# Small Angle X- ray Scattering (SAXS) study of Polyanilines doped with nanoparticles of Gold

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Key words: polyaniline, gold nanoparticles, SAXS.

#### Introduction

Polyaniline (PANI) polymers have different properties according to the pH of the media in which they are prepared. When prepared in various pH media the polymer is formed as basic (EB-PANI) or salt (ES-PANI) and the last is the one that presents high electrical conductivity. The ES-PANI samples were prepared following the chemical synthesis method described by Bhadra, S. et al (1) and present great environmental stability when compared with other conductive polymers. Although the polyaniline preparation is quite simple, the polymerization mechanism is complex and not well understood despite the numerous studies performed on this polymer. With this work we intend to find out how the presence of Au nanoparticles affects the ES-PANI structural and conductivity properties.

## **Results and Discussion**

The Small Angle X-ray Scattering experiments (SAXS) were performed at the LNLS using solutions of pure polymer, pure nanoparticles of gold and containing ES-PANI several solutions and concentrations of nanoparticles of gold. From the SAXS curves, as it is well known, it is possible to determine, from the Guinier region, the radius of gyration and, through the calculation of the pair distribution function  $\rho_{max}$  the internal largest distance of the particles in solution <sup>(2)</sup>. The determination of these parameters allows following the structural changes that occurs in the ES-PANI when we increase the quantity of the Au nanoparticles. The SAXS experiments were carried using a solution of pure Au, pure ES-PANI and Au + ES-PANI where the added amount of nanoparticles of Gold was increased from 20 to 500µL/mL adding to ES-PANI solution of 5mg/mL. Our SAXS results indicate a very reasonable size for the nanoparticles of gold (R<sub>g</sub>=6.47 and  $\rho_{max}$ =18 nm) and pure SPANI (R<sub>g</sub>=15.4 and  $\rho_{max}$ =47.0 nm) and smaller values of the same parameters for the polymer particle with increasing amount of added nanogold.

### Conclusões

The SAXS results indicate that there is an interaction between the gold nano particles and the polymer molecules. As the sizes of the resulting complexes are smaller than the size of polymer particles, we may suggest that the gold nano particles attract the polymer forming a new particle. The shape of these particles are presently under investigation.

## Acknowledgements

CAPES and CNPq.

<sup>1</sup>Bhadra, S. et al, J. Polym. Sci., vol 104 Pg 1900-1904 <sup>2</sup>Glater, O.; Kratty, O. "Small angle X-ray scattering", Academic Press, London, 1982.