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Polystyrene-based plastic scintillators for theranostics applications

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Plastic scintillators are used in many applications connected with medical devices, for example in time-of-flight positron emission tomography [1], long-axial field of view positron emission tomography scanners [2] and in plastic scintillation dosimetry [3]. Scintillators absorb ionizing radiation and convert its energy into visible light via fluorescence. Purpose of this research is to find optimal fluorescent dyes combination dissolved in polystyrene matrix. Polymer scintillators were synthesized from styrene monomer in bulk radical polymerization [4].

In this research one the best fluorescent compound emitting ultraviolet light is combined with a few fluorescent dyes shifting scintillators emission to blue and green light spectrum [5]. Emission maxima of manufactured polystyrene scintillators are close to maximum quantum efficiency of light detectors used in plastic scintillation detectors. Light output of scintillators as a measure of gamma radiation conversion into blue and green light will be presented. High light output and matching emission spectra of scintillator with quantum efficiency of light detector is needed to obtain good signal-to-noise ratio in scintillation detectors [6].

Green-emitting plastic scintillators have several advantages over blue-emitting scintillators in plastic scintillation dosimetry application. Firstly, green light is less attenuated by polystyrene matrix and yellow compounds resulting from radiation damage. Secondly, the longer the wavelength of scintillators light, the smaller portion of Cerenkov light is emitted in this green bandwidth in plastic dosimeter and subtraction of this stem signal is easier. Thirdly, green light around 500 nm is the least attenuated in plastic optical fibers usually glued to plastic scintillators forming scintillation dosimeter.

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