Preparation of Mixed Alpha Standard Sources by using U-234, U-238, Pu-239 and Am-241 Radionuclides with Molecular Plating Process

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The CDC Radiation Lab developed custom mixed alpha standard sources to meet quality control (QC) needs for its clinical alpha spectroscopy radiobioassay methods. By using Molecular Plating (MP) to create an ultra-thin, uniformly deposited film on a thick backing with sufficient radioactivity, we were able to reduce QC count times from 16 to 2 hours (over 85% reduction). The optimal MP parameters, (e.g., type of electrolyte, cathode material, geometry, shape of the platinum anode, baking surface quality, concentration, agitation rate, current density or potential, and deposition time) will be discussed.

We analyzed the sources based on their current density, total activity, and film color distribution for different radionuclide and alcohol types. The uniformity of the sources depends on the distance between the anode and cathode, MP geometry, plating time, planchet, and alcohol types. Our MP procedures created consistently mixed alpha standard sources with higher radioactivity levels than commercially available sources. The study found that ultra-thin film standard sources were produced using the MP process at a constant potential 800V and agitation at 190 revolutions per minute (rpm) for 15 minutes. The thickness of the sources ranged between 300-450 nanometers (nm), and their total activities ranged between 12-17 Becquerels (Bq). The MP technique used achieved a high yield range of 95-100%, which prevented the loss of valuable radionuclides.

Using these sources for daily quality control procedures can significantly improve sample throughput without sacrificing method quality. Sample throughput is particularly important during emergency responses where there is a high risk of intake of known alpha emitters. Adopting these custom source procedures may have broad implications for public health and environmental safety as they can be used in rapid response methods for radionuclides in different matrices, such as food, water, and soil.

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