CONTROL OF OXIDATIVE DEGRADATION IN ^{99m}Tc-LABELED FERROUS HYDROXIDE: A SIMPLIFIED METHOD

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Preparation of aggregated ^{99m}Tc-ferrous hydroxide requires that the ferrous state be maintained for maximum incorporation of the radionuclide and stability of the chemical form. Others have succeeded in maintaining the ferrous state by adding reducing agents such as stannous ion (*1*), or by displacing air with nitrogen in the solutions and containers used in the preparation (*2*). We prefer an alternative method which eliminates unnecessary reducing ingredients and makes unnecessary more complicated nitrogen hardware and the associated problems of maintaining sterility.

To prevent oxidation of ferrous ion, we prefer to create a partial vacuum inside the product vial by aspirating air with an ordinary syringe and needle. The vacuum effectively deaerates the added liquids and prevents significant oxidation of ferrous ion to ferric, as evidenced by maintenance of the bright green ferrous hydroxide color for several days.

Our method requires the following pretested ingredients and quantities:

1. Ferrous sulfate heptahydrate 2% in 0.1 *N* HCl — 0.1 ml
2. ^{99m}Tc-eluate, millicuries as needed, volume adjusted with saline ad — 3.0 ml
3. Sodium hydroxide 0.1 *N* solution — 0.5 ml
4. Pharmagel B 5%, pH 7.0 — 1.0 ml

Using asceptic technique, these directions are followed:

1. To a vial containing 0.1 ml of ferrous sulfate, add the desired amount of ^{99m}Tc, adding saline if necessary to adjust this addition to 3.0 ml.
2. Withdraw at least two 10-ml quantities of air using a 10-ml syringe. Maintain this vacuum subsequently.
3. Add sodium hydroxide solution with gentle agitation of the vial. Continue gentle agitation intermittently over the next 1 or 2 min.
4. Add the gelatin solution, warmed to facilitate transfer by syringe.

Preparation time is about 5 min. Without further pH adjustment, the final pH has consistently been in the range of 5.3–8.0, and we do not check pH during the course of the preparation. Vacuum should not be released from the vial during withdrawal of doses. Nonbound radionuclide has consistently been less than 5% immediately after preparation and up to 2 days later, even with centrifugation performed without concern for the oxidation which might take place during the assay.

The amount of radioactivity we add to the 4.6 ml final volume permits a dose volume of less than 1.0 ml. We inject no more than 1.0 ml of this formulation (40 μg of iron) to minimize possible long-term effects of iron retained in the lungs (*3*). Maintaining a fixed concentration of iron in the final product and adhering strictly to this preparative method provides a reproducible range of aggregate size—very few particles larger than 60 microns as observed under the microscope, and less than 5% of total injected radioactivity in the liver.

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