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Synthesis of polypyrrole nanocomposite by using poly (ethylene glycohol) as surfactant in aqueous and aqueous/non-aqueous solution

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ABSTRACT

Nanocomposite particles of Polypyrrole was successfully synthesized in water/acetonitrile and water/ethyl methyl ketone solution by polymerization of pyrrole by using ferric chloride and as an oxidant in presence of polyethylene glycol) as surfactant. These nanocomposites were subsequently characterized such as morphology and chemical structure by using scanning electron microscopy (SEM) and fourier-transform infrared spectroscopy (FTIR), respectively. The results indicated that the morphology and chemical structure of the products were dependent on the type and concentration of solutions. The results of FTIR indicated that the intensity of peaks is dependent on the type of solutions.
Keywords: Nanocomposite, Polypyrrole, poly (ethylene glycol), Chemical structure, acetonitrile

1. INTRODUCTION

Polypyrrole is conjugated polymer with alternating single and double bonds. The conductivity of polypyrrole originates from the π electrons delocalized over the conjugated system and from the doping ions. These ions are interstitially positioned between the polymer chains and may considerably increase the conduction of the bpolymer. PPy is attractive as an electrically conducting polymer because of its relative synthesis. During the last decade there has been widespread interest in conducting polymers both for academic purposes and for potential applications. Conductive electroactive polymers such as polypyrrole (PPy) possess some unique chemical and electrochemical properties. The insolubility in common solvents and infusibility of conducting polymers, in general, make them poorly processable either by solution technique or by melt processing methods [1, 2]. Improvement of these material properties can be achieved either by forming copolymers of pyrrole, or by forming PPy composites or blends with commercially available polymers or inorganic materials which offer better mechanical and optical properties, stability and processability [3].

A process that was developed at the time took advantage of the aggregated character and consisted of forming colloidal dispersions or latex forms of conducting polymers [4,5]. Two methods have been used to produce stable dispersions. The first utilizes a dispersion polymerization route in which macroscopic precipitation is prevented by a thin, physically adsorbed outer layer of suitable polymeric surfactant which acts as a steric stabilizer. The second consists of the synthesis of a graft copolymer in which one of the components is the steric stabilizer [5]. Macroscopic precipitation/flocculation takes place if the concentration of stabilizer is not sufficient.

Bulk quantities of PPy can be obtained as fine powders using the oxidative polymerization of the monomer by selected transition metal ions in water or various other solvents [6].

From the beginning, interest in conducting polymers has it origins in the possible commercial applications of these materials. The commercial applications are based on the promise of a novel combination of light weight, processability and electrical conductivity. Foremost among the current commercial ventures are applications of conducting polymers in energy storage devices such as rechargeable batteries [7], conductive paint [8], heavy metals separation [9], membrane [10], electromagnetic interference (EMI) shieding [11], antistatic coating [12], and biomedical applications [13], etc.

In this study, polypyrrole nanocomposites weres prepared in water/acetonitrile and water/ethyl methyl ketone solution solution by polymerization of pyrrole using $FeCl_3$ an oxidant.

2. EXPERIMENTAL

2.1 Instrumentation

A magnetic mixer model MK20, digital scale model FR 200, scanning electron microscope (SEM) model XL30 and fourier transform infrared (FTIR) spectrometer model shimadzu 4100 were employed.