

Title: **Synthesis and characterization of new crosslinked plastic scintillator microspheres for radioactivity measurement**

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Radioactive samples come from very different origins and therefore their measurement is performed in very varied matrices which can include different radionuclides. Liquid scintillation (LS) is used for measuring α and β radioactivity with high detection efficiency, but with the drawback of having stability problems in certain matrices and generating mixed waste. An alternative to LS is plastic scintillation (PS) in the form of microspheres, with the advantage of not producing mixed waste and allowing the preparation of selective scintillation resins. Despite this, it still has a major disadvantage, as the microspheres are degraded in aggressive matrices. Crosslinked plastic scintillation (C-PS) consists in PS microspheres with the addition of a crosslinker to increase their chemical resistance. However, this synthesis results in the formation of aggregates with particles of lower size and less spherical shape, which reduces their detection efficiency.

In this project the effect of several parameters (monomers concentration, solvent polarity, surfactant concentration and ionic strength) was evaluated in the C-PSm syntheses, aiming towards the formation of particles with high diameter and in a good yield. The polymers of every synthesis were characterized morphologically and radiometrically.

The decrease in the monomers concentration implied a reduction in C-PSm size but always in the form of aggregates. When solvent polarity was increased the amount of bulk polymer formed also increased; except for a mixture with 50%/50% methanol/water where C-PSm particles with a good particle size were obtained with a relatively higher yield. Two surfactants were tested in order to avoid a bulk polymer formation in polar solvents, resulting in no improvements in the yield of C-PSm obtained. The ionic strength of the medium was evaluated, observing no tendency with its increase and obtaining aggregates of microspheres. An assay in the mixture of 50%/50% methanol/water with less monomer concentration, suggested a displacement from the previous conditions in this mixture with greater bulk polymer formation.

Keywords: plastic scintillation, crosslinked polymer, radioactivity measurement, polymerization.