

**Yttrium (<sup>90</sup>Y) silicate injection (Yttrii (<sup>90</sup>Y) silicatis injectio)**

**Description.** Yttrium (<sup>90</sup>Y) silicate injection is a white to off-white colloid aqueous suspension.

Yttrium-90 has a half-life of 64 hours.

**Category.** Therapeutic.

**Storage.** After aseptic withdrawal of the first dose from a multidose container, the container should be stored at a temperature between 2°C to 8°C and the contents used within 7 days.

**Labelling.** State the date of withdrawal of the first dose for multidose containers.

**Additional information.** Wherever V is used within the tests of this monograph, V is the maximum recommended dose in millilitres.

**Requirements**

Complies with the monograph for "[Parenteral Preparations](#)" and with that for "[Radiopharmaceuticals](#)".

**Definition.** Yttrium (<sup>90</sup>Y) silicate injection is a sterile solution of yttrium-90 in the form of yttrium silicate, suitable for intra-articular administration. The injection contains not less than 90% and not more than 110% of the content of yttrium-90 stated on the label at the reference date and hour stated on the label. Not less than 99% of the total radioactivity is due to yttrium-90. Not less than 95% of the total yttrium-90 radioactivity is present as yttrium silicate.

**Manufacture**

**Radionuclide production.** Yttrium-90 may be obtained by neutron irradiation of yttrium-89 or from strontium-90, a product of uranium fission.

**Production of radiopharmaceutical preparation.** Yttrium-90 is bound to silicate to form a fine colloid. Yttrium (<sup>90</sup>Y) silicate injection may have the pH adjusted and may contain stabilizing and antioxidizing agents as well as buffers. The injection may be sterilized by "Heating in an autoclave" (see [5.8 Methods of sterilization](#)).

**Identity tests**

• Either tests A and C or tests B and C may be applied.

A. Record the beta-ray spectrum using a suitable instrument with a sample of yttrium-90, suitably diluted if needed. The spectrum is concordant with the *reference spectrum* of a specimen of yttrium-90 in that it exhibits a major peak of 2280 keV.

Standardized yttrium-90 solutions are available from laboratories recognized by the relevant national or regional authority.

B. The half-life determined using a suitable detector system is between 62 and 66 hours.

C. Examine the radiochromatogram obtained in the test for radiochemical purity. The distribution of the radioactivity contributes to the identification of the preparation.

**pH value.** Carry out the test as described in the monograph for "Radiopharmaceuticals". pH of the injection, 9.0 to 11.0.

**Sterility.** The injection complies with [3.2 Test for sterility](#), modified as described in the monograph for "Radiopharmaceuticals". Test for sterility will be initiated on the day of manufacture. The injection may be released for use before completion of the test.

**Bacterial endotoxins.** Carry out the test as described under [3.4 Test for bacterial endotoxins](#), modified as described in the monograph for "Radiopharmaceuticals". The injection contains not more than 175/V I.U of endotoxins per millilitre. The injection may be released for use before completion of the test.

**Radionuclidic purity.** Record the gamma- and beta-ray spectra using a suitable instrument and measure the half-life using a suitable method. Determine the relative amounts of yttrium-90, strontium-89, strontium-90 and any alpha, beta and gamma impurities that may be present. Distinguish strontium-90 from strontium-89, comparing strontium-90 to its daughter nuclide yttrium-90. Strontium-90 exhibits a major peak of maximum 546 keV and a half-life of 29.1 years and strontium-89 exhibits a major peak of maximum 1.46 MeV and a half-life of 50.6 days. Yttrium-90 exhibits a major peak of maximum 2280 keV and a half-life of 64.0 hours. Not less than 99% of the total radioactivity is due to yttrium-90. Not more than 1×10<sup>-3</sup>% of the total radioactivity is due to strontium-90. Not more than 1×10<sup>-3</sup>% of the total radioactivity is due to the gamma impurity. The content of strontium-90 is determined after co-precipitating yttrium-90 with ferric chloride R. Dilute 1 mL of yttrium (<sup>90</sup>Y) silicate injection to 1000 mL with water R. Use 1 mL of the diluted solution, add 10 mL of water R, 10 mg of ferric chloride R, and 25 mg of strontium chloride hexahydrate R. The solution is made alkaline by addition of sodium hydroxide (10 g/l) TS. Analyse the filtrate for strontium-90 using a suitable beta-counter.

**Radiochemical purity.** Dilute 0.2 mL of yttrium silicate (<sup>90</sup>Y) injection with 2 mL of water R and centrifuge for 10 minutes. Carefully separate the supernatant and measure the yttrium-90 activity in the sedimented particles and the supernatant using a suitable instrument. Not less than 95% of the total yttrium-90 activity is associated with the particles.

**Particle size.** Observe and measure the particle size distribution of a representative sample contained in a suitable chamber (equipped with a grid and allowing counting) by optical microscopy using a micrometer attachment or by reference to a haemocytometer grid. The particle size range is between 5 to 10 µm and no particle is less than 2 µm or more than 15 µm.

**Radioactivity.** Measure the radioactivity as described under [R.1.1 Detection and measurement of radioactivity](#) in a suitable calibrated counting equipment by comparison with a standardized yttrium-90 solution or by measurement using an instrument calibrated with the aid of such a solution.

Standardized yttrium-90 solutions are available from laboratories recognized by the relevant national or regional authority.

**Biodistribution.** Carry out the test as described under [R3.1 Biological distribution](#) using a set of three rats. Assess leakage from the knee joint. Not more than 5% of the injected radioactivity should be found outside the knee joint at 24 hours post injection or not more than 15% of the injected radioactivity should be found outside the knee joint at 4 days post injection.