Poster MS24

Plastic Scintillation Nanoparticles Produced by Supercritical Anti-Solvent Precipitation

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Plastic scintillation microspheres (PSm) are a solid dispersion of a couple of fluorescent solutes encapsulated in a polymeric matrix. They appear to be an interesting alternative to the use of liquid scintillation (LS) cocktail for the quantification of α and β emitters, mainly because their use avoid the generation of mixed waste (organic and radioactive waste) and they offer the possibility of other applications (e.g. support for extractive resins, measurement in continuous monitoring equipment). PSm are not available on the market, however different methodologies for synthesizing micro or nano polymeric particles and for encapsulating solutes inside them have been described in the literature. There is a growing interest in polymer processing and particle generation using supercritical fluids (SF) due to the possibility of the complete removal of residual organic solvent in the final particle, moreover SF allows a good control of particle size, particle size distribution and morphology. This work focuses on the synthesis of plastic scintillation particles through the precipitation and encapsulation of 2,5-diphenyloxazol (PPO), 1,4-Bis(5-phenyloxazol-2-yl) benzene (POPOP) and 2,6-diisopropyl-naphthalene (DIN) into a polymeric matrix of polystyrene (PS) by Supercritical Anti-solvent process (SAS). The compounds of interest as well as the polymer were dissolved in ethyl acetate (EA) and supercritical CO_2 was used as an anti-solvent. The influence of the variation of different process parameters on the formed particles was studied; solute concentration in the organic solution, injection velocity (u, m/s) of the organic solution, molar ratio of the organic solvent regarding to CO_2 as well as injection capillary tube diameter. Radiometric capabilities of a PSn serie composed of: PS, PS/PPO, PS/PPO/POPOP and PS/PPO/POPOP/DIN were evaluated through measuring the detection efficiency (%) of ^{3}H(β), ^{14}C(β), ^{90}Sr/^{90}Y(β) and 241 Am(α) in a LS spectrometer (Quantulus). According to the results it was confirmed that spectrum for PSn was located at lower energies in comparison with PSm due to optical quenching. On the other hand, the values of detection efficiency (%) increased when the fluorescent solutes were added, therefore assuming that encapsulation was accomplished. Values of detection efficiency (%) for PSn containing PS/PPO/POPOP obtained were 0.2%(^{3}H), 13.8%(^{14}C), 101.2%(^{90}Sr/^{90}Y) and 88.9%(^{241}Am).