# Tritiation of Lithium Benzoate by Irradiation with Thermal Neutrons

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RECOIL tritium atoms from the nuclear reaction $^6Li(n, \alpha)^3H$ are able to tritiate organic compounds, and various inorganic lithium salts have been used as a source of tritium.[1] We have now found that irradiation of lithium benzoate with neutrons yields tritiated benzoic acid much more efficiently than irradiation of a mixture of benzoic acid and an inorganic lithium salt. Thus, irradiation of a system containing lithium in molecular dispersion seems to afford a useful way of labelling organic compounds with tritium.

Lithium benzoate (2—5 g.) was sealed in a quartz tube under $10^{-4}$ mm. of air and irradiated for ten hours in the JRR-1 reactor (neutron flux, $10^{11}$ $n$.cm.$^{-2}$ sec.$^{-1}$) at the Japan Atomic Energy Research Institute. Tritiated benzoic acid recovered from the irradiated material was recrystallized from water or alcohol until it showed a constant specific activity. In a typical experiment, 3·067 g. of lithium benzoate gave 2·164 g. of tritiated benzoic acid of a specific activity of $1·667 \times 10^{10}$ d.p.m./mole.

The Table shows that the present method gives a higher specific activity and almost quantitative chemical yield (as determined by dilution analysis) of tritiated benzoic acid, as compared with the method using lithium carbonate and benzoic acid. The low yield in the latter method is probably due to the occurrence of extensive radiation damage and the present experiments partly confirm the findings of Russian workers.[2]

The distribution of tritium in the various nuclear positions of benzoic acid was found to be $o:m:p=$ 39·8 : 38·8 : 21·4% for the product from lithium benzoate and 40·3 : 39·0 : 20·7% for the product in the control experiment with a mixture of benzoic acid and lithium carbonate. The distribution appears to be uniform in both cases, confirming the results of previous experiments in which mixtures of benzoic acid and lithium carbonate were irradiated.[3]

TABLE. *Chemical yield and specific activity of tritiated benzoic acid*

| Irradiated material | Lithium benzoate | Benzoic acid and lithium carbonate |
|---|---|---|
| Chemical yield (%) .. | 99 | 45 |
| Specific activity .. ($10^{10}$ d.p.m./mole) | 1·866 | 1·046 |

Similar irradiation of lithium benzyl oxide, lithium phenethoxide, lithium phenylacetate, and lithium hydrocinnamate afforded the corresponding tritiated compounds of a specific activity of about $10^{10}$ d.p.m./mole in high yields.

The tritiated compounds were counted for activity with a liquid scintillation apparatus and the countings were corrected for their quenching effects.

(*Received, October 24th*, 1966; *Com.* 819.)

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