Y-01-RC

STANDARDIZATION OF YTTRIUM CARRIER

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APPLICATION

This procedure is applicable for the standardization of yttrium carrier solution. The carrier is standardized, in triplicate, by the direct precipitation of yttrium oxalate, $Y_2(C_2O_4)_3 \bullet 9H_2O$, from a measured quantity of carrier solution. The precipitate is then filtered through a tared filtering funnel and the weight of the yttrium oxalate is determined.

SPECIAL APPARATUS

1. Gooch type filtering funnels (30 mL, tall type) with fritted disc, fine or medium porosity.

2. Filter funnel holders.

3. Flask, side arm vacuum, 500 mL.

4. Volumetric pipette, 10 mL, Class A.

5. Teflon filter holder or filter funnel and sample mount - see Specification 7.12

6. Ring and discs - see Specification 7.2

7. Mylar film - see Specification 7.5

SPECIAL REAGENTS

1. Yttrium carrier, 10 mg Y^{+3} mL^{-1}:

   a) dissolve 12.7 g of highest purity Y_2O_3 in a minimal amount of HNO_3; use heat if necessary. Gravity filter through Whatman No. 42 filter paper to remove any insolubles (if necessary). Transfer the solution to a 1 L volumetric flask and make up to volume with water.

   b) or obtain a commercially prepared yttrium standard, e.g., 10000 µg Y^{+3} mL^{-1} in 5% HNO_3 (SPEX CertiPrep, Metuchen, NJ 08840 or equivalent).

   c) see the Appendix to determine any activity in the carrier.

2. Ammonium oxalate solution, saturated.

3. Ethyl alcohol, 95%.

SAMPLE PREPARATION

1. Condition each of three fritted disc glass filtering funnels with 25 mL of water and 25 mL of ethyl alcolhol.

2. Dry the funnels in an oven at 105°C for ½ hour, cool in a desiccator for ½ hour and weigh to the nearest 0.1 mg. Record the tare weight of each funnel.

3. Pipette 10 mL quantities of yttrium carrier solution into each of three 100-mL beakers.

4. Dilute to the carrier solutions to ~ 25 mL with water and heat to boiling on a hot plate.

5. Slowly add 25 mL of saturated ammonium oxalate solution to the beakers with stirring. Continue to heat the mixture on the hot plate with occasional stirring, using a glass rod, for ~ 10 min.

6. Cool the beakers to room temperature and filter each precipitate, with vacuum, through one of the tared filter funnels. Rinse each beaker with water and pass the rinse through the filter funnels.

7. Wash the yttrium oxalate precipitate with ~ 25 mL of water, followed by 25 mL of 95% ethyl alcohol.

8. Dry the filter funnels in an oven at 105°C for ½ hour, cool in a desiccator for ½ hour. Weigh the funnels containing the precipitates to the nearest 0.1 mg.

9. Record the total weight of each funnel and precipitate.

10. Calculate the weight of the yttrium oxalate precipitate.

11. Average the weights of the precipitates obtained from the replicate determination and calculate the precision (standard deviation).

12. Repeat the carrier standardization if the precision from the standardization is > 0.5%.

13. Determine the yttrium yield for each sample analyzed from the ratio of the weight of the sample yttrium oxalate to the expected weight of the yttrium oxalate, as determined from the standardization. [**Note:** The gravimetric factor for conversion of yttrium to yttrium oxalate is 3.397.]

APPENDIX

DETERMINATION OF THE ACTIVITY OF THE YTTRIUM CARRIER

The carrier is initially screened for activity by radioassay of the directly precipitated yttrium oxalate (Section A). If the beta counting results are not within plus or minus 1 standard deviation of the mean of the counter background, proceed to Section B to determine if the activity is attributed to ^{90}Sr.

A. Initial screening.

1. Pipette 1 mL (10 mg mL^{-1}) of yttrium carrier solution into each of three 40-mL centrifuge tubes. Dilute to 20 mL with water.

2. Heat the tubes in a hot water bath to about 90°C, and, with stirring, add 10 mL of saturated ammonium oxalate solution.

3. Digest the precipitates in the hot water bath for ~ 20 min or until the precipitate settles.

4. Cool the tubes to room temperature.

5. Vacuum filter the precipitate, using a Teflon filter assembly, onto a 2.8-cm Whatman No. 42 filter. Wash the tubes and precipitates with ~ 10 mL of water and 10 mL of 95% ethyl alcohol. Place the precipitates on a glass plate or cover glass.

6. Dry the precipitate in an oven at 105°C for ~ ½ hour, cool to room temperature. Mount the Whatman disk containing the precipitate on a nylon disc, cover with Mylar and beta count.

B. Specific determination.

1. If the beta counting results are not within the ± 1 standard deviation of the mean of the counter background, pipette 1 mL of yttrium carrier into each of three 40-mL centrifuge tubes and dilute to 20 mL with water.

2. Heat the tubes in a hot water bath to ~ 90°C, and, while stirring, adjust the pH to 8.0 (pH paper) with NH_4OH.

3. Digest the precipitates for 10 min and cool to room temperature.

4. Centrifuge for the tubes for 5 min, decant and discard the supernate in an appropriate manner.

5. Proceed with Steps 8 to 24, **Paragraph D, Second Milking**, Procedure Sr-05-RC and beta count for the ^{90}Y half-life.