The Preparating Methods of Compounds Labeled with ^{113m}In for Lung, Liver, Bone Marrow and Brain Scans.

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1. The relationship between particle size of ^{113}In colloid & pH of solution.

Indium solution was adjusted to pH's varying 1.0-12.0. The particle size of indium colloid was measured by electron microscope and various sized millipore filters (10 mμ-14μ). The colloid formation begun near at pH 3.0. Its particle size was about 1 mμ. At pH from 4.5-5.0, its particle size was about 1mμ-10mμ, from 5.0-6.0 its size was about 450mμ, from 7.0-7.5 its size was about 1μ, and when pH's varying from 11.0-12.0, its particle size was lager than 14μ.

2. Connecting power of the secondary colloid.

Stern et al. prepared ^{113m}In-Fe(OH)$_3$ for lung scans by adding ferric ion to a eluate, the final ferric ion concentration was 10 μg/ml. They also prepared ^{113m}In-In(OH)$_3$ for liver scans by adding small amounts of indium carrier.

We performed the further investigation to get the stable agent. The electron microscopic observation revealed that secondary colloids of Fe(OH)$_3$ appeared discoid and they connected unstable each other. But In(OH)$_3$ colloid appeared completely spherical and combined each other stably and strongly. These results were thought to give due to prepare the stable agent for lung scans. By adding Fe^{+++} (final concentration 10 μg/ml) and In^{+++} (0,05 μg-0.1 μg) simulataneously to a eluate, more than 99% of its particle size was lager than 14μ at incubation for 15 min.(75°c). By adding Fe^{+++} only, the particle size below 14μ was found at the ratio of about 20%. But for liver scans it was better to use Fe^{+++} only than In^{+++} or Fe^{+++} & In^{+++} as carrier.

The particle size also depended upon incubation time, temperature, mechanical stimulus and coating of colloids. Especially incubation time and temperature is very important to prepare large (sized) particles. The colloid growed lager when incubation time became longer.

3. ^{131}In-Fe(CH)$_3$ colloid (20-50μ).

To prepare the colloid for lung scanning. $^{113m}In^{+++}$ was eluated from a ^{113}Sn-^{113m}In generator with 0.05N-HCL (pH1.3-1.4). Fe^{+++} was added to an aliquot of the colum eluate so that the final ferric ion concentration was 10 μg/ml and carrier In^{+++} was added 0.1μg/ml. The mixture is titrated with 2N-NaOH to pH 11.0-12.0. When the titration was complete by incubation at 75°c for 15 min., gelatin (10% solution) was added so that the final gelatin concentration was 20 mg/ml. The mixture was adjusted to pH 7.5-8.0 with N-Hcl. The final product was sterilized by autoclaving at 120°c for 20 min.

4. Particle size of 1000 mμ.

To prepare the colloid for liver scanning. Fe^{+++} was added so that the final ferric ion concentration was 10 μg/ml. The mixture is titrated with N-NaOH to pH 6.0-6.5. When the titration was complete by incubation at 75°c for 15 min., gelatin (10% solution) was added so that the final gelatin concentration was 20 mg/ml. The product was sterilized by autoclaving at 120°c for 20 min.

5. Particle size of 10 mμ.

To prepare the colloid for liver scanning. Fe^{+++} was added so that the final ferric ion concentration was 10 μg/ml. The mixture is titrated with N-NaOH to pH4.0-4.5. The incubation was 15 min. at 75°c.

6. ^{113m}In-Fe-E.D.T.A.

To prepare the solution for brain scanning. Fe^{+++} carrier (200μg) and E.D.T.A-2Na

(2 mg) was added to the ^{113m}In eluate (10 ml). The solution is titrated with N-NaOH to pH.0-7.5. 50% dextrose was added 1 ml. The product was sterilized by autoclaving at 120°c for 20 min.

7. Sterilization of reagent solutions.

The reagent solutions for ^{113m}In-preparation was stierilized by autoclaving at 120°c for 20 min. or 100°c for 30 min. in ampules. Fe^{+++} (200 μg/2N-HCL 0.1 ml) and In^{+++} (0.25 μg/2N-NCL 0.1 ml) of carrier was sterilized at 100¹c for 30 min.

New Preparation of Some ^{113m}In Compounds as Scanning Agents

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We have already reported a new excellent compound ($^{113m}In_2S_3$ colloid) for liver and bone marrow scanning.

Now we would like to report another new and simplified preparation of ^{113m}In for blood pool, cerebral ventricle and spinal subarachnoid space scanning. The procedure is following; 1) 4 or 6 ml of the ^{113m}In in dilute (pH 1.5) HC1 eluted from the ^{113m}In generator. 2) Fe^{+++} as the chloride is added so that the final ferric iron concentration is 20 μg/ml, 3) and then 50 mg of ascorbic acid is added before titration to pH 6.5-8.5 (9.0) with NaOH, when the pH of this solution becomes 6.5-7.0, its appearance is pure violet and as the pH is 7.5-9.0 the color changes slightly violet-brown, so that one need not use the pH meter for the titration of the mixture. 4) The terminal sterilization by 0.45 μ millipore filter is possible.

When the ^{113m}InFe ascorbic acid solution of pH 8.5 (9.0) is injected in human, blood levels remain high. There is only 20% fall in concentration of radioactivity during the period between 5 minutes and 2 hours after injection. Less than 0.9 % of injected dose is excreted in urine for 2 hours. Therefore this pH 8.5 (9.0) solution is of choice for blood pool scanning, especially for placental scanning because of smallest amount of excretion into the bladder. A disappearance after intravenous injection of the solution ^{113m}InFe ascorbic acid of pH 6.5 is relativelly rapid and blood levels become about 50 % one hour after. The urine activity is 5 % the injected dose during 2 hours period. However, in the practice of heart blood pool scanning a difference between two solutions varying pH 6.5 and 8.5 (9.0) is not so great, and so the neutralized solution (pH 7.0-7.5) of ^{113m}In Fe ascorbic acid can be used for scanning.

Cerebral ventricle and spinal subarachnoid space scanning are also made with this neutral solution.

Lung inhalation scanning can be made with the mixture to which a little of gelatin is added.

Brain scanning is made successfully with the ^{113m}InFe DTPA ascorbic acid complex which is prepared by adding ascorbic acid to the ^{113m}InFe DTPA solution before neutralization. This solution can be finally sterilized by millipore filter. In tumor (Yosida sarcoma)-bearing rats, the tumor-to-brain ratios approach 34 : 1 at 30 minutes after intravenous injection. Those ratios are higher than with ^{113m}InFe DTPA.