SILICON DIOXIDE, AMORPHOUS
(TENTATIVE)

Tentative specifications prepared at the 77th JECFA (2013) and published in FAO JECFA Monographs 14 (2013), superseding specifications prepared at the 17th JECFA (1973), published in FNP 4 (1978). An ADI 'not specified' for silicon dioxide and certain silicates was established at the 29th JECFA (1985).

Information required on different types of silicon dioxide, used as food additive:

- *Composition and methods of manufacture*
- *Functional use other than anticaking agent, if used*
- *Data on pH and loss on drying*
- *Description, assay and loss of ignition for silicic acid and dehydrated silica gel*
- *Data on a minimum of five batches, on the content of silicon dioxide using the proposed "Method of assay"*
- *Data on lead, arsenic and mercury content, in a minimum of five batches, carried out in the impurities soluble in 0.5 M hydrochloric acid using the proposed methods.*

SYNONYMS Silica; INS No. 551

DEFINITION The products included under this specification are: silica aerogel (precipitated silicon dioxide), hydrated silica, "silicic acid" and dehydrated silica gel.

Chemical names: Silicon dioxide

C.A.S. number: 7631-86-9

Chemical formula: $(SiO_2)_x$

Formula weight: 60.09 (SiO_2)

Assay:
- Silica aerogel: not less than 90% of SiO_2 on the ignited basis.
- Hydrated silica: not less than 89% of SiO_2 on the ignited basis.
- Silicic acid and dehydrated silica gel: information required

DESCRIPTION
- Silica aerogel: a microcellular silica occurring as a fluffy powder or granules
- Hydrated silica: a precipitated, hydrated silicon dioxide occurring as a fine, white, amorphous powder, or as beads or granules
- Silicic acid and dehydrated silica gel: information required

FUNCTIONAL USES Anticaking agent

CHARACTERISTICS

IDENTIFICATION

Solubility (Vol. 4)	Insoluble in water and ethanol$
Test for silicon	Passes test See description under TESTS

PURITY

pH	Information required
Loss on drying (Vol. 4)	Information required
Loss on ignition (Vol. 4)	Not more than 6% on the dried basis (105° to constant weight), after igniting at 600o (for silica aerogel) or at 900o (for hydrated silica) to constant weight. Store the ignited sample in a desiccator for use in the method of assay. Information required for Silicic acid and dehydrated silica gel
Impurities soluble in 0.5 M hydrochloric acid	Lead : Information required Arsenic: Information required Mercury: Information required See description under TESTS

TESTS

IDENTIFICATION TESTS

Test for silicon	Prepare the test solution as shown under method of assay. Analyze aluminum and silica in the test solution by ICP-AES technique (Vol. 4). Set instrument parameters as specified by the instrument manufacturer, use the analytical lines for Si (251.611 nm).

PURITY TESTS

Impurities soluble in 0.5 M hydrochloric acid	Extract 20 g of finely ground sample under reflux conditions (to prevent loss of mercury) with 100 ml of 0.5 M hydrochloric acid (spectroscopic grade) for 30 min. Let solution cool, then filter through a 0.1 µm membrane filter. Wash the filter twice with hot 0.5 M hydrochloric acid. Combine the filtrate and wash solution in a 200 ml volumetric flask and make up to volume with 0.5 M hydrochloric acid. Determine arsenic using an AAS (Hydride generation) technique; lead using an AAS (Electrothermal atomization) technique; and mercury using an AAS (Cold vapour generation) technique. See “Metallic impurities” in the Combined Compendium of Food Additive Specifications (Volume 4).
METHOD OF ASSAY	Weigh about 0.5 g of the sample to the nearest 0.1 mg, in a platinum or nickel crucible, add 5 g potassium hydroxide and 2 g boric acid, mix and melt completely using a torch burner and allow to stand at room temperature. Place the reaction product along with crucible into 150 ml hot deionized water in a 250-ml PTFE beaker and dissolve residue by agitation. Wash the crucible with hot deionized water and remove it. Add 50 ml hydrochloric acid and transfer the contents into a 250-ml polypropylene volumetric flask. Wash the beaker three times with hot deionized water. Transfer the washings to the volumetric flask and make up to volume (Solution A). Prepare the test solution by diluting Solution A

with 2% hydrochloric acid, to get the readings within the standard curve range. Analyze silica, aluminium and calcium in the test solution by ICP-AES technique (Vol. 4). Set instrument parameters as specified by the instrument manufacturer, use the analytical line for Si (251.611 nm) and construct standard curve using standard solutions 0.1 – 5.0 µg/ml. Read the concentration of Si in test solution (as µg/ml) and calculate the silicon dioxide content of the sample using the formula:

$$\%SiO_2 = \frac{2.139 \times C \times 250 \times DF}{W \times 106} \times 100$$

Where

C is concentration of Si in the test solution, µg/ml;
DF is dilution factor (dilution of Solution A to get test solution);
W is weight of the ignited sample, g.