



ANSI/ASTM D 3001 - 71 (Reapproved 1977)

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Standard Test Method for ABSORBED GAMMA AND ELECTRON RADIATION DOSE WITH THE CERIC SULFATE DOSIMETER¹

This Standard is issued under the fixed designation D 3001; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

1. Scope

1.1 This method covers the preparation and procedure for the use of the ceric sulfate dosimeter.

1.2 Ceric sulfate dosimetry is used for accurate measurement of the absorbed dose in water irradiated with X or gamma rays or high-energy electrons. It is based on the process of reduction of ceric to cerous ions by ionizing radiation. The method is most accurate for absorbed doses in the range from 1×10^6 to 8×10^8 rd, using spectrophotometric measurement of the ceric ion concentration.

2. Summary of Method

2.1 The change in absorbance (at a given wavelength) after irradiation of a solution of ceric ammonium sulfate is measured spectrophotometrically. Since the absorbed dose in the solution is proportional to the change in absorbance (optical density), the dose can be determined by multiplying the change in absorbance by a suitable conversion factor.

3. Significance

3.1 *Absorbed Dose*—This dosimeter provides a means for measuring the radiation dose absorbed in a solution that is equivalent to the dose absorbed in water. To convert to the absorbed photon dose in other materials the procedures of ASTM Recommended Practice D 2568, Calculation of Absorbed Dose from X or Gamma Radiation, should be used.

3.2 *Dose Rate*—No effect on accuracy or measurement of radiation dose is observed with dose rates between 20 rd/s and 10^8 rd/s (100 rd/pulse).

3.3 *Temperature*—The reliability of the method is not significantly influenced by a variation of the temperature of the system between 15 and 30 C during irradiation.

However, at temperatures above 30 C the *G*-value decreases as the temperature increases leading to erroneously low values for absorbed dose.

3.4 *Energy Dependence*—The response of this system (here defined as change in absorbance per unit absorbed dose in solution), has been shown to be independent of photon energy in the range of 0.1 to 10 MeV.

4. Definitions

4.1 *rad*—the recommended unit for reporting absorbed radiation dose; it is defined as 100 ergs of energy absorbed per gram of specimen.

5. Interferences

5.1 The use of organic stoppers, organic tubing, or metal tubing for sealing or transferring any of the solutions should be avoided, since contact between the solutions and any organic material or metals can lead to erratic results. This system is extremely sensitive to organic impurities even in trace quantities.

5.2 Glassware should be kept extremely clean.

6. Apparatus

6.1 *Spectrophotometer*—Beckman Model DU, hydrogen lamp attachment, and 1-cm matched quartz cells, or equivalent apparatus equipped with a temperature-controlled cell compartment should be used for absorbance measurements.

6.2 Containers:

6.2.1 Chemically resistant borosilicate glass should be used to hold the reagents.

6.2.2 Irradiation containers for the dosim-

¹ This method is under the jurisdiction of ASTM Committee E-10 on Nuclear Applications and Measurement of Radiation Effects.

Effective Dec. 22, 1971.