Warren and Burwell², applied to photographs of the trial model, and with these co-ordinates the structure factors were calculated for the even-numbered planes having indices ≤ 10 (Table 2). The agreement between calculated intensities and those observed on the oscillation photographs verifies the correctness of the structure (Fig. 1).

A least squares refinement³ of the lattice parameters based on twelve unequivocally indexed powder lines yielded the following values: $a = 20.83 \text{ \AA}$, $b = 21.76 \text{ \AA}$, $c = 11.41 \text{ \AA}$.

The structure consists of infinite chains of SnI_4 tetrahedra parallel to the c axis of the crystal, bonded together through double S_8 rings, each iodine atom being in closer proximity to a sulphur atom than can be accounted for on the basis of normal van der Waals radii. A similar interaction intermediate between that of covalent bonding and van der Waals attraction has been observed recently by Hassel *et al.*⁴. In many of the compounds examined by them covalently bound iodine atoms in otherwise electronically saturated compounds act as Lewis acids toward electron pair donors such as nitrogen, oxygen or sulphur atoms in other 'saturated' molecules, with a resultant shortening of the distance of closest approach between the atoms involved.

It appears that this charge transfer interaction is the principal source of the stability of $\text{SnI}_4 \cdot 2\text{S}_8$. Another factor which could contribute to the stability of the compound is the dielectric effect of the S_8 rings in separating the SnI_4 units from each other, since, due to the partial ionic character of the Sn-I bond, there is a tendency toward mutual repulsion in the close packed arrangement of cubic SnI_4 .

The effect of the charge transfer bond on the length of the c axis is striking: assuming normal van der Waals interaction the length of the c axis should be $12.06 \text{ \AA}$, or $0.65 \text{ \AA}$ more than that observed. This effect is of the same order of magnitude as that observed by Hassel in iodoform-sulphur complexes and in dithian-sulphur complexes.

On the basis of the c axis shortening and the ability of this compound to exist at fairly high temperatures despite its unfavourable density, it would appear that the charge transfer bond can be a fairly strong type of force between otherwise saturated covalent molecules.

I thank Mr. J. F. Tilley and Mr. I. Munro for their help in this work.

LORIN L. HAWES

Department of Chemistry,
Australian National University,
Canberra.

¹ Dickinson, R. G., *J. Amer. Chem. Soc.*, **45**, 958 (1923).

² Warren, B. E., and Burwell, J. T., *J. Chem. Phys.*, **3**, 6 (1935).

³ Hawes, L. L., *Amer. Min.*, **45**, 1285 (1960).

⁴ Hassel, O., and Romming, Chr., *Quart. Rev.*, **16**, 1 (1962).

RADIOCHEMISTRY

Removal of Radiostrontium from Milk

In the past few years several methods have been proposed for the removal of radiostrontium from milk. Among the most elaborate methods is a procedure worked out by Migicovsky¹ and further improved by L. F. Emondson *et al.*². This method is based on an ion-exchange process using a bed of resin charged with a mixed solution of calcium, potassium, sodium, and magnesium ions. In pilot plant experiments this

process has proved able to remove about 90 per cent of the radiostrontium present in milk.

The procedure developed in our laboratory is a batch method using three treatments of the milk with cation exchange resins. In the first step 1 litre of milk is mechanically stirred for 20 min with 50 g 'Dowex 50 W-X8' (50/100 mesh) resin in potassium form plus 5 g of the resin in hydrogen form. After stirring, the resin is removed by filtration and the filtered milk is treated once more for 20 min with fresh portions of 50 g potassium resin and 5 g hydrogen resin. The milk is filtered and is finally stirred for 20 min with 55 g 'Dowex 50 W-X8' (50/100 mesh) resin in calcium form plus 5 g resin in hydrogen form. By this method it is possible in laboratory experiments to remove about 99.7 per cent of the radiostrontium from the milk.

The taste of the treated milk is good and a taste panel of 20 persons failed as a whole to distinguish any significant difference between treated and untreated consumer milk.

The used resin which contains the strontium activity removed from the milk is first washed with water and detergent, then sterilized with hot diluted nitric acid. The resin is then transferred to a column and converted to the sodium form by passing a strong sodium chloride solution through the column. The sodium resin is finally transferred to potassium resin, calcium resin, and hydrogen resin in three different columns by passing a potassium chloride solution, a calcium chloride solution, and a hydrochloric acid solution, respectively, through the sodium resin beds.

The milk used for the ion-exchange experiments was obtained from a cow of red Danish milk breed, which was intravenously injected with about 0.5 mc. strontium-85.

It is important to emphasize that the nutritional value and the chemical composition of the treated milk from these experiments have not yet been thoroughly examined; but the Food and Nutrition Division of the National Health Service has from the very beginning planned experiments at the State Vitamin Laboratory involving chemical analyses and investigation of nutritional value by pair-feeding experiments on rats. It may be mentioned that initial chemical determinations have indicated lack of certain vitamins.

Furthermore, the National Health Service planned experiments in pilot plant scale performed by the State Experimental Dairy in order to investigate whether it is practical to carry out the process on a technical scale while maintaining an acceptable efficiency of the ion exchange resin and a bacteriologically satisfactory quality of the treated milk.

We thank Mr. Mogens Simensen for carrying out the injections of the cows.

This work was initiated in 1961 by the Food and Nutrition Division of the National Health Service.

A. AARØKROG
H. C. ROSENBAUM

Health Physics Department,
Danish Atomic Energy Commission,
Research Establishment,
Risø,
Roskilde.

¹ Migicovsky, B. B., *Symp. Radioisotopes in the Biosphere*, 293 (1960).

² Emondson, L. F., *et al.*, *Rep. Removal of Radiostrontium from Milk*. Meeting of the Dairy Industry held at Beltsville, Maryland, December 19, 1961.