CHAPTER V

SUMMARY AND CONCLUSION

We have synthesized successfully polymer The MTsPc doped polyaniline loaded with silver chloride nanoparticles have been synthesized by an oxidation polymerization technique via interfacial biphasic method. A detailed protocol for the synthesis of the nanocomposite is given in the experimental section. After completion of the polymerization reaction, the resulting polyaniline nanocomposite were isolated by centrifugation and then dried under vacuum. The PANI nanocomposite was then characterized with various instrumental techniques to identify the reaction products, the nature of polymer bounded with metal nanoparticles and the morphology of the polyaniline nanocomposite. The characterization results will be discussed in the fourth chapter in different sections. We have chosen four different tetrasulfonated metal phthalocyanines metal such as copper, nickel, cobalt and iron as dopants. The electrocatalytic behavior of the the polyaniline doped with four tetrasulfonated metal phthalocyanines with and without silver nanoparticles have been studied. Here, we presented electrocatalytic oxidation of nitrite, hydrazine and hydrogen peroxide using tetrasulfonated metal phthalocyanine doped polyaniline in presence of silver chloride nanoparticles as one of the nanoparticles system.

The obtained polymer nanocomposites were analyzed to understand the stability, crystalline nature, binding nature of the stabilizing agent and the average element composition. The size and shape of the nanoparticles were analyzed with FE-SEM studies. The thermal stability as well as the decomposition temperature of
the system was identified from thermogravimetry analysis. From the percentage of weight loss, the stability of loosely bound water molecules and smaller ions can be derived from the TGA curves. The FT-IR results reveal that the binding nature of the polymer with metallic ions and water molecules. The crystallinity of the system was investigated from powder XRD analysis. The broadening of the peak shapes are due to the nanocrystal nature of the polymer. By indexing the peak positions for each system it is concluded that all obey fcc pattern of the nanocrystalline system. The redox behavior of the nanocomposites was investigated by cyclic voltammetry studies. All the eight systems follow the adsorption controlled electron transfer process which was confirmed from \( I_p \) vs. \( \nu^{1/2} \) analysis.

Tetrasulfonated Metal phthalocyanine of Cu, Ni, Co, and Fe are widely used as an electron transfer mediator for oxidation of nitrite, hydrazine and reduction of hydrogen peroxide in water sources. The advantage of the mediator is to reduce the over potential for the oxidation, to less positive values as well as enhances the oxidation peak current. Because of these properties, these nanocomposites can be used for the detection of toxic pollutants.

The important objective of the present investigation is due to exploit the metal tetrasulfonated phthalocyanine doped polymer nanocomposites for the oxidation of nitrite hydrazine and reduction of hydrogen peroxide. These molecules are considered as important environmental pollutants because of their toxic nature. Though these toxic pollutants can be quantitatively analyzed with various spectroscopic methods, the electrochemical methods are simple, fast and less expensive. Here we have optimized the experimental condition to analyze the toxic molecules. The electrocatalytic oxidation of toxic pollutant was investigated by
cyclic voltammetry. A calibration graph was constructed by plotting the peak current against the concentration of the added analyte concentration.

The detection limit was further improved by analyzing the toxic molecules by differential pulse voltammetry. Thus the detection limit is in very low concentration ranges when compared with CV current ranges. The detection limit was further quantified by amperometry method. The calibration ranges of the detection limit using such a modified electrode were compared with already reported results. The concentration ranges are comparable with the reported results. These results are given in tabular form.

**FUTURE WORK**

This work will be extended further by studying the electrochemical oxidation of dopamine, uric acid, AA, etc. Instead of the water soluble metal phthalocyanine, we can try to use metal phthalocyanine in the organic solvent medium to study the structural change of polyaniline nanomaterial. It is also possible to use other conducting polymers such as polypyrrole, polythiophene and polydioxythiophene using tetrasulfonated metal phthalocyanine as dopant under interfacial polymerization method. Such nanocomposite can also be used for electrochemical application.