TechTip No. 106

VOLATILE DECOMPOSITION PRODUCTS OF ^{35}S LABELED AMINO ACIDS

Recently, Meisenhelder and Hunter (1988) described a phenomenon that has only recently been appreciated for its potential Health Physics ramifications. As Meisenhelder and Hunter observed, the radiolytic decomposition of ^{35}S labeled amino acids produces volatile component(s).

The exact nature of these components is unknown at this time, but some possibilities have been put forward in a review by Liebster and Kopoldova (1964). The volatile decomposition product from cysteine is presumed to be H_2S. The formation of this compound is related to the concentration, pH, and absorbed radiation. The likely volatile from the decomposition of methionine is methyl mercaptan (CH_3SH). As with cysteine, the decomposition of methionine is dependent upon the absorbed radiation dose and the pH of the solution.

Since the absorbed radiation dose cannot readily be controlled when using materials approaching the theoretical maximum specific activity for ^{35}S (55.3TBq/mA, 1494 Ci/mA), stabilizing the pH and preventing the build-up of decomposition products which may enhance further decomposition (Evans, 1982) is essential for minimizing the production of volatile products.

In work done at Amersham, we have found that the radiochemical purity of the compound affects the production of volatiles. In recent experiments we measured the levels of volatiles adsorbed to charcoal during a 24-hour period of incubation of ^{35}S-amino acids in cell culture medium at 37°C. Results are presented in Table 1. Note that HPLC purified methionine showed an approximate three-fold lower level of volatile decomposition products than the protein hydrolysate; and that stabilized, HPLC purified methionine showed an eleven-fold decrease in volatiles.

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TABLE 1

SAMPLE 1mCi ^{35}S	CHARCOAL ADSORBED ACTIVITY (nCi)	PERCENTAGE ($\times 10^{-3}$)
Protein Hydrolysate	280	28
HPLC Purified Methionine	99	9.9
Stabilized, HPLC Methionine	25	2.5

In light of the potential contamination of hoods, incubators, equipment, and personnel, we suggest the following possible solutions:

A) Use fresh, highly purified ^{35}S labeled amino acids. Wherever possible use stabilized solutions of these amino acids.

B) Thaw vials of ^{35}S amino acids in a fume hood.

C) Monitor work areas frequently. Wear disposable gloves and labcoats. When cleaning fume hoods and incubators, monitor cleaning materials prior to disposal.

D) If possible, use a designated incubator for all labeling experiments.

E) Placing an activated charcoal filter or a plastic tray with a shallow bed of activated charcoal in the incubator will adsorb some of the ^{35}S volatiles.

F) Whenever possible, contain your experiment in a sealed plastic bag containing charcoal.

REFERENCES

Evans, E. A. (1982) “Self-decomposition of Radiochemicals” Review 16 Available from Amersham Corporation R821037

Liebster, J. and Kopoldova, J. (1964) in Radiation Biology, Volume 1, Pp.157-226

Meisenhelder, J. and Hunter, T. (1988) Nature 335:120