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Development of liquid scintillator contaning zirconium complex for neutrinoless double beta decay experiment

An organic liquid scintillator containing zirconium complex was studied for neutrinosless double beta decay experiment. A ^{96}Zr nuclei has a large Q-value (3.35MeV), and no experiment is planned to use as a target. In order to realize ton scale target isotope with good energy resolution (4\%@2.5MeV), we have used zirconium beta-diketon complex which has huge solubility (over 10w.t.\%) to the Anisole. However, the absorption wavelength of diketon ligand overlaps with the luminescence from Anisole. Therefore, the light yield of liquid scintillator decreased in proportion to the concentration of beta-diketon complex. In order to avoid this problem, we synthesized beta-keto ester complex introducing -OC3H7 or -OC2H5 substituent groups in the beta-diketon complex. These complexes have shorter absorption wavelength (245nm) than the emission wavelength of Anisole (275nm). The scintillation light yield recovered about double, however, did not reach at the expected value, because the residual absorption around the 275nm still exists. We have found that those were caused by the impurities of beta-keto ester complex and it will be solved by the purifying the complex. We obtained that the light yield was about 30\% with respect to the original cocktail, and the energy resolution was 13\%@1MeV even though 8.5\% of PMT photo coverage. We have also found that a diethyl malonate ligand shifted the absorption peak to around 210nm, and the complex will have no quenching for the Anisole based liquid scintillator. Here we will report the present status.

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