



AMERICAN NATIONAL
STANDARD

ANSI/ASTM D 2954 - 71 (Reapproved 1977)

REAPPROVED 84

Standard Test Method for ABSORBED GAMMA AND ELECTRON RADIATION DOSE WITH THE FERROUS SULFATE-CUPRIC SULFATE DOSIMETER¹

This Standard is issued under the fixed designation D 2954; 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 use of the ferrous sulfate-cupric sulfate dosimeter for measuring absorbed gamma and electron radiation dose.

1.2 Ferrous-cupric 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 oxidation of ferrous to ferric ions by ionizing radiation. The method is most accurate for absorbed doses in the range from 2×10^5 to 8×10^5 rads, using spectrophotometric measurement of the ferric ion concentration. It can be used to measure doses as low as 6×10^4 rads, with decreased accuracy.

2. Summary of Method

2.1 The change in absorbance (at a given wavelength) of an irradiated solution of ferrous sulfate-cupric sulfate is measured in a temperature-controlled spectrophotometer. Since the absorbed dose in rads in the solution is proportional to the change in absorbance (optical density), it 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. Conversion to the absorbed photon dose in other materials should be in accordance with the procedures of ASTM Recommended Practice D 2568, Calculation of Absorbed Dose from X or Gamma Radiation.²

3.2 *Dose Rate*—No effect on accuracy of measurement of radiation dose is observed

with dose rates between 20 rads/s and 10^9 rads/s.

3.3 *Temperature*—The reliability of the method is not significantly influenced by a variation of the temperature of the system between 20 and 60 C during irradiation. However, at 0 C, the *G*-value is approximately 12 percent higher than at 25 C; this leads to an erroneously high value 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 energy in the range from 0.1 to 10 MeV.

4. Definition

4.1 *rad*—the recommended unit for reporting absorbed radiation dose, 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 used should be kept extremely clean.

6. Apparatus

6.1 *Spectrophotometer*—Beckman Model DU, hydrogen lamp attachment, with 1-cm matched quartz cells, or equivalent apparatus

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

²Effective March 18, 1971.

³Annual Book of ASTM Standards, Part 35.

