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A Technetium-99*m* Labeled Colloid

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Introduction

Six-hour Tc^{99m} has been recently[1-3] proposed as a tracer for medical diagnosis. This isotope can easily be "milked" as $Tc^{99m}O_4^-$ by 0.1 N hydrochloric acid or isotonic sodium chloride solution, from an alumina column containing 67-hr Mo^{99}. Moreover, its single low energy (0.140 MeV) γ-ray makes it especially suitable for scintillation scanning.

Harper *et al.*[2,3] use for liver scanning a Tc^{99m} colloidal preparation, probably Tc_2S_7 absorbed on colloidal sulphur. They prepare[4] this colloidal solution by bubbling hydrogen sulphide through an acid solution of gelatine containing Tc^{99m}, and purifying it from free TcO_4^- by ion exchange resin.

We have studied a simple preparation procedure, which the user can perform by very short chemical manipulations before the injection.

We have found that a labeled colloid can be prepared adding to preformed colloidal antimony sulphide, free from hydrogen sulphide and stabilized with polivinylpyrrolidone (PVP), an equivalent volume of the saline solution containing the "milked" Tc^{99m}. This preparation was sterilized by autoclave heating for 30 min at 120°C. Further purification proved to be unnecessary because, after this treatment, the colloidal particles retain the Tc^{99m} quantitatively.

In this way the preformed colloid, supplied to the user, can easily be labeled shortly before injection.

We have obtained clear liver scannings by intravenous injection of the colloid to rabbits. Degrossi *et al.*[5] have used the same preparation in men with good results.

Experimental

$Tc^{99m}O_4^-$ was "milked" from Mo^{99} by elution with isotonic saline solution.

The preparation of the antimony sulphide was carried out by the classical procedure, adding 20 ml 1% antimony potassium tartrate to 100 ml boiling distilled water, saturated with hydrogen sulphide. After stabilizing with 10 ml 6% PVP solution, the excess hydrogen sulphide was carefully removed with nitrogen. The preparation was sterilized, heating for 30 min at 120°C. The preformed colloid is extremely stable for more than 3 months.

The investigation of labeling yield was performed by adding, to 5 ml colloid, different amounts of $Tc^{99m}O_4^-$ saline solution and subsequent autoclave heating for 30 min at 120°C.

Under these conditions, for ratios of theTc^{99m} solution volume to the preformed colloid volume up to 1, the yield was better than 98%.

We have found that the heating process increases the labeling yield. Furthermore we have observed that in preparing the Tc_2S_7 colloid according to the procedure described by Harper *et al.*, the yield is about 70%. However, if the preparation is heated for 30 min at 120°C, after having bubbled hydrogen sulphide through the Tc^{99m} solution, the yield increases to 100%. This makes unnecessary the purification step by exchange resin.

All the studies of the labeling yield and the determinations of free Tc^{99m} were carried out by dialysis.

The particle size was determined by ultrafiltration, 15–20% of them having a diameter smaller than 100 mμ, the remainder a diameter of 100–200 mμ.

The toxicity of the colloidal antimony sulphide was investigated by intravenous injection of antimony sulphide to mice (0.17 mg) and rabbits (8.4 mg). No toxicity reactions were observed.

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Shielding for Radioisotope Bremsstrahlung Sources Sr^{90} + Y^{90}

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In a recent paper Florkowski[1] has compared the attenuation factors in lead, for the radiation from a Sr^{90} bremsstrahlung source, determined by experiment with values which he has deduced theoretically using the following assumptions: (i) That only the Y^{90} component of the source contributes substantially to the bremsstrahlung. (ii) The energy distribution of the bremsstrahlung is analogous to that calculated by Wyard[2] for P^{32}. (iii) This bremsstrahlung spectrum