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#11-105 Optimization of liquid organic scintillator composition for fast neutron spectrometry

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Liquid organic scintillators are important devices for measurements of neutron radiation. This work aims to develop and optimize the composition of liquid organic scintillators so it can be used for fast neutron spectrometry. As the neutron radiation is usually accompanied with γ ray radiation, this work is focused on γ/n discrimination. In our experiments, the ^{252}Cf is used as a radiation source for a mixed field of γ rays and neutrons, and ^{137}Cs and ^{60}Co are used as radiation sources for pure γ rays. The scintillators within 20 ml glass vials are placed above the photomultiplier (PM) RCA 8575. The two parameter spectrometric system NGA-01 is used to analyze the energy and discrimination characteristics. It is shown first that from six selected solvents, the DIPN (Di-iso-propyl-naphthalene Mixed Isomers) and 1-Methylnaphthalene are capable of good γ/n discrimination in combination with luminophore PYR (1-Phenyl-3-(2,4,6-trimethyl-phenyl)-2-pyrazoline). In second stage the solvent is DIPN and the concentration of luminophores is varied. The concentration of luminophore PYR from 3 g/l to 9 g/l is shown to be best for γ/n discrimination. The energy threshold for good γ/n discrimination is 0.14 MeVee. Luminophore THIO (2,5-Bis(5-tert-butyl-benzoxazol-2-yl)thiophene) has best γ/n discrimination at concentrations from 3 g/l to 6 g/l and the energy threshold is 0.17 MeVee. Luminophore XAZ (2-(4-BiPhenyl)-6-phenylbenzoxazole) has best γ/n discrimination at concentrations from 2.4 g/l to 3 g/l and the energy threshold is 0.20 MeVee. These scintillators at optimal concentrations have lower energy threshold for γ/n discrimination than reference liquid scintillator AquaLight AB. However the stilbene crystal scintillator is better than scintillators from this work. It was shown also that the additives of water and detergent, components used to improve the solubility, deteriorate the γ/n discrimination of the scintillator.

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