PARTICLE SIZE STABILITY AND SURFACE CHARGE OF A TIN COLLOID LIVER SCANNING RADIOPHARMACEUTICAL

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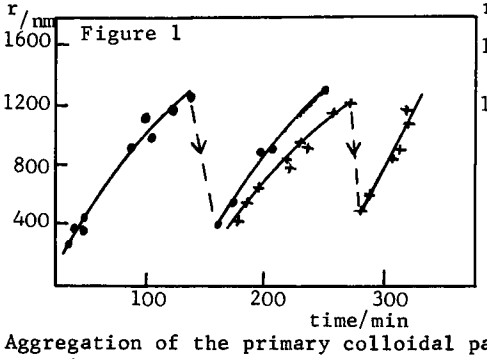
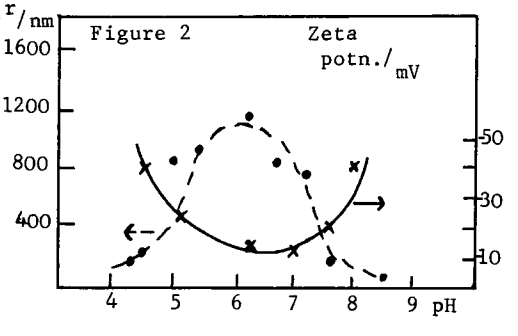
The particle size of liver and lung imaging colloidal radiopharmaceuticals is important in nuclear medicine as this is the major parameter which determines in vivo distribution (surface charge may also be important). Tin colloid labelled with technetium-99m ("Amerscan"™, Amersham International) is a convenient alternative to the widely used sulphur colloid and, in practice, the tin colloid has been shown to give superior scintigrams (Adams et al 1980).

Investigations into the particle size of the tin colloid have been undertaken by Whateley et al (1980) and Pedersen and Kristensen (1981), both using photon correlation spectroscopy (PCS). The initial study by Whateley et al. found that the tin colloid showed apparent stability with respect to particle size after ca 60 min, when a radius of ca 500nm was attained. However, Pedersen and Kristensen found that the tin colloid continued to grow in size up to ca 2000nm radius over a similar time (3-5hr).

A sample (2ml) of the tin colloid was taken from the preparation vial into the PCS cell immediately after preparation, involving simply the addition of 8ml of 0.9% NaCl. This sample grew in particle size to 1300nm after 140 min (Fig.1): it was then taken up into a syringe (needle 21G, internal diameter 0.57mm) and immediately re-syringed back into the PCS cell. The particle size was then 400nm radius, a size similar to that obtained previously when samples had been syringed from the preparation vial at the appropriate times. A sample taken from the preparation vial at 180 min showed similar behaviour (Fig.1). In both cases the tin colloid grew again after syringing: it thus appears that the growth in size is due to a relatively weak aggregation, reversible by the shearing forces in the syringe needle. Thus, although the tin colloid will grow to large sizes if undisturbed,the process of withdrawing the sample from the vial prior to injection in the clinical situation results in a particle radius of ca 500nm, which is ideal for liver localisation.





Aggregation of the primary colloidal particles showed a maximum at pH6, which correlated reasonably well with the observed minimum in the measured zeta potential (Fig. 2). Aggregation also increased with salt concentration, with no aggregation in the absence of salt (particle size remaining constant at 200-250nm). These results indicate a charge stabilisation mechanism for the tin colloid. However, both the nature of the tin colloid (probably a colloidal hydrated tin hydroxy-fluoro complex) and the weak aggregation process are uncertain.

Adams et al (1980) Eur. J. Nucl. Med. 5: 237-239
Pedersen, B. and Kristensen, K. (1981) Eur. J. Nucl. Med. 6: 521-526
Whateley, T.L. et al. (1980) J. Pharm. Pharmacol. 32: 88P

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