

## CHARACTERS

Clear, colourless liquids of various viscosities, practically insoluble in water and in methanol, miscible with ethyl acetate, with methyl ethyl ketone and with toluene, very slightly soluble in ethanol.

## IDENTIFICATION

- A. It is identified by its kinematic viscosity at 25 °C (see Tests).
- B. Examine by infrared absorption spectrophotometry (2.2.24), comparing with the spectrum obtained with *silicone oil CRS*. The region of the spectrum from 850 cm<sup>-1</sup> to 750 cm<sup>-1</sup> is not taken into account since it may show slight differences depending on the degree of polymerisation.
- C. Heat 0.5 g in a test-tube over a small flame until white fumes begin to appear. Invert the tube over a second tube containing 1 ml of a 1 g/l solution of *chromotropic acid, sodium salt R* in *sulphuric acid R* so that the fumes reach the solution. Shake the second tube for about 10 s and heat on a water-bath for 5 min. The solution is violet.
- D. In a platinum crucible, prepare the sulphated ash (2.4.14) using 50 mg. The residue is a white powder that gives the reaction of silicates (2.3.1).

## TESTS

**Acidity.** To 2.0 g add 25 ml of a mixture of equal volumes of *ethanol R* and *ether R*, previously neutralised to 0.2 ml of *bromothymol blue solution R1* and shake. Not more than 0.15 ml of 0.01 M *sodium hydroxide* is required to change the colour of the solution to blue.

**Viscosity** (2.2.10). Determine the dynamic viscosity at 25 °C. Calculate the kinematic viscosity taking the relative density to be 0.97. The kinematic viscosity is not less than 95 per cent and not more than 105 per cent of the nominal viscosity stated on the label.

**Mineral oils.** Place 2 ml in a test-tube and examine in ultraviolet light at 365 nm. The fluorescence is not more intense than that of a solution containing 0.1 ppm of *quinine sulphate R* in 0.005 M *sulphuric acid* examined in the same conditions.

**Phenylated compounds.** The refractive index (2.2.6) is not greater than 1.410.

**Heavy metals.** Mix 1.0 g with *methylene chloride R* and dilute to 20 ml with the same solvent. Add 1.0 ml of a freshly prepared 0.02 g/l solution of *dithizone R* in *methylene chloride R*, 0.5 ml of *water R* and 0.5 ml of a mixture of 1 volume of *dilute ammonia R2* and 9 volumes of a 2 g/l solution of *hydroxylamine hydrochloride R*. At the same time, prepare a standard as follows: to 20 ml of *methylene chloride R* add 1.0 ml of a freshly prepared 0.02 g/l solution of *dithizone R* in *methylene chloride R*, 0.5 ml of *lead standard solution (10 ppm Pb) R* and 0.5 ml of a mixture of 1 volume of *dilute ammonia R2* and 9 volumes of a 2 g/l solution of *hydroxylamine hydrochloride R*. Immediately shake each solution vigorously for 1 min. Any red colour in the test solution is not more intense than that in the standard (5 ppm).

**Volatile matter.** Not more than 2.0 per cent, determined on 2.00 g by heating in an oven at 150 °C for 24 h. Carry out the test using a dish 60 mm in diameter and 10 mm deep.

## LABELLING

The label indicates the nominal viscosity by a number placed after the name of the product. The label also states that the contents are to be used as a lubricant.

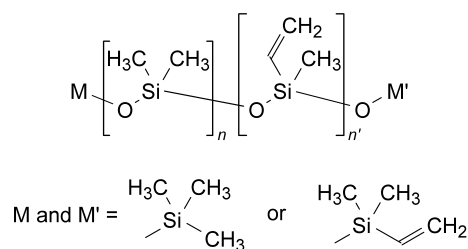
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## 3.1.9. SILICONE ELASTOMER FOR CLOSURES AND TUBING

## DEFINITION

Silicone elastomer complying with the following requirements is suitable for the manufacture of closures and tubing.

Silicone elastomer is obtained by cross-linking a linear polysiloxane constructed mainly of dimethylsiloxy units with small quantities of methylvinylsiloxy groups; the chain ends are blocked by trimethylsiloxy or dimethylvinylsiloxy groups. The general formula of the polysiloxane is:



The cross-linking is carried out in the hot state either with:

- 2,4-dichlorobenzoyl peroxide for extruded products,
- 2,4-dichlorobenzoyl peroxide or dicumyl peroxide or *OO*-(1,1-dimethylethyl) *O*-isopropyl monoperoxy carbonate or 2,5-bis[(1,1-dimethylethyl)dioxy]-2,5-dimethylhexane for moulded products,

or

- by hydrosilylation by means of polysiloxane with -SiH groups using platinum as a catalyst.

In all cases, appropriate additives are used such as silica and sometimes small quantities of organosilicon additives ( $\alpha,\omega$ -dihydroxypolydimethylsiloxane).

## CHARACTERS

A transparent or translucent material, practically insoluble in organic solvents, some of which, for example cyclohexane, hexane and methylene chloride, cause a reversible swelling of the material.

## IDENTIFICATION

- A. Examine by infrared absorption spectrophotometry recording the spectrum by the multiple reflection method for solids (2.2.24), comparing with the spectrum obtained with *silicone elastomer CRS*.
- B. Heat 1.0 g in a test-tube over a small flame until white fumes begin to appear. Invert the tube over a second tube containing 1 ml of a 1 g/l solution of *chromotropic acid, sodium salt R* in *sulphuric acid R* so that the fumes reach the solution. Shake the second tube for about 10 s and heat on a water-bath for 5 min. The solution is violet.
- C. 50 mg of the residue of combustion gives the reaction of silicates (2.3.1).

## TESTS

*If necessary, cut the material into pieces of maximum dimension on a side of not greater than 1 cm.*

**Solution S.** Place 25 g in a borosilicate-glass flask with a ground-glass neck. Add 500 ml of *water R* and boil under a reflux condenser for 5 h. Allow to cool and decant the solution.

**Appearance of solution.** Solution S is clear (2.2.1).

**Acidity or alkalinity.** To 100 ml of solution S add 0.15 ml of *bromothymol blue solution R1*. Not more than 2.5 ml of 0.01 M sodium hydroxide is required to change the colour of the indicator to blue. To a further 100 ml of solution S, add 0.2 ml of *methyl orange solution R*. Not more than 1.0 ml of 0.01 M hydrochloric acid is required to reach the beginning of the colour change of the indicator from yellow to orange.

**Relative density (2.2.5).** 1.05 to 1.25, determined using a density bottle with *ethanol R* as the immersion liquid.

**Reducing substances.** To 20 ml of solution S add 1 ml of dilute sulphuric acid R and 20 ml of 0.002 M potassium permanganate. Allow to stand for 15 min. Add 1 g of potassium iodide R and titrate immediately with 0.01 M sodium thiosulphate using 0.25 ml of starch solution R as indicator. Carry out a blank titration using 20 ml of water R instead of solution S. The difference between the titration volumes is not more than 1.0 ml.

**Substances soluble in hexane.** Evaporate 25 ml of the solution obtained in the test for phenylated compounds in a glass evaporating dish on a water-bath and dry in an oven at 100 °C to 105 °C for 1 h. The residue weighs not more than 15 mg (3 per cent).

**Phenylated compounds.** Place 2.0 g in a borosilicate-glass flask with a ground-glass neck and add 100 ml of hexane R. Boil under a reflux condenser for 4 h. Cool, then filter rapidly through a sintered-glass filter (16). Collect the filtrate and close the container immediately to avoid evaporation. At wavelengths from 250 nm to 340 nm, the absorbance (2.2.25) is not greater than 0.4.

**Mineral oils.** Place 2 g in a 100 ml conical flask containing 30 ml of a mixture of 5 volumes of ammonia R and 95 volumes of pyridine R. Allow to stand for 2 h, shaking frequently. Decant the pyridine solution and examine in ultraviolet light at 365 nm. The fluorescence is not greater than that of a solution containing 1 ppm of quinine sulphate R in 0.005 M sulphuric acid examined in the same conditions.

**Volatile matter.** Weigh 10.0 g of the substance previously stored for 48 h in a desiccator over anhydrous calcium chloride R. Heat in an oven at 200 °C for 4 h, allow to cool in a desiccator and weigh again. For silicone elastomer prepared using peroxides, the volatile matter is not greater than 0.5 per cent. For silicone elastomer prepared using platinum, the volatile matter is not greater than 2.0 per cent.

*Silicone elastomer prepared using peroxides complies with the following additional test:*

**Residual peroxides.** Place 5 g in a borosilicate-glass flask, add 150 ml of methylene chloride R and close the flask. Stir with a mechanical stirrer for 16 h. Filter rapidly, collecting the filtrate in a flask with a ground-glass neck. Replace the air in the container with oxygen-free nitrogen R, introduce 1 ml of a 200 g/l solution of sodium iodide R in anhydrous acetic acid R, close the flask, shake thoroughly and allow to stand protected from light for 30 min. Add 50 ml of water R and titrate immediately with 0.01 M sodium thiosulphate, using 0.25 ml of starch solution R as indicator. Carry out a blank titration. The difference between the titration volumes is not greater than 2.0 ml (0.08 per cent calculated as dichlorobenzoyl peroxide).

*Silicone elastomer prepared using platinum complies with the following additional test:*

**Platinum.** In a quartz crucible, ignite 1.0 g of the material to be examined, raising the temperature gradually until a white residue is obtained. Transfer the residue to a graphite crucible. To the quartz crucible add 10 ml of a

freshly prepared mixture of 1 volume of nitric acid R and 3 volumes of hydrochloric acid R, heat on a water-bath for 1 min to 2 min and transfer to the graphite crucible. Add 5 mg of potassium chloride R and 5 ml of hydrofluoric acid R and evaporate to dryness on a water-bath. Add 5 ml of hydrofluoric acid R and evaporate to dryness again; repeat this operation twice. Dissolve the residue in 5 ml of 1 M hydrochloric acid, warming on a water-bath. Allow to cool and add the solution to 1 ml of a 250 g/l solution of stannous chloride R in 1 M hydrochloric acid, rinse the graphite crucible with a few millilitres of 1 M hydrochloric acid and dilute to 10.0 ml with the same acid. Prepare simultaneously a standard as follows: to 1 ml of a 250 g/l solution of stannous chloride R in 1 M hydrochloric acid add 1.0 ml of platinum standard solution (30 ppm Pt) R and dilute to 10.0 ml with 1 M hydrochloric acid. The colour of the test solution is not more intense than that of the standard (30 ppm).

#### LABELLING

The label states whether the material was prepared using peroxides or platinum.

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### 3.1.10. MATERIALS BASED ON NON-PLASTICISED POLY(VINYL CHLORIDE) FOR CONTAINERS FOR NON-INJECTABLE, AQUEOUS SOLUTIONS

#### DEFINITION

Materials based on non-plasticised poly(vinyl chloride) that comply with the following specifications are suitable for the manufacture of containers for non-injectable aqueous solutions. They may also be used for solid forms for oral administration and in some cases, subject to special studies on the compatibility of the container with its contents, these materials may be suitable for the preparation of containers for suppositories. They consist of one or more poly(vinyl chloride/vinyl acetate) or of a mixture of poly(vinyl chloride) and poly(vinyl acetate) or of poly(vinyl chloride).

They contain not more than 1 ppm of vinyl chloride.

The chlorine content expressed in poly(vinyl chloride) is not less than 80 per cent.

They may contain not more than 15 per cent of copolymers based on acrylic and/or methacrylic acids and/or their esters, and/or on styrene and/or butadiene.

#### PRODUCTION

Materials based on non-plasticised poly(vinyl chloride) are produced by polymerisation methods which guarantee a residual vinyl chloride content of less than 1 ppm. The production method used is validated in order to demonstrate that the product complies with the following test:

**Vinyl chloride.** Not more than 1 ppm, determined by head-space gas chromatography (2.2.28), using ether R as the internal standard.

**Internal standard solution.** Using a microsyringe, inject 10 µl of ether R into 20.0 ml of dimethylacetamide R, immersing the tip of the needle in the solvent. Immediately before use, dilute the solution to 1000 times its volume with dimethylacetamide R.