

Sulfur-35 Contamination Reduction Strategies

PSU - EHS
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Surveys performed by EHS have found that contamination is not uncommon in laboratories using sulfur-35 labeled methionine, cysteine, or translabel. Contamination levels can be surprisingly high depending on the amount and frequency of use.

Some of the problems associated with sulfur 35 labeled methionine, cysteine, or translabel are:

- They are volatile. Radiolysis of labeled amino acids may lead to the release of S-35 labeled volatile impurities, typically SO_2 and CH_3SH , which are water-soluble.
- Radiolytic breakdown may also occur during freezing processes, releasing as much as 1 μCi per 8.0 mCi vial of S-35 amino acid during the thawing process
- Vapors will also be released when opening other labeled compounds, during incubation of culture or cells, and even during storage of S-35 contaminated wastes.
- S-35 compounds stick readily to the insides of centrifuges, autoclaves, incubators (including water reservoirs), refrigerators, tubing, rubber seals, and gloves. This contamination is easily transferable to gloves or even other items used and stored in the same area.
- Low levels of contamination are hard to detect with a standard GM pancake probe.
- Sulfur's 90 day half-life does not readily lend itself to decontamination by decay. Instead, continual (daily or weekly) additions of low grade contamination will result in the contamination increasing in activity for about 900 days before an equilibrium concentration is reached where the decay equals the amount deposited.

Contamination resulting from volatile sulfur compounds can be controlled to some degree. An activated carbon or charcoal canister, charcoal filled absorbent sheet, or tray (50-100 grams of activated charcoal granules evenly distributed on a tray or dish) have been shown to readily capture S-35. Just one gram of activated charcoal has a surface area in excess of 500 m^2 so a little bit in a dish will greatly reduce the probability that your sulfur will plate out on the inside of your incubator and refrigerator.

Another simple method is to use copper coated materials. Volatile sulfur compounds readily chemically bind to copper. Simply adding copper foils, copper fittings, copper mesh sponges (Chore Boy Scrubbers), or even pennies have been shown to be effective sulfur traps. These have the added advantage of being unlikely to spill when disturbed.

The following are recommendations for handling S-35 compounds that you should consider to help mitigate the contamination problems that will arise.

Stock Vials:

- Dispensing from the primary stock vial should be done in a chemical exhaust (not biological) fume hood.
- Vials can also be "vented" using an open-ended charcoal-filled disposable syringe. Activated charcoal has a high affinity for S-35 vapors. The syringe must be disposed into a radioactive sharps container
- Stock vials, along with a copper scrubbing pad, should be stored in a secondary container with a tight fitting lid. EHS will provide you with the containers.

Incubators:

- Place an absorbent into your incubator to passively absorb S-35 vapors. Activated charcoal or copper scrubbing pads can be placed into an uncovered Petri dish on a shelf. Be sure to replace

the absorbing material when survey meter readings are significantly above normal – 100 times background (~5000 cpm). Dispose of the old absorber into the solid radioactive waste.

- Water trays in the incubator can also become contaminated. Sample and replace contaminated incubator water so the sulfur cannot contaminate your laboratory or become re-suspended in the incubator. Dispose of the old water into your liquid radioactive waste.
- Culture dishes, along with a pan of charcoal or copper, can be placed inside a larger plastic container with perforations in the lid. This allows full gas circulation but helps trap the volatile S-35 in the charcoal or copper.

Refrigerators:

- Since the volatile S-35 compounds plate out on any surface, non-radioactive items stored in the same refrigerator with S-35 stock vials and samples may also become contaminated.
- In addition to storing stock vials in a separate container, spin tubes and other S-35 samples should be stored in a container with a tight fitting lid. Adding a copper mesh scrubber to the container is suggested to trap any out-gassing of the sulfur.
- Consider placing activated charcoal paper on refrigerator shelves and in S-35 sample storage boxes. Alternatively copper scrubbing pads may be placed on uncovered Petri dishes to trap volatile sulfur.
- Refrigerator surfaces (walls, shelves) should be checked monthly for removable contamination by taking a wipe of the surfaces checking it with a pancake Geiger-Mueller survey meter. If contamination is found, the interior of the refrigerator and items stored in the refrigerator must be cleaned.

General Laboratory

- All incubators, refrigerators, freezers, and centrifuges where S-35 compounds are used and stored must be tagged with a “Radioactive Material” sticker.
- When aspirating S-35 liquids use a second flask containing copper mesh between the vacuum system and the collection flask. This will help reduce the chance of the vacuum system becoming contaminated.
- Centrifuge contamination is almost unavoidable. Putting the lid on the rotor is required and will help contain the material. Survey the rotor and side walls of the centrifuge after each use. Wipe down the surfaces, several times if needed, to reduce the levels of removable contamination. Some residual remaining contamination (~ 1000 cpm or so) is acceptable provided the centrifuge is tagged as radioactive.
- Survey gloves frequently and change them when contaminated, and, as always
- Survey, survey, survey.
- Survey the area, floor, and your shoes when finished.

The copper mesh scrubbers are available from discount and grocery stores.

Activated charcoal impregnated papers are available from Atlantic Nuclear www.atnuke.com/nuclear/hoods/filterpaper.htm Activated charcoal can also be obtained from Environmental Health and Safety.

Additional information and suggestions can be found at the following web sites:

Carnegie Mellon University

ehs-alert.fms.bap.cmu.edu/pdf/S-35-methionine-guideline.pdf

Harvard University

www.uos.harvard.edu/ehs/radiation/purchasing_s35_reference.shtml

