Sulfur-35
Handling Precautions

^{35}S
87.4 d
ß⁻ 0.167
No γ
E 0.167

Physical Data

Maximum Beta Energy: 0.167 MeV (100%)[1]

Maximum Range of Beta in Air: 24 cm (9.6 in.)[2]

Occupational Limits[3]

Annual Limit on Intake: 6 mCi (220 MBq) for oral ingestion and 2 mCi (74 MBq) for inhalation.

Derived Air Concentration: 9 x 10^{-7} µCi/ml (33 kBq/m^3).

Dosimetry

Millicurie (37 MBq) quantities of ^{35}S do not present a significant external exposure hazard since the low-energy emissions barely penetrate the outer dead layer of skin. The metabolism and retention of sulfur compounds in the body vary considerably for different chemical forms[4]. Sulfur uptakes are assumed to be uniformly distributed throughout all organs and tissues in the body[4]. For uptakes of inorganic sulfur, 15% is assumed to be retained with a 20 day biological half-life and 5% retained with a 2,000 day biological half-life. The remaining 80% is assumed to be rapidly excreted[4].

Decay Table

Physical Half-Life: 87.4 days[1]

To use the decay table, find the number of days in the top and left hand columns of the chart, then find the corresponding decay factor. To obtain a precalibration number, divide by the decay factor. For a postcalibration number, multiply by the decay factor.

Days	0	3	6	9	12	15	18	21	24	27
0	1.000	0.976	0.954	0.931	0.909	0.888	0.867	0.847	0.827	0.807
30	0.788	0.770	0.752	0.734	0.717	0.700	0.683	0.667	0.652	0.636
60	0.621	0.607	0.592	0.579	0.565	0.552	0.539	0.526	0.514	0.502
90	0.490	0.478	0.467	0.456	0.445	0.435	0.425	0.415	0.405	0.395
120	0.386	0.377	0.368	0.359	0.351	0.343	0.335	0.327	0.319	0.312
150	0.304	0.297	0.290	0.283	0.277	0.270	0.264	0.258	0.252	0.246
180	0.240	0.234	0.229	0.223	0.218	0.213	0.208	0.203	0.198	0.194
210	0.189	0.185	0.180	0.176	0.172	0.168	0.164	0.160	0.156	0.153
240	0.149	0.146	0.142	0.139	0.136	0.132	0.129	0.126	0.123	0.120
270	0.118	0.115	0.112	0.109	0.107	0.104	0.102	0.099	0.097	0.095
300	0.093	0.090	0.088	0.086	0.084	0.082	0.080	0.078	0.077	0.075
330	0.073	0.071	0.070	0.068	0.066	0.065	0.063	0.062	0.060	0.059
360	0.058	0.056	0.055	0.054	0.052	0.051	0.050	0.049	0.048	0.046

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precisely.

PerkinElmer has developed the following suggestions for handling Sulfur-35 after years of experience working with this low-energy beta emitter.

General Handling Precautions for Sulfur-35

1. Designate area for handling ^{35}S and clearly label all containers.
2. Prohibit eating, drinking, smoking and mouth pipetting in room where ^{35}S is handled.
3. Use transfer pipets, spill trays and absorbent coverings to confine contamination.
4. Handle potentially volatile compounds in ventilated enclosures.
5. If enhanced containment is necessary, handle volatile compounds in closed systems vented through suitable traps.
6. Sample exhausted effluent and room air by drawing a known volume through a membrane filter followed by an impinger containing dilute NaOH.
7. Wear disposable lab coat, gloves and wrist guards for secondary protection.
8. Select appropriate gloves for chemicals handled.
9. Maintain contamination and exposure control by regularly monitoring and promptly decontaminating gloves and surfaces.
10. Use pancake or end-window Geiger-Mueller detector or liquid scintillation counter to detect ^{35}S.
11. Submit periodic urine samples for bioassay to indicate uptake by personnel.
12. Isolate waste in clearly labeled sealed containers and hold for decay.
13. Establish air concentration, surface contamination and bioassay action levels below regulatory limits. Investigate and correct any conditions that may cause these levels to be exceeded.
14. On completing an operation, secure all ^{35}S; remove protective clothing and dispose of protective coverings; monitor and decontaminate self and surfaces; wash hands and monitor them again.

^{35}S may be difficult to distinguish from ^{14}C because the beta emissions are of similar energy. If ^{14}C and ^{35}S are being used in the same area, establish controls that are conservative for both radionuclides. Some ^{35}S compounds, including Methionine, generate volatile fractions particularly during lyophilization or incubation. Check for airborne and surface contamination. Charcoal and copper turnings are effective in absorbing and minimizing airborne contamination.

References

1. Kocher, David C., Radioactive Decay Data Tables, Springfield: National Technical Information Service, 1981 DOE/TIC-11026.
2. Kaplan, Irving, Nuclear Physics, New York: Addison-Wesley, 1964.
3. U.S. Nuclear Regulatory Commission. 10CFR 20 Appendix B – Standards for Protection Against Radiation, 1994.
4. ICRP Publication 30, Part 2, Limits for Intakes of Radionuclides by Workers. Pergamon Press, Oxford, 1980.

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