

Prevention of Uptake of Strontium Ions on Glass

THE uptake of metal ions by the walls of glass vessels is a frequently encountered phenomenon in analytical chemistry and radiochemistry, and is responsible for the difficulty of maintaining dilute solutions at a known concentration during storage. In general this problem is overcome by making such solutions acid, and neutralizing immediately before use. This technique is not applicable, however, when it is necessary to use the same solution at neutral pH for long periods of time.

We have been investigating the uptake, by bone, of strontium ions (labelled with strontium-89) at approximately physiological pH (7.3), and here the effect of uptake by the walls of the glass tubes used is quite serious. Attempts were made to overcome this by using polythene tubes; but these were found to be even less suitable than glass.

The difficulty has been overcome by coating the inside surfaces of the glass tubes with a non-adsorbent material—a proprietary polyester resin. Though this is satisfactory in preventing uptake, the vigorous shaking required for our experiments caused breakdown of the coating after 60–70 hr. The life of the coating can be extended by first coating the glass tubes with vinyltrichlorosilane and then with the polyester resin. Coating surfaces with non-adsorbent materials has already been investigated for the purpose of easing the decontamination of active surfaces^{1,2}; but there appears to have been no application of this to the prevention of uptake in reaction vessels.

Labelled solutions of strontium chloride (pH ~ 7) were vigorously shaken for 24 hr. in tubes of the following materials: (A) glass, (B) polythene, (C) glass coated with polyester resin, (D) glass coated first with vinyltrichlorosilane and then polyester resin.

Afterwards, an assay was made of the radioactivity remaining in solution. Table 1 shows the percentage uptake for each series at varying concentrations of metal ion. The number of tubes examined is shown in parentheses.

[Sr ²⁺] (moles/l.)	A	B	C	D
1 × 10 ⁻³	12 ± 8 (8 tubes)	66 ± 6 (6 tubes)	0 (36 tubes)	1 (12 tubes)
1 × 10 ⁻⁶				0 (6 tubes)
Carrier-free ⁸⁹ Sr	15 (5 tubes)		7 (10 tubes)	8 (12 tubes)

Within the limits of experimental error the results show that polyethylene is quite unsuitable, but that the use of this coating introduces a significant improvement compared with glass.

The use of this, or other similar coatings, was suggested by Mr. J. R. Morris of this Establishment, and may be applicable to other systems of metal ions.

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¹ Jackson, E. W., and Garrard, L., *Nature*, **171**, 442 (1953).

² Tompkins, P. C., and Bizzell, O. M., *Indust. Eng. Chem.*, **42**, 1469, 1475 (1950).

THE finding that polyethylene adsorbs about five times as much strontium-89 as does glass is rather unexpected considering that in the case of glass, possible adsorption mechanisms include powerful ion exchange processes, while with polyethylene the possible mode of attachment is not evident. On this finding the widespread use of polyethylene instead of glass or ceramics for radioactive effluent tank linings, pipelines, etc., could conceivably lead to a build-up of activity if conditions of pH were suitable.

The assumption by Boocock *et al.* that the strontium-89 is in ionic form may not be justified. At the physiological pH of 7.3 it is not unlikely that the strontium is partially, at least, in the form of a radiocolloid of strontium hydroxide, the adsorption mechanism for which is dependent on interfacial zeta potential, rather than ionic bonding.

It is hoped that the authors can improve further the adhesion of their polyester film, as the technique might well greatly ease the problems of the decontamination of vessels or equipment which have been in contact with radioactive solutions.

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CHEMISTRY

Isotope Effects in the Infra-red Spectrum of I-¹³C-Propene-1

THE abundance and location of isotopically labelled carbon atoms have been investigated by numerous techniques, but no use has been reported of vibrational spectra for this purpose. This communication describes how the infra-red spectrum of a sample of propene prepared with carbon-13 is consistent with all the labelled isotope being in the 1-position.

The sample was prepared from barium carbonate enriched with 55 per cent carbon-13, using a modification of the method of Fries and Calvin¹. These authors provide radiochemical evidence for the specific preparation of 1-¹⁴C-propene-1 by this route. Analysis by mass spectroscopy gave good value for the percentage enrichment but it could not locate the carbon-13 with certainty. There seemed to be rearrangement in the ionization chamber, possibly due to the formation of a cyclic intermediate. The use of nuclear magnetic resonance spectra in the examination of carbon-13 resonances in a variety of organic compounds has been discussed by Lauterbur². However, insufficient sample was available for a nuclear magnetic resonance investigation in the present work.

The infra-red spectrum of a labelled propene sample at 32 mm. mercury pressure in a 9.5 cm. single path cell was recorded between 400 and 3,650 cm.⁻¹ on a Unicam SP100 spectrometer fitted with the SP130 grating accessory. The quantity of sample used was 2.4 mgm. The spectrum differs from unlabelled propene in two respects: first the C=C stretching frequency at 1,652 cm.⁻¹ is decreased by approximately 10 cm.⁻¹; secondly, the out-of-plane frequency at 912.3 cm.⁻¹ is shifted to 903.6 cm.⁻¹.

A shift in the C=C stretching frequency can arise from a labelled carbon atom in either the 1- or 2-position. Unfortunately the precise shift and the relative strengths of the carbon-13 and carbon-12