the 300-320 nm region and that at 550-610 nm region exhibited by POT in DMF correspond to excitation of amine nitrogen of the benzenoid segments and imine nitrogen of the quinoid segments of POT. There are rising curves at wavelength 380 nm, which attributed to oxidized phase of poly (o-toluidine) [14].

Poly (o-toluidine) exhibits two-marked absorption at 312 nm and at 592 nm in the UV-Vis spectra. This is similarly to the spectra of polyaniline, they can be ascribed to π-π* and quinoid ring transitions, respectively [1].

b) X-Ray Diffraction Spectroscopy (XRD)

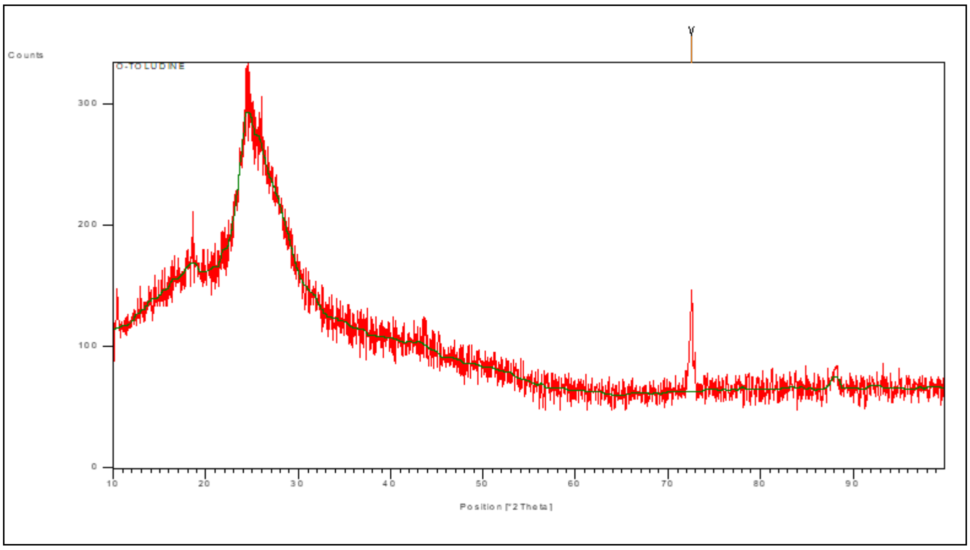

Fig 3: XRD Pattern of POT

Fig. 3 shows X-ray diffraction pattern of the POT and exhibits an amorphous structure with two small peaks at 16.78°and 25.5°, which are interplanar distance of o-Toluidine-o-Toluidine. The result of structure of POT shows that the conducting polymers have amorphous structure.

c) **Scanning Electron Microscopy (SEM)**

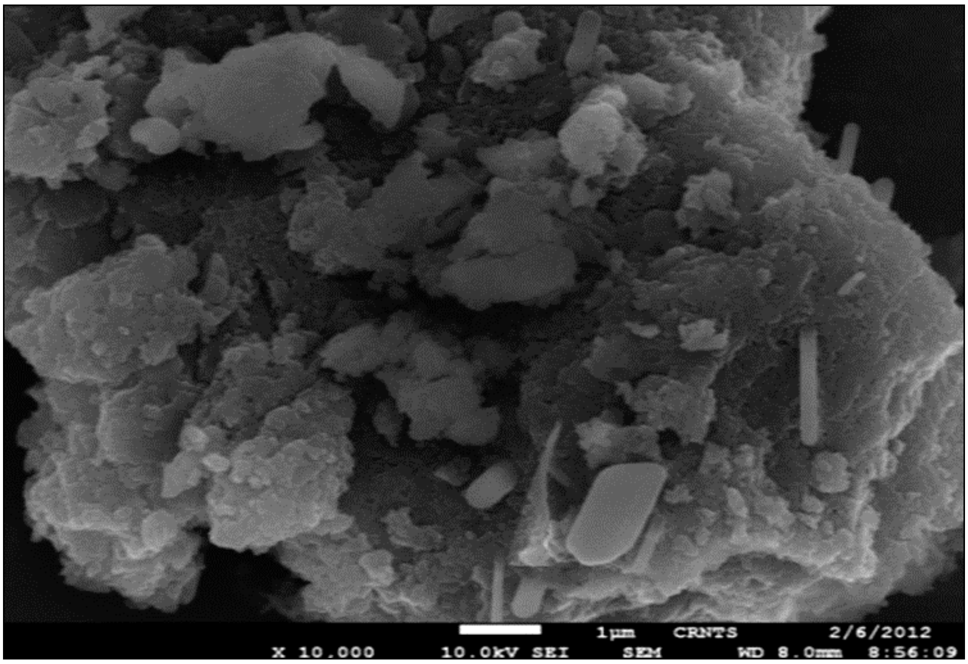

Fig 4: SEM of POT

Fig 4. shows the micrograph of poly (o-toluidine) which shows the smooth and homogeneous appearances. It shows the globular morphology and the structure contains a prominent globules distributed all over. The surface of each globule shows single cluster morphology [15].

Conclusion

In this paper poly (o-toluidine) prepared by chemical oxidation method. The detailed characterization of this sample successfully carried out through XRD, SEM and UV-Vis. From these study it is clear that the conducting polymers shows amorphous structure, surface morphology is smoot and homogeneous and shows similar behaviors of polyaniline.

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