Accuracy analysis on concentration determination of molecular iodine in aqueous and organic solutions

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It is important to determine the concentration of volatile radiodine species in the aspect of the radiation protection. There are two sample treatment methods on determining the concentration of molecular iodine in ultraviolet-visible (UV-VIS) spectrophotometry. One is to determine the concentration of volatile $I_2(+I_3^-)$ in aqueous solution by using the I_3^- concentration and the equilibrium relationship of I^-, I_2 and I_3^-, the other is to extract I_2 by the organic solvents (toluene) and to measure the I_2 concentration in the extracted solutions. In this study, we compared above two methods for determining I_2 concentrations in samples. With the first method, a linear relationship was confirmed between the I_3^- concentration and the I_3^- absorption intensity at 288 nm of UV-VIS absorption spectra in the concentration range of 0.01 - 1.5 mM. With the second method, a linearity was confirmed between the I_2 concentration and the I_2 absorption intensity at 309 nm in the concentration range of 0.1 to 2.5 mM I_2 in toluene. The correlation coefficients of the calibration curves were calculated to be 0.9980 with the first method, and 0.9995 with the second method. The extraction method showed a relatively good correlation. However, in the extraction method, the measurement accuracy of I_2 concentration showed somewhat lower (-14%) than that of the first method. The result indicated that the additional extraction process would give a negative effect on the concentration measurement of I_2.

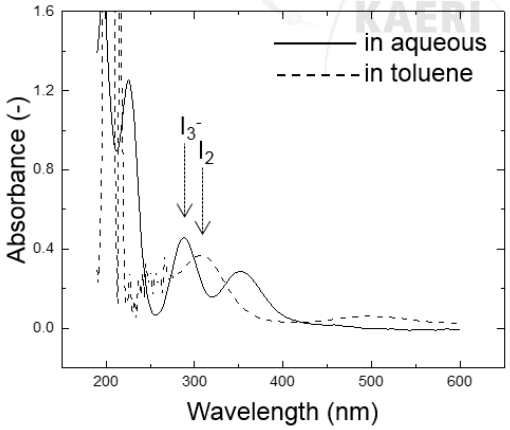

Fig. 1. The UV-VIS absorption spectra of the samples obtained by two different methods.

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