

Characterization of Salt and Base forms of Polyaniline Doped with Gold Nanoparticles

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Key words: Au-PAMAM, Au-CITRATE, Gold Nanoparticles, Polyaniline

Introduction

The ability to combine the electrical properties of semiconductors with the versatility and processability of polymers is the basic concept behind intrinsically conducting polymers (ICPs). Conducting polymer/inorganic nanoparticle composites have attracted attention for they have interesting physical properties and many potential applications. Polyaniline (PANI) is one of the most important conducting polymer due to its easy preparation and doping process, environmental stability and potential use as electrochromic device, sensor and corrosion protecting [1-4]. Among the inorganic materials, gold nanoparticles have received great attention because of their unique electrical and optical properties, as well as their extensive applications in biomedical areas.

Distilled aniline was dissolved in 500mL of HCl (1.0M) solution maintained at room temperature. Ammonium persulfate was dissolved in 200mL of HCl (1.0M) and added to the above solution. The system was kept under constant stirring for 3h. The dark green precipitate Emeraldine-salt Polyaniline (ES-PANI) was solubilized in 10mL of distilled water, sonicated for 0.5 h and filtered. The resulting solution was separated in aliquots of 1mL, in which were added volumes of 50, 100 and 500mL of Au-PAMAM solutions. The same procedure was repeated for the additions of Au-CITRATE solutions.

Au-CITRATE nanohybrids were prepared using 5mL of HAuCl₄ (2g.L⁻¹) dissolved in 40mL of water and 100mg of sodium citrate dissolved in 5mL of water. Addition of the sodium citrate solution to the gold solution was followed by increasing the temperature to 95°C and continuous stirring for 1h. A clear red solution was formed during the addition of sodium citrate solution. The final Au-CITRATE NPs were kept in the dark at room temperature and then mixture with ES-PANI solution.

Results and Discussion

Au nanoparticles stabilized with polyamidoamine dendrimers (PAMAM) or sodium citrate were synthesized and incorporated in a solution of 34^a Reunião Anual da Sociedade Brasileira de Química

polyaniline emeraldine-salt (ES-PANI) and allowed to complex. Samples were characterized by FTIR, UV-vis and Zeta Potential analysis to verify the possible interaction between the polymer and the Au nanoparticles (NPs). Structural characterization was performed using SEM and TEM. It was verified that when the solutions of Au-CITRATE NPs are added to the polymer solution, a precipitate occurred. In this case, the formed precipitate showed a different morphology from those found for the ES-PANI and the Au-CITRATE NPs, suggesting that the ES-PANI coated the surface of the Au-CITRATE due to the attractive electrostatic interaction between the opposite charges. On the other hand, when adding Au-PAMAM to the ES-PANI solution, it was not observed any interaction probably due to the repulsive electrostatic interaction, suggesting that the organization of the ES-PANI chains is unaffected by the presence of the Au-PAMAM NPs.

Conclusions

X-ray diffraction pattern of the precipitate containing ES-PANI and Au-CITRATE NPs showed two broad peaks characteristic of the polyaniline and five additional peaks of Au-CITRATE added to the peaks of ES-PANI, which indicated the existence of Au NPs in the precipitate, suggesting that the ES-PANI was coated in its surface by the Au-CITRATE due to the opposite charges. Au-PAMAM in ES-PANI solution did not show interaction probably due to the repulsive electrostatic interaction.

Acknowledgments

The authors wish to thank the financial support from CAPES and FAPESP.

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