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The Removal and Control of Iodide-131 Contamination[2] in Sodium O-Iodo[131] Hippurate

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With free iodide-131 present in solutions of sodium o-iodo[131] hippurate (radio Hippuran, OI[131]HA) the results are inconsistent when the material is used in renal clearance tests(1). A method was reported earlier for the removal of this contamination, involving the treatment of the OI[131]HA solutions with freshly precipitated silver-chloride (1).

Apparently, self-irradiation in OI[131]HA solutions causes the release of iodide-131 (1,2). The resulting presence of iodide-131 may in turn give rise to further contamination with radioiodinated organic materials(3,4). Even in solutions of OI[131]HA which have been purified by the silver-chloride treatment, iodide-131 contamination will again increase, especially if the specific activity is high.

A material was sought which could be placed in contact with the stored solutions of radioiodinated pharmaceuticals and would remove the contaminating radioiodide as it formed. Volk Radiochemical Company supplied us with silver-chloride coated Berl porcelain saddles for evaluation and some similar saddles were prepared in this laboratory. (Berl saddles are normally used as fractionating column packing.) The silver chloride acts as an ion-exchange medium, exchanging chloride ions for iodide ions. The Berl saddle merely acts as an inert support for the silver-chloride to prevent more than a negligible contamination of the pharmaceutical with silver-chloride. Since a large area of silver-chloride must be exposed to the solution for effectiveness, and since Berl saddles are essentially

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nonporous, a more efficient support material was sought. Todd microporous, inert carbon boiling-chips were studied as a more effective support material.

EXPERIMENTAL

The silver-chloride-impregnated Berl porcelain saddles were supplied either by Volk Radiochemical Company or prepared in this laboratory. The untreated Berl saddles and the Todd microporous carbon boiling-chips were supplied by Fisher Scientific Company.

The material to be impregnated with silver-chloride was allowed to stand in contact with one molar silver nitrate for several hours. The chips were removed from the silver nitrate solution by filtration and placed in a drying oven at 105° for four hours. They were allowed to stand in a solution of one molar sodium chloride for four hours, and again removed and dried. After washing with water, they were redried and were stored in the dark for use.

Per cent contamination of radio-Hippuran solutions with iodide-131 were followed by the I_2-CCl_4 test (5). The solutions to be tested contained ca. 100 microcuries of radio-Hippuran in ca. 5 ml of water. Contaminations above that already in the commercial product were made by addition of small amounts of sodium iodide-131 solution.

Table I shows the result of the treatment of various solutions with silver chloride-impregnated microporous carbon chips, with silver-chloride coated Berl saddles made by Volk Radiochemical Company and with similar saddles made in this laboratory.

In addition, a solution of commercial radio-Hippuran containing ca. four per cent iodide-131 contamination was treated with the impregnated carbon chips. After 20 hours, the contamination was reduced to about two per cent, at which level it remained during a one month study. The control remained at the four per cent value throughout the study. All solutions were stored in the dark.

DISCUSSION

Both Berl porcelain saddles and microporous carbon boiling-chips, when impregnated with silver-chloride, give substantial reductions of levels of iodine-131 contamination of sodium o-iodo^{131} hippurate solutions. However, only the impregnated carbon chips appear to give reductions of contamination to acceptable levels, *i.e.*, below three per cent. The porosity of the carbon chips probably allows a much greater surface area of silver-chloride to be effective in providing ion exchange sites. Although no studies of the effect of age of the prepared chips have been made, early observations indicate that half-year old chips are not as effective as freshly prepared ones. Such an observation might be expected, because of the light sensitivity of silver-chloride.

The AgCl-carbon-chip treatment should be effective in controlling iodine-131 contamination in any water soluble salt of a radioiodinated organic compound. The containment of the silver-chloride by the carbon matrix should prevent contamination of the treated solution with any appreciable amount of free silver-chloride particles.

The anomalous phenomenon of the reduction of contamination levels in respect to time evident in the controls in Experiments Nos. I and IV is discussed in our recent paper on the incorporation of iodine-131 into the nonradioactive Hippuran molecule (3).

TABLE I

Experiment I

Day	*Control (Iodide-131 Per Cent)*	*Treatment with Two AgCl Saddles (Prepared by Hosick & Witt) (Per Cent Iodide-131 in $OI^{131}HA$)*					
		#1	*#2*	*#3*	*#4*	*#5*	*#6*
0	7.12	17.8	21.6	19.0	15.2	17.4	13.6
2	7.03	12.5	16.6	11.3	10.0	13.5	8.7
6	——	10.9	14.4	9.1	——	——	——
9	6.7	8.9	12.5	7.8	——	——	——

Experiment II

Day	*Control*	*Treatment with Two AgCl Saddles (Prepared by Hosick & Witt) (Per Cent Iodide-131 in $OI^{131}HA$)*		
0	5.9	6.0	5.9	5.9
3	6.0	3.6	3.4	3.3
5	6.4	3.1	3.2	3.1
7	6.1	2.9	2.9	2.8
20	6.1	2.7	2.6	2.7

Experiment III

Day	*Control*	*Treatment with Four Volk AgCl Saddles (Per Cent Iodide-131 in $OI^{131}HA$)*			
0	5.52	63.7	65.4	44.0	27.6
1	——	——	——	——	22.6
3	5.82	48.6	63.6	37.7	——

Experiment IV

Day	Control	Treatment with Ten Microporous AgCl Carbon Chips (Per Cent Iodide-131 in $OI^{131}HA$)		
0	14.8	14.8	14.8	14.8
1	——	2.1	2.1	1.9
2	10.8	1.0	1.0	1.0
3	9.9	1.0	1.0	0.9
7	6.4	0.9	0.8	0.7
10	6.4	0.6	0.6	0.6

SUMMARY

A method has been found to remove contaminating sodium iodine-131 from radio-Hippuran (and other water-soluble salts of radioiodinated organic compounds) and to keep such contamination at acceptable levels during the shelf-life of the compound. The solution of radio-Hippuran is allowed to remain in contact with microporous carbon boiling chips which have been impregnated with freshly precipitated silver-chloride. The iodide-131 ions are replaced by chloride ions. Minimal contamination of the solution with silver-chloride is obtained.

Berl porcelain saddles, coated with silver-chloride failed to give adequate reduction of contamination.

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