

LARGE SCALE PRODUCTION OF CARRIER-FREE I-131  
BY AN ADSORPTION METHOD USING  $Mg_3TeO_6$  AS TARGET  
MATERIAL

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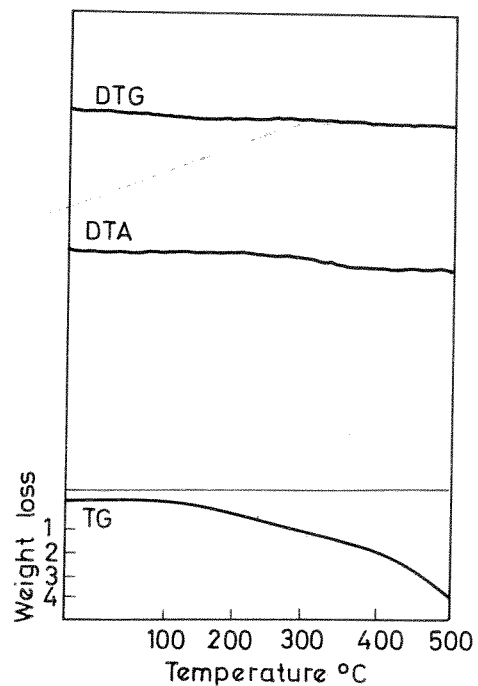
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$Mg_3TeO_6$  was applied as target material for producing carrier-free I-131, utilizing the adsorption of iodine on platinum black. The thermal and radiation stability of  $Mg_3TeO_6$  permits irradiation even in high-flux reactors. The large specific surface area of platinum black permits the separation of I-131 in multicurie amounts.

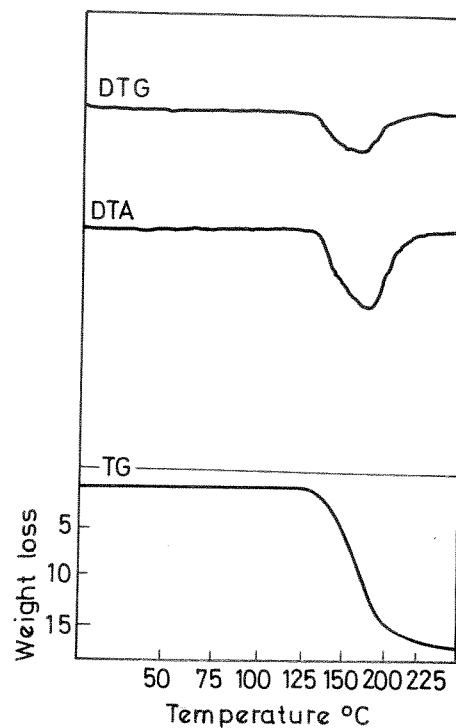
The strong tendency of iodine to deposition on platinum has already been utilized in the separation of carrier-free  $^{131}I$  from reactor-irradiated telluric acid<sup>1-3</sup> and uranium.<sup>4</sup> Telluric acid  $/H_6TeO_6/$ , when used as target material, undergoes thermal and radiation-induced decompositions during irradiation with the loss of two water molecules to give insoluble  $H_2TeO_4$ . The removal of 90-95% of the water by heating telluric acid somewhat below 136 °C makes irradiation possible, provided the temperature during irradiation does not exceed this value. However, the dissolution of partially dehydrated telluric acid is very tedious. Attempts were made to find a tellurium compound which is soluble in dilute sulfuric acid and stable at high temperatures and during irradiation.  $Mg_3TeO_6$  has proved to satisfy these requirements.

Thermogravimetric analysis of  $Mg_3TeO_6$ 

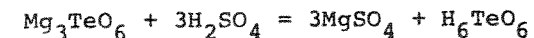
Fig.1 shows the thermogram of  $Mg_3TeO_6$  up to 500 °C. As can be seen from the TG curve, the weight loss remains below 4%. Since no peaks are observed on the DTG and/or DTA curves,

Fig.1. Thermogram of  $Mg_3TeO_6$ 

the weight loss can be attributed to the release of traces of water occluded in the  $Mg_3TeO_6$  grains rather than to any change in composition. In the case of  $H_2TeO_4 \cdot 2H_2O$ , the TG curve presented in Fig.2 shows a weight loss of about 15% around 140 °C corresponding to the loss of two water molecules.

Fig.2. Thermogram of  $H_2TeO_6$ Irradiation of  $Mg_3TeO_6$ 

Irradiation was performed with a thermal neutron flux of  $1/2 \times 10^{13} \text{ ncm}^{-2} \text{ sec}$  for a maximum of 250 hours. The irradiated target material was dissolved in a slight excess of 10 N sulfuric acid, calculated on the basis of the following stoichiometric equation:

Platinum black adsorbent

Platinum black with a specific surface area of 10-15  $m^2/g$  was prepared by reducing hydrogen hexachloroplatinate/IV/ with formaldehyde in an alkaline solution. 0.5 - 1.0 g of platinum black was packed into a small column. The surface of platinum was treated before use with dilute formaldehyde. If this pre-treatment is omitted, the surface layer of platinum would be dissolved in the form of a platinum-iodo complex<sup>5</sup> and thus contaminate the separated  $^{131}I$  and decrease the separation yield.

Adsorption of  $^{131}I$  on platinum black

The slightly acidic solution of  $H_6TeO_6$  obtained by the dissolution of  $Mg_3TeO_6$  in sulfuric acid was passed through a small column filled with 0.5 - 1 g of platinum black, at a flow rate of about 1 ml/min, resulting in the adsorption of 95-98% of  $^{131}I$ . After repeated washing of the adsorbent with redistilled water, the desorption of  $^{131}I$  was effected by a  $NaHCO_3 + Na_2SO_3$  or  $NaOH + Na_2SO_3$  solution. The maximum activity of  $^{131}I$  bound by the platinum black packing can be estimated by taking into

account that, when iodide is brought into contact with platinum black in acidic solution, a monolayer of adsorbed iodine is formed,<sup>5</sup> which corresponds to 0.3 mg iodine/m<sup>2</sup>.

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#### USE OF ZIRCONIUM TELLURATE IN ION EXCHANGE SEPARATION TECHNIQUE

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Distribution coefficients were determined for 45 ions in hydrochloric acid and ammonium chloride solutions. The measurements were carried out at room temperature under stationary conditions using a tracer technique.

The adsorption of mono-, di- and trivalent ions on zirconium tellurate was studied following our investigations in the field of inorganic ion exchangers.<sup>1</sup>

#### EXPERIMENTAL

Amorphous zirconium tellurate of 0.4 - 0.31 mm grain size was used throughout the experiments. The proper radioactive isotopes of the examined elements were produced by irradiation in a pile. In the case of mother-daughter element systems, e.g. Mo-Tc, the daughter element was separated in advance.

The measurement of distribution coefficients /D/ was carried out at room temperature under stationary conditions.

Prior to the determination of "D" values for the different ions, the influence of the shaking time was examined; the attainment of equilibrium was found to occur after 120 min. A shaking time of 3 hrs was used in every run.