SHORT COMMUNICATIONS

Temperature Dependence of Ceric-cerous Gamma-ray Dosimeter

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The 0.8 N sulfuric acid aqueous solution of ceric sulfate is usually recommended as a gamma-ray dosimeter for high dose. On the other hand, the temperature of irradiated solutions is apt to be raised at high dose rate owing to the absorption of gamma-ray energy. Therefore, in order to examine the temperture effect on the yield of cerous ion, the above solution was irradiated for one or two hours in a water thermostat under various dose rate between about 7×10^4 *r*/hr. and 6×10^6 *r*/hr. at the Co-60 Irradiation Laboratory of JAERI, and the yield was determined from the decrement of optical density at 314 mμ. Ceric sulfate (Frederick Smith Chem. Co.) without further purification was dissolved in water, distilled triply as usual, in a test tube of hard glass (Hario Glass). A series of the samples was put carefully under the same condition for various temperatures between about 20 and 90°C.

The logarithm of the decrement of optical density of the sample irradiated

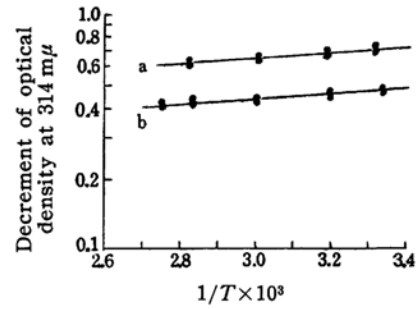

Fig. 1. The observed decrement of optical density of ceric ion by irradiation for 1 hr., against the inverse absolute temperature at (a) 5.6×10^5 *r*/hr. and (b) 1.7×10^6 *r*/hr. For measuring, the sample was diluted to the suitable concentration, for convenience.

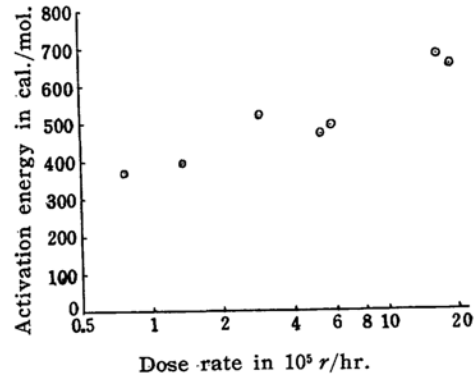

Fig. 2. The apparent activation energy of the reduction of cerous ion at various dose rates.

for one hour at 5.6×10^5 and 1.7×10^6 r/hr., among the observed values at various dose rate is plotted against inverse absolute temperature in Fig. 1. The value at higher dose rate was more reproducible than at the lower one owing to the property of this system. The decrement of the optical density, namely, the yield of cerous ion decreses with the increase of temperature as shown in Fig. 1.

The interpretation of the result is not so easily given, for the various elementary reactions are surposed. According to Hardwick, the apparent activation energy is about −300 cal./mol. at very low dose rate (600 millicurie radium source)[1].

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1) T. J. Hardwick, *Can. J. Chem.*, **30**, 23 (1952).