Carbon Nanoparticles (CNP) production using Solvent Assisted Hydrothermal Carbonization (SA-HTC)

In recent years, carbon nanoparticles (CNP) have emerged as an innovative and alternative nanomaterial to semiconductor nanoparticles. Since they have low toxicity and excellent optical properties. One of the methods for the formation of CNP is hydrothermal carbonization (HTC) which presents low costs, little equipment requirement, and less synthesis time. For the separation of CNP the extraction with solvents is often used; where an organic solvent separates the nanoparticles from water due to their chemical affinity (polarity) between the carbon material and the solvent. It has been hypothesized that, if the solvent used for the extraction was placed together with water in the reactor, the nanoparticles would grow only to a certain size, have a better size distribution, and increase their mass yield, this process is called Assisted Hydrothermal Carbonization (SA-HTC).

In this research, a liquid blend of water-organic solvent, was tested instead of only water. The carbon source was glucose, and the solvents were: hexane, toluene, and butyl acetate. The nanoparticles were characterized by UV-Vis, fluorescence and infrared spectroscopy. Electron microscopy was used to determine the size distribution.

The mass yields in the solvent assisted process using as organic solvent: hexane, toluene, and butyl acetate are: 2.13%, 3.89% and 14.11%; respectively. Regardless of the solvent, all nanoparticles have similar absorption and emission spectra, with higher fluorescence intensity. On the other hand, when butyl acetate was used, the degree of carbonization of the glucose was greater than the other solvents.