

Production of carrier-free I-131 from telluric acid by an adsorption method

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IN ALL wet processes⁽¹⁻⁵⁾ used for the production of I-131, iodine is separated from the irradiated tellurium or a telluric compound by distillation. Elementary tellurium is dissolved under strong oxidizing conditions, and the distillation process leads to samples containing impurities and the yield is rather low. With telluric acid as a target, the I-131 samples are of higher purity and the process is more efficient.⁽⁶⁾ Distillation, however, involves some contamination by inactive material (e.g. NaOH, KOH, Na₂SO₄), because the distillate is trapped in an alkaline medium to prevent the escape of iodine.

Studies of the adsorption⁽⁷⁾ and electrolytically-induced desorption of I-131 on a platinum surface have lead to a new technique for the preparation of chemically and radiochemically pure I-131.

The adsorption of I-131 onto platinum metal in solutions of varying pH has been studied by suspending a platinum disc in the solutions; the activity on the disc is measured by Geiger counting. Equilibrium adsorption is attained in about 30 min, and the adsorption rate is increased by increasing the hydrogen ion concentration. The adsorption equilibrium is considerably affected by the quality of the platinum surface, e.g. treatment of the platinum by chloro-nitric acid, annealing in an oxygen flame, or an anodic polarisation treatment, lead to small amounts of adsorbed iodine. The most satisfactory surface to give maximum adsorption was obtained by thorough polishing with a fine abrasive paper and after cathodical polarization. Iodine may be removed almost completely from the platinum by treatment with a strong oxidising reagent, or by making the platinum the anode of an electrolytic cell in which the cathode is also platinum but of much smaller surface area (presumably due to formation of an oxide layer).

Experiments to study the removal of iodine from solutions containing telluric acid have been carried out, and the following results obtained.

Telluric acid was irradiated in a quartz capsule, sealed in an aluminium can, at a neutron flux of 10^{18} n/cm²/sec. The activated telluric acid was then dissolved in 50 ml N sulphuric acid contained in a 50 ml platinum vessel. This vessel was agitated for 40 min and, after removing the telluric acid solution, was repeatedly rinsed with redistilled water. It was then filled with 50 ml redistilled water, into which a 6 cm² surface platinum disk was suspended, and a terminal voltage of 2-3 volts was applied to the vessel as anode, and the platinum disc as cathode, to initiate electrolytic polarization. Eighty-five per cent of the I-131 adsorbed on the platinum surface passed into the solution in 90 min; the results are as follows.

| Experiment | Telluric acid dissolved in platinum vessel <i>Grams</i> | I-131 activity in telluric acid <i>mc</i> | I-131 activity adsorbed on platinum surface | |
|------------|--|--|---|-----------|
| | | | <i>per cent</i> | <i>mc</i> |
| 1. | 1 | 5.7 | 74 | 2.2 |
| 2. | 2.16 | 12 | 56 | 6.72 |
| 3. | 4.32 | 24 | 56 | 13.44 |
| 4. | 8.0 | 44 | 52 | 22.8 |
| 5. | 18.2 | 180 | 48 | 86.0 |

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The active and inactive impurities of the sample were analysed by gamma spectroscopy and optical spectroscopy.* The gamma spectrum showed no activity other than I-131 and a decay curve followed for ten half-lives showed not more than 0.05 per cent of contamination. This small contamination is attributed to long-lived I-129 produced from Te-128. By using a platinum vessel of suitable dimensions (surface of about 200–300 cm²) the method can be used for producing I-131 in quantities of the order of 1 Curie.

Observations on the adsorption and electrolytic recovery of I-131 on platinum surface will be published in a subsequent paper.

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* The results showed no more impurities than in the redistilled water used.

Some experiments on the use of the chelating ion exchanger Dowex A-1 in nuclear chemistry

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THE chelating ion exchanger Dowex A-1⁽²⁾ is, to our knowledge, the first commercially available material of this type. It has been shown in this laboratory⁽¹⁾ that divalent cations in the presence of complex-forming sodium triphosphate were strongly absorbed by the resin. Since hitherto no literature data concerning the behaviour of trivalent ions in this resin are known to the authors, it seemed interesting to extend the studies to this region. So far two preliminary experiments have been performed.

EXCHANGE BETWEEN La AND Cu IN Cu-SATURATED RESINS

A solution containing 25 ml of 0.3 C CuCl₂ solution, pH-buffer, 20 mg inactive La(NO₃)₃·6 H₂O (corresponding to 3 per cent of the resin capacity), and radioactive La¹⁴⁰ (produced by irradiation in the Danish high flux reactor DR 2) were mixed in a beaker together with Cu-saturated, 50–100 mesh, Dowex A-1 chelating resin at room temperature.

The activity of the solution was measured in a double-mantled GM-tube both before and at the end of different times of contact with the resin. At the end of the experiment, the resin was separated from the solution and washed with distilled water. The copper in the resin phase was displaced with

TABLE 1.—COPPER-LANTHANUM EQUILIBRIUM ON A-1 RESIN

| pH | 3.08 (acetate-buffer) | | 2.28 (biphthalate-buffer) |
|---------------------|--------------------------|------|------------------------------|
| | 1 and 3.5 h | 25 h | 0.5 h |
| $\frac{Cu_r}{Cu_s}$ | 0.30 | 0.30 | 0.31 |
| $\frac{La_r}{La_s}$ | 0.4* | 0.57 | 0.5* |

* Somewhat less accurate than the other figures.

⁽¹⁾ S. FORBERG and S. LUNDGREN *Anal. Chem.* **32**, 1202 (1960).

⁽²⁾ "Dowex Chelating Resin A-1", January 1959, The Dow Chemical Company, Technical Service and Development, Midland, Michigan.