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Aluminium Magnesium Silicate

General Notices

(Ph. Eur. monograph 1388)

Action and use

Excipient.

Ph Eur

DEFINITION

Mixture of colloidal-size particles of montmorillonite and saponite, practically free from grit and non-swellable ore.

The requirements for viscosity and ratio of aluminium content to magnesium content differ for the several types of aluminium magnesium silicate, as shown in the table below.

Type	Viscosity (mPa·s)		Al content / Mg content	
	min.	max.	min.	max.
IA	225	600	0.5	1.2
IB	150	450	0.5	1.2
IC	800	2200	0.5	1.2
IIA	100	300	1.4	2.8

CHARACTERS

Appearance

Almost white, coarse powder, granules or flakes (types IA, IC and IIA); almost white, fine powder (type IB).

Solubility

Practically insoluble in water and in organic solvents.

It swells in water to produce a colloidal dispersion.

IDENTIFICATION

Carry out either tests A, B, C, F or tests D, E.

A. In a platinum crucible mix 1.0 g with 5.0 g of *anhydrous lithium metaborate R*. Heat slowly at first and ignite at 1000-1200 °C for 15 min. Allow to cool and crush the residue. 0.25 g of the residue gives the reaction of silicates (2.3.1).

B. Dissolve 1.0 g of the residue obtained in identification test A in a mixture of 5 mL of *dilute hydrochloric acid R* and 10 mL of *water R*. Filter to obtain a clear solution and add *ammonium chloride buffer solution pH 10.0 R*. A white, gelatinous precipitate is formed. Centrifuge and keep the supernatant for identification test C. Dissolve the precipitate in *dilute hydrochloric acid R*. Add dropwise *dilute sodium hydroxide solution R*. A white gelatinous precipitate is formed. Filter and add a few drops of *phenolphthalein solution R* to the residue. The residue turns pink. Wash the residue with *water R* until the pink colour is completely discharged and the residue remains white upon addition of a drop of *phenolphthalein solution R*. Sprinkle a few crystals of *sodium fluoride R* on the residue. The residue, in contact with the crystals, turns pink again in a short time.

C. To 2 mL of the supernatant obtained after centrifugation in identification test B, add 1 mL of *dilute ammonia R1* and 1 mL of *ammonium chloride solution R*. Upon the addition of *dilute ammonia R1* a white precipitate may form, which dissolves after addition of the *ammonium chloride solution R*. Add 1 mL of *disodium hydrogen phosphate solution R*. A white precipitate is formed.

D. X-ray diffraction (*2.9.33*), oriented sample.

Add 2 g in small portions to 100 mL of *water R*, with vigorous shaking. Allow to stand for at least 12 h to ensure complete hydration. Place 2 mL of the resulting mixture on a suitable glass slide and allow to dry in air at room temperature to produce an oriented film. Place the slide in a vacuum desiccator over *ethylene glycol R*. Evacuate the desiccator and close the stopcock so that the ethylene glycol saturates the chamber. Allow to stand for at least 12 h. Record the X-ray diffraction pattern and calculate the *d* values: the largest peak corresponds to a *d* value between 1.5 nm and 1.72 nm.

E. X-ray diffraction (*2.9.33*), random sample.

Prepare a random powder sample, record the X-ray diffraction pattern and determine the *d* values in the region between 0.148 nm and 0.154 nm. Peaks are found between 0.1492 nm and 0.1504 nm and between 0.1510 nm and 0.1540 nm.

F. It complies with the limits of the assay.

TESTS

pH (*2.2.3*)

9.0 to 10.0.

Disperse 5.0 g in 100 mL of *carbon dioxide-free water R*.

Viscosity (*2.2.10*)

Weigh a quantity of the substance to be examined equivalent to 25.0 g of the dried substance and immediately transfer to a suitable 1 L blender jar containing a quantity of *water R*, at 25 ± 2 °C, that is sufficient to produce a mixture weighing 500 g. Blend for exactly 3 min, at 14 000-15 000 r/min. The heat generated during blending causes the temperature to rise to above 30 °C. Transfer the contents of the blender to a 600 mL beaker and allow to stand for 5 min. The sample temperature should be 33 ± 3 °C.

Using a suitable rotating viscometer equipped with a spindle as specified below, operate the viscometer at 60 r/min for exactly 6 min and record the scale reading.

For type IA, use a spindle with a cylinder 1.87 cm in diameter and 0.69 cm high attached to a shaft 0.32 cm in diameter, the distance from the top of the cylinder to the lower tip of the shaft being 2.54 cm, and an immersion depth of 5.00 cm (No. 2 spindle); if the scale reading is greater than 90 per cent of the full scale, repeat the measurement using a spindle similar to the No. 2 spindle but with a cylinder 1.27 cm in diameter and 0.16 cm high (No. 3 spindle).

For type IC, use a No. 3 spindle; if the scale reading is greater than 90 per cent of the full scale, repeat the measurement using a spindle with a cylindrical shaft 0.32 cm in diameter and an immersion depth of 4.05 cm (No. 4 spindle).

For types IB and IIA, use a No. 2 spindle.

Limits:

Type	Viscosity (mPa·s)	
	min.	max.
IA	225	600
IB	150	450
IC	800	2200

Type	Viscosity (mPa·s)	
	min.	max.
IIA	100	300

Acid demand

Weigh a quantity of the substance to be examined equivalent to 5.00 g of the dried substance and disperse in 500 mL of *water R* using a suitable blender fitted with a 1 L jar. With constant mixing, add 3.0 mL portions of *0.1 M hydrochloric acid* at 5 s, 65 s, 125 s, 185 s, 245 s, 305 s, 365 s, 425 s, 485 s, 545 s, 605 s, 665 s and 725 s and add a 1.0 mL portion at 785 s. The pH (*2.2.3*) determined at 840 s is not greater than 4.0.

Arsenic (*2.4.2, Method A*)

Maximum 3 ppm.

Transfer 16.6 g to a 250 mL beaker containing 100 mL of *dilute hydrochloric acid R*. Mix, cover with a watch glass and boil gently, with occasional stirring, for 15 min. Allow the insoluble matter to settle and decant the supernatant through a rapid-flow filter paper into a 250 mL volumetric flask, retaining as much sediment as possible in the beaker. To the residue in the beaker add 25 mL of hot *dilute hydrochloric acid R*, stir, heat to boiling, allow the insoluble matter to settle and decant the supernatant through the filter into the volumetric flask. Repeat the extraction with 4 additional quantities, each of 25 mL, of hot *dilute hydrochloric acid R*, decanting each supernatant through the filter into the volumetric flask. At the last extraction, transfer as much of the insoluble matter as possible onto the filter. Allow the combined filtrates to cool to room temperature and dilute to 250.0 mL with *dilute hydrochloric acid R*. Dilute 5.0 mL of this solution to 25.0 mL with *dilute hydrochloric acid R*.

Lead

Maximum 15 ppm.

Atomic absorption spectrometry (*2.2.23, Method I*).

Test solution Transfer 10.0 g to a 250 mL beaker containing 100 mL of *dilute hydrochloric acid R*. Mix, cover with a watch glass and boil for 15 min. Allow to cool to room temperature and allow the insoluble matter to settle. Decant the supernatant through a rapid-flow filter paper into a 400 mL beaker. To the insoluble matter in the 250 mL beaker add 25 mL of hot *water R*. Stir, allow the insoluble matter to settle and decant the supernatant through the filter into the 400 mL beaker. Repeat the extraction with 2 additional quantities, each of 25 mL, of *water R*, decanting each time the supernatant through the filter into the 400 mL beaker. Wash the filter with 25 mL of hot *water R*, collecting this filtrate in the 400 mL beaker. Concentrate the combined filtrates to about 20 mL by gently boiling. If a precipitate appears, add about 0.1 mL of *nitric acid R*, heat to boiling and allow to cool to room temperature. Filter the concentrated extracts through a rapid-flow filter paper into a 50 mL volumetric flask. Transfer the remaining contents of the 400 mL beaker through the filter paper and into the flask with *water R*. Dilute this solution to 50.0 mL with *water R*.

Reference solutions Prepare the reference solutions using *lead standard solution (10 ppm Pb) R*, diluted as necessary with *water R*.

Source Lead hollow-cathode lamp.

Wavelength 217 nm.

Atomisation device Oxidising air-acetylene flame.

Loss on drying (*2.2.32*)

Maximum 8.0 per cent, determined on 1.000 g by drying in an oven at 110 °C.

Microbial contamination

TAMC: acceptance criterion 10^3 CFU/g (*2.6.12*).

TYMC: acceptance criterion 10^2 CFU/g (*2.6.12*).

Absence of *Escherichia coli* (*2.6.13*).

ASSAY

Aluminium

Atomic absorption spectrometry (2.2.23, Method I).

Test solution In a platinum crucible mix 0.200 g with 1.0 g of anhydrous lithium metaborate R. Heat slowly at first and ignite at 1000-1200 °C for 15 min. Allow to cool, place the crucible in a 100 mL beaker containing 25 mL of a 40 per cent *V/V* solution of dilute nitric acid R and add 50 mL of a 40 per cent *V/V* solution of dilute nitric acid R, filling and submerging the crucible. Place a polytetrafluoroethylene-coated magnetic stirring bar in the crucible and stir gently with a magnetic stirrer until dissolution is complete. Transfer the solution to a 200 mL volumetric flask, wash the beaker, crucible and magnetic stirrer bar with water R, collecting the washings in the volumetric flask, and dilute to 200.0 mL with water R (solution A). To 20.0 mL of solution A add 20 mL of a 10 g/L solution of sodium chloride R and dilute to 100.0 mL with water R.

Reference solutions Dissolve, with gentle heating, 1.000 g of aluminium R in a mixture of 10 mL of hydrochloric acid R and 10 mL of water R. Allow to cool, then dilute to 1000.0 mL with water R (1 mg of aluminium per millilitre). Into 4 identical volumetric flasks, each containing 0.20 g of sodium chloride R, introduce 1.0 mL, 2.0 mL, 3.0 mL and 4.0 mL of this solution respectively, and dilute to 100.0 mL with water R.

Blank solution Dissolve 0.20 g of sodium chloride R in water R and dilute to 100.0 mL with the same solvent.

Source Aluminium hollow-cathode lamp.

Wavelength 309 nm.

Atomisation device Acetylene-nitrous oxide flame.

Magnesium

Atomic absorption spectrometry (2.2.23, Method I).

Test solution Dilute 25.0 mL of solution A, prepared in the assay for aluminium, to 50.0 mL with water R. To 5.0 mL of this solution add 20.0 mL of lanthanum chloride solution R and dilute to 100.0 mL with water R.

Reference solutions Place 1.000 g of magnesium R in a 250 mL beaker containing 20 mL of water R and carefully add 20 mL of hydrochloric acid R, warming if necessary to dissolve. Transfer the solution to a volumetric flask and dilute to 1000.0 mL with water R (1 mg of magnesium per millilitre). Dilute 5.0 mL of this solution to 500.0 mL with water R. Into 4 identical volumetric flasks, introduce 5.0 mL, 10.0 mL, 15.0 mL and 20.0 mL of the solution respectively. To each flask add 20.0 mL of lanthanum chloride solution R and dilute to 100.0 mL with water R.

Blank solution Dilute 20 mL of lanthanum chloride solution R to 100.0 mL with water R.

Source Magnesium hollow-cathode lamp.

Wavelength 285 nm.

Atomisation device Air-acetylene flame.

LABELLING

The label states the ratio of aluminium content to magnesium content, the viscosity and the corresponding type (see Definition).

FUNCTIONALITY-RELATED CHARACTERISTICS

This section provides information on characteristics that are recognised as being relevant control parameters for one or more functions of the substance when used as an excipient (see chapter 5.15). Some of the characteristics described in the Functionality-related characteristics section may also be present in the mandatory part of the monograph since they also represent mandatory quality criteria. In such cases, a cross-reference to the tests described in the mandatory part is included in the Functionality-related characteristics section. Control of the characteristics can contribute to the quality of a

medicinal product by improving the consistency of the manufacturing process and the performance of the medicinal product during use. Where control methods are cited, they are recognised as being suitable for the purpose, but other methods can also be used. Wherever results for a particular characteristic are reported, the control method must be indicated.

The following characteristic may be relevant for aluminium magnesium silicate used as viscosity-increasing agent and stabiliser.

Viscosity

(see Tests).

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