Chemicals used for treatment of water intended for human consumption — Poly (diallyldimethylammonium chloride)

ICS 13.060.20; 71.100.80

BSI British Standards

National foreword

This British Standard is the UK implementation of EN 1408:2008. It supersedes BS EN 1408:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CII/59, Chemicals for drinking water treatment.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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English Version

Chemicals used for treatment of water intended for human consumption - Poly (diallyldimethylammonium chloride)

Produits chimiques utilisés pour le traitement de l'eau destinée à la consommation humaine - Poly (chlorure de diméthyldiallylammonium)

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Poly (diallyldimethylammonium chlorid)

This European Standard was approved by CEN on 10 November 2007.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN 1408:2008) has been prepared by Technical Committee CEN/TC 164 “Water supply”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2008, and conflicting national standards shall be withdrawn at the latest by July 2008.

This document supersedes EN 1408:1998.

Significant technical differences between this edition and EN 1408:1998 are as follows:

- updating of the reference to the drinking water directive from 80/778/EEC to 98/83/EC.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this European Standard:

a) this European Standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;

b) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

NOTE Conformity with this European Standard does not confer or imply acceptance or approval of the product in any of the Member States of the EU or EFTA. The use of the product covered by this European Standard is subject to regulation or control by national authorities.

1 Scope

This European Standard is applicable to poly (diallyldimethylammonium chloride) used for treatment of water intended for human consumption. It describes the characteristics of poly (diallyldimethylammonium chloride) and specifies the requirements and the corresponding test methods for poly (diallyldimethylammonium chloride). It gives information on its use in water treatment.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696:1987)*

ISO 3165, *Sampling of chemical products for industrial use — Safety in sampling*

ISO 6206, *Chemical products for industrial use — Sampling — Vocabulary*

3 Description

3.1 Identification

3.1.1 Chemical name

2-Propen-1-aminium,N,N-dimethyl-N-2-propenyl, chloride, homopolymer.

3.1.2 Synonyms or common names

— Poly (diallyldimethylammonium chloride).

— Poly (dimethyldiallylammonium chloride).

— PolyDADMAC.

NOTE The more general terms: "quarternary ammonium polyelectrolyte", "cationic polymer", "cationic polyelectrolyte", "polymer coagulant" and "cationic flocculant" are used, but can also cover other chemicals referred to in other European Standards.

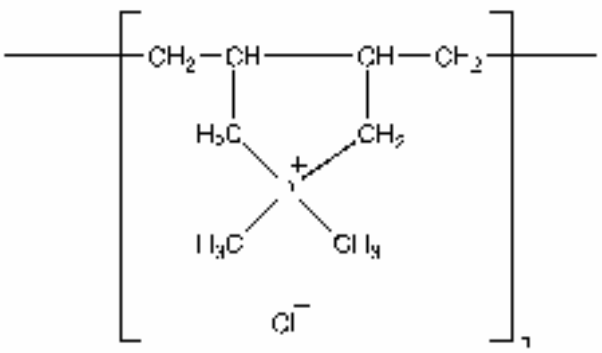
3.1.3 Relative molecular mass

Typically in the range of 20 000 to 1 million.

3.1.4 Empirical formula

— $(C_8\ H_{16}\ N\ Cl)_n$-

3.1.5 Chemical formula



3.1.6 CAS Registry Number [1)]

— 26062-79-3

3.1.7 EINECS reference [2)]

The conformity of polymers to EINECS is assessed on the basis of the monomers of which they are composed. Thus, EINECS reference numbers do not exist for polymers.

DADMAC monomer is listed in EINECS (EINECS reference 230-993-8; CAS Registry Number 7398-69-8).

3.2 Commercial form

PolyDADMAC as specified in this standard is an aqueous solution, the concentration (active content) of which is approximately 10 percent 40 percent mass fraction (see 5.2.2.2).

3.3 Physical properties

3.3.1 Appearance

The product is a clear, colourless to amber-coloured liquid.

3.3.2 Density

The density of the solution depends on the concentration. A typical value is 1,09 g/ml for 40 % mass fraction polyDADMAC at 20 °C.

3.3.3 Solubility

The product is miscible with water at all concentrations.

3.3.4 Vapour pressure

A typical value is 3,2 kPa for 40 % mass fraction polyDADMAC at 20 °C.

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1) Chemical Abstracts Service Registry Number.

2) European Inventory of Existing Commercial Chemical Substances.

3.3.5 Boiling point at 100 kPa [3)]

Approximately 100 °C.

3.3.6 Freezing point

Typical freezing points relative to polyDADMAC content are given in Table 1.

Table 1 — Freezing points

PolyDADMAC % mass fraction	**Freezing point** °C
20	- 1
30	- 6
40	- 15

3) 100 kPa = 1 bar.

3.3.7 Specific heat

Typical specific heats relative to polyDADMAC content are given in Table 2.

Table 2 — Specific heats

PolyDADMAC % mass fraction	Specific heat kJ/kg·K
20	3,78
30	3,57
40	3,36

3.3.8 Viscosity, dynamic

The viscosity is dependent on molecular mass and active content. Typically, it is in the range of 10 mPa·s to 10 000 mPa·s.

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

PolyDADMAC is a non-hazardous material and not intrinsically reactive. However, in common with many other organic compounds, a strong exothermic reaction will occur if it is brought into contact with strong acids or oxidizing agents.

NOTE In dilute solution there can be a reaction with, or destruction by, some of the disinfection and oxidizing agents used in water treatment.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for polyDADMAC used for the treatment of water intended for human consumption. Limits are given for impurities commonly present in the product. Depending on the raw material and the manufacturing process other impurities may be present and, if so, this shall be notified to the user and when necessary to relevant authorities.

NOTE Users of this product should check the national regulations in order to clarify whether it is of appropriate purity for treatment of water intended for human consumption, taking into account raw water quality, required dosage and contents of other impurities and additives used in the product not stated in the product standard.

Limits have been given for impurities and chemical parameters where these are likely to be present in significant quantities from the current production process and raw materials. If the production process or raw materials lead to significant quantities of impurities, by-products or additives being present, this shall be notified to the user.

4.2 Composition of commercial product

The following requirements shall apply to polyDADMAC:

— there shall be no visible insoluble gel or extraneous matter;

— pH shall be in the range 4 to 7.

4.3 Impurities and main by-products

DADMAC monomer: the product shall contain no more than 5 000 mg/kg active product.

Based on the raw materials and manufacturing process (see A.1), there are no significant concentrations of additional reactants or by-products which are relevant to the application of these products in drinking water treatment.

4.4 Chemical parameters

Chemical parameters and indicator parameters as listed in EU Directive 98/83/EC (see [1]) are not relevant to polyDADMAC because the raw materials used in the manufacturing process are free of them and they are not by-products of the manufacturing process.

5 Test methods

5.1 Sampling

5.1.1 General

For sampling the recommendations given in ISO 3165 and ISO 6206 shall be followed.

A representative sample of the liquid product, of sufficient mass, shall be obtained immediately after manufacture or from a newly opened container(s). The sample shall be clearly labelled with product name/code, batch number, type of container(s) sampled and date sampled. Reference samples shall be retained for the storage life of the product as claimed by the manufacturer/supplier.

5.1.2 Sampling from drums and bottles

5.1.2.1 General

5.1.2.1.1 Mix the contents of the container to be sampled by shaking the container, by rolling it or by rocking it from side to side, taking care not to damage the container or spill any of the liquid.

5.1.2.1.2 If the design of the container is such (for example, a narrow-necked bottle) that it is impracticable to use a sampling implement, take a sample by pouring after the contents have been thoroughly mixed. Otherwise, proceed as described in 5.1.2.1.3.

5.1.2.1.3 Examine the surface of the liquid. If there are signs of surface contamination, take samples from the surface as described in 5.1.2.2; otherwise, take samples as described in 5.1.2.3.

5.1.2.2 Surface sampling

Take a sample using a suitable ladle. Lower the ladle into the liquid until the rim is just below the surface, so that the surface layer runs into it. Withdraw the ladle just before it fills completely and allow any liquid adhering to the ladle to drain off. If necessary, repeat this operation so that, when the other selected containers have been sampled in a similar manner, the total volume of sample required for subsequent analysis is obtained.

5.1.2.3 Bottom sampling

Take a sample using an open sampling tube, or a bottom-valve sampling tube, suited to the size of container and the viscosity of the liquid.

When using an open sampling tube, close it at the top and then lower the bottom end to the bottom of the container. Open the tube and move it rapidly so that the bottom of the tube traverses the bottom of the container before the tube is filled. Close the tube, withdraw it from the container and allow any liquid adhering to the outside of the tube to drain off.

When using a bottom-valve sampling tube, close the valve before lowering the tube into the container and then proceed in a similar manner to that when using an open sampling tube.

5.1.3 Sampling from tanks and tankers

From each access point, take samples as follows:

a) from the surface of the liquid, using a ladle as described in 5.1.2.2;

b) from the bottom of the tank or tanker, using a sampling tube as described in 5.1.2.3 or using specially designed bottom-sampling apparatus;

c) from one or more positions, depending on the overall depth, between the bottom and the surface using a weighted sampling can.

5.2 Analyses

5.2.1 General

Unless otherwise specified, all reagents shall be of recognised analytical grade. The water used shall conform to grade 2 specified in EN ISO 3696.

5.2.2 Main product

5.2.2.1 pH measurement

The measurement of the pH is carried out on the undiluted product, at a temperature of 20 °C, using a pH meter. Before making the measurement, the apparatus shall be calibrated using a reference buffer solution of pH about 7,0.

5.2.2.2 Determination of active content

The proportion of active ingredient, i.e. polyDADMAC, in a sample of product is determined by a procedure in which it is assumed that the product is an aqueous solution containing polyDADMAC, DADMAC monomer and inorganic metal salt. The active content, expressed as a percentage by mass of polyDADMAC, is given by the following equation:

$$C_0 = C_1 - C_2 - (C_3 \times 10^{-4})$$

where

— C_0 is the percent by mass of polyDADMAC;

— C_1 is the percent by mass of dry solids (see 5.2.2.3);

— C_2 is the percent by mass of inorganic metal salt (see 5.2.3.2);

— C_3 is the concentration of DADMAC monomer in milligrams per kilogram of product (see 5.2.3.1).

The result shall be expressed to two decimal places.

NOTE The procedure will tend to over estimate the active content slightly if there are ammonium salts present in the product, as these are lost by volatilisation at the ash determining step.

5.2.2.3 Determination of dry solids content

5.2.2.3.1 Principle

The product is heat dried and the mass difference determined gravimetrically.

5.2.2.3.2 Apparatus

Ordinary laboratory apparatus and glassware together with the following:

5.2.2.3.2.1 Balance, with an accuracy of 0,1 mg.

5.2.2.3.2.2 Oven, capable of maintaining (110 ± 1) °C vented to fume cupboard.

5.2.2.3.2.3 Desiccator containing dried silica gel.

5.2.2.3.2.4 Porcelain crucible, 57 mm diameter.

5.2.2.3.3 Procedure

Place porcelain crucible (5.2.2.3.2.4) in oven at 110 °C (5.2.2.3.2.2) for at least 10 min.

Remove crucible from oven, place in desiccator (5.2.2.3.2.3) and allow to cool for at least 10 min.

Weigh the crucible to the nearest 0,1 mg.

Shake the sample in its container to ensure that it is homogeneous.

Add 1 g to 2 g, test portion of the product sample to the crucible and weigh to the nearest 0,1 mg.

Place crucible in oven at 110 °C for 2 h.

After this time, transfer crucible directly from the oven to desiccator and allow to cool for at least 10 min.

Weigh the crucible containing the dry residue to the nearest 0,1 mg.

5.2.2.3.4 Expression of results

5.2.2.3.4.1 Method of calculation

The dry solids content, C_1, expressed as a percentage by mass of the product, is given by the following equation:

$$C_1 = \frac{(m_3 - m_1)}{(m_2 - m_1)} \times 100$$

where

— m_1 is the mass, in grams, of the crucible;

— m_2 is the mass, in grams, of the crucible and wet sample;

— m_3 is the mass, in grams, of the crucible and dried sample.

The result shall be expressed to two decimal places.

5.2.2.3.4.2 Precision

The absolute difference between two single test results, obtained under repeatability conditions (see note), shall not be greater than the repeatability value, *r*, as calculated from the following equation:

— $r = 0{,}05\ z$

where

— z is the mean of the two results, expressed in % (*m/m*).

NOTE Repeatability conditions are conditions where mutually independent test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time.

5.2.2.4 Test methods for assessment of product quality

If additional requirements are agreed between the customer and the manufacturer/supplier, the latter shall provide the necessary test methods, if requested, so that the customer can carry out his own quality checks. A certificate of analysis shall be provided by the manufacturer/supplier, if requested.

NOTE A number of physical/chemical measurements can be used by manufacturers to ensure the consistent quality of products delivered to customers. For example, solution viscosity is commonly measured, this being done under strictly controlled conditions. The viscosity value obtained provides a reliable indication of relative molecular mass when

comparing batches of a particular product, but has no significance in absolute terms, since it is highly dependent on the composition of the product, the solution preparation procedure, the measuring device and test conditions used. Other tests which can be carried out include determination of ionic charge and infra-red spectroscopic analysis, depending on the product and manufacturer/supplier.

5.2.3 Impurities

5.2.3.1 Determination of residual DADMAC monomer content by gel-permeation chromatography (GPC)

5.2.3.1.1 Principle

The product is diluted with the mobile phase and directly injected into a liquid chromatograph (LC). Separation and detection is achieved using a high performance aqueous gel-permeation chromatograph (GPC) column and differential refractive index (DRI) detector. The height of the monomer peak is measured using an integrator and is proportional to the concentration of the monomer present in the product.

WARNING: Acetic acid is flammable and corrosive. It can cause severe damage to eyes, skin and respiratory system. Do not breathe vapour. In case of contact with eyes or skin, rinse immediately with plenty of water and seek medical advice. Handling requires the use of protective gloves and safety glasses.

5.2.3.1.2 Reagents

5.2.3.1.2.1 Sodium acetate trihydrate, HPLC (High performance liquid chromatography) grade.

5.2.3.1.2.2 Glacial acetic acid, HPLC grade.

5.2.3.1.2.3 DADMAC monomer, analytical grade.

5.2.3.1.2.4 Mobile phase: 0,312 5 mol/l equi-molar sodium acetate/acetic acid buffer solution. Weigh (42,5 ± 0,01) g of sodium acetate trihydrate (5.2.3.1.2.1) into a beaker and add approximately 300 ml of water. Stir to dissolve and transfer to a 1 l volumetric flask (5.2.3.1.3.4). Into the flask with pipette (5.2.3.1.3.2) introduce 18 ml of glacial acetic acid (5.2.3.1.2.2) and make up to the mark with water and mix well. Filter through a 0,22 µm membrane under vacuum (5.2.3.1.3.5). This solution is referred to as the "buffer solution".

5.2.3.1.2.5 DADMAC standard stock solution

Weigh to the nearest 0,1 mg, approximately 0,1 g of DADMAC monomer (5.2.3.1.2.3) into a 100 ml volumetric flask and dilute to volume with buffer solution (5.2.3.1.2.4) to give a stock standard DADMAC monomer solution of known concentration of approximately 1 000 mg/l.

5.2.3.1.2.6 Calibration solution

Quantitatively dilute the 1 000 mg/l standard stock solution (5.2.3.1.2.5) with buffer solution (5.2.3.1.2.4) to give a series of solutions ranging in concentration, for example, 20 mg/l, 50 mg/l, 100 mg/l, 200 mg/l and 400 mg/l.

5.2.3.1.3 Apparatus

Ordinary laboratory apparatus and glassware together with the following:

5.2.3.1.3.1 Liquid chromotograph LC system consisting of:

— HPLC solvent delivery pump;

— sample injector with 200 µl loop;

— DRI detector;

— computing integrator;

— separating column (7,8 mm internal diameter × 30 cm), type Toso Haas TSK gel PWXL G 2500 [4)];

— guard column (6 mm internal diameter × 4 cm), type Toso Haas TSK gel PWXL [4)].

5.2.3.1.3.2 Pipettes, with an accuracy of 0,03 ml, with suitable filling devices.

5.2.3.1.3.3 Balance, with an accuracy of 0,1 mg.

5.2.3.1.3.4 Volumetric flasks.

5.2.3.1.3.5 Membrane for sample and standard filtering, of polyvinylidene difluoride (PVDF), with pore size of 0,45 µm in housing in polypropylen (PP) type Whatman Puradisc [4)].

5.2.3.1.4 Procedure

5.2.3.1.4.1 Test portion and preparation of test solution

Weigh, to the nearest 0,1 mg, approximately 0,5 g to 1 g of the test sample into a 100 ml volumetric flask. Add about 50 ml of buffer solution (5.2.3.1.2.4); stopper and shake the flask vigorously to mix. Make up to the mark with more buffer solution, then stopper and shake the flask to ensure an homogeneous solution.

5.2.3.1.4.2 Instrument settings

Samples, calibration and blank solutions are analyzed by liquid chromatography using the apparatus (5.2.3.1.3.1) with the following settings and conditions:

— flow rate of mobile phase: 1 ml/min;

— pH of mobile phase: 4,7;

— injection: 200 µl using 2 ml syringe.

Detector settings:

— 1 V output to integrator;

— 31,2 mV detector sensitivity.

[4)] Toso Haas TSK and Whatman Puradisc are the trade name of products supplied by Toso Haas and Whatman. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN of the product named. Equivalent products may be used if they can be shown, to lead to the same result.

Integrator settings:

— attenuation 32 mV full scale;

— zero set at 10 % of full scale.

5.2.3.1.4.3 Sample analysis

Pass 2 ml of each calibration solution through a 0,45 µm filter unit (5.2.3.1.3.5) into the sample loop and inject into the LC system (5.2.3.1.3.1). Obtain the corresponding peak heights from the integrator and draw a calibration graph of peak height against concentration. Repeat this procedure for the test solution.

5.2.3.1.4.4 Blank determination

Repeat the procedure for sample analysis (5.2.3.1.4.3) omitting the test solution and substituting the test solution with the buffer solution (5.2.3.1.2.4).

5.2.3.1.5 Expression of results

5.2.3.1.5.1 Method of calculation

The DADMAC monomer content, C_3, expressed in milligrams per kilogram of the product, is given by the following equation:

$$C_3 = \frac{100 \times c}{m}$$

where

— c is the concentration, expressed in milligrams per litre, of the test solution (5.2.3.1.4.1) read from the calibration graph;

— m is the mass, in grams, of the test portion (5.2.3.1.4.1).

Alternatively, the DADMAC monomer content, C_4, expressed in milligrams per kilogram of the active product, is given by the following equation:

$$C_4 = \frac{10\,000 \times c}{m \times C_0}$$

where

— C_0 is the percentage by mass active content of the product (5.2.2.2).

Results shall be expressed to the nearest whole number.

5.2.3.1.5.2 Precision

The absolute difference between two single test results, obtained under repeatability conditions (see note), shall not be greater than the repeatability value, *r*, as calculated from the following equation:

— $r = 0{,}07\ z$

where

— z is the mean of the two results, expressed in milligrams per kilogram of product.

NOTE Repeatability conditions are conditions where mutually independent test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time.

5.2.3.2 Determination of inorganic metal salt content

5.2.3.2.1 Principle

A known mass of wet sample is dried in accordance with 5.2.2.3. The salt content is then determined gravimetrically following ignition of the dry residue in a furnace at 600 °C.

WARNING: Toxic vapours may be released during the ignition of the test material. Use a furnace which is vented to a fume cupboard.

5.2.3.2.2 Apparatus

Ordinary laboratory apparatus and glassware together with the following:

5.2.3.2.2.1 Balance, with an accuracy of 0,1 mg.

5.2.3.2.2.2 Muffle furnace, capable of maintaining (600 ± 20) °C vented to fumed cupboard.

5.2.3.2.2.3 Desiccator containing dried silica gel.

5.2.3.2.2.4 Oven, capable of maintaining (110 ± 1) °C.

5.2.3.2.3 Procedure

Place the crucible, containing the dry residue from 5.2.2.3 in the furnace at 600 °C (5.2.3.2.2.2) for at least 30 min. Remove the crucible and place in an oven at 110 °C (5.2.3.2.2.4) for at least 30 min, then place in a desiccator (5.2.3.2.2.3) until cool and reweigh to the nearest 0,1 mg.

5.2.3.2.4 Expression of results

5.2.3.2.4.1 Method of calculation

The salt content, C_2, expressed as a percentage by mass of the product, is given by the following equation:

$$C_2 = \frac{(m_4 - m_1)}{(m_2 - m_1)} \times 100$$

where

— m_1 is the mass, in grams, of the crucible;

— m_2 is the mass, in grams, of the crucible and wet sample;

— m_4 is the mass, in grams, of the crucible and ashed sample.

5.2.3.2.4.2 Precision

The absolute difference between two single test results, obtained under repeatability conditions (see note), should not be greater than the repeatability value, *r*, as calculated from the following equation:

— $r = 0{,}13\ z$

where

— z is the mean of the two results, expressed as a percentage by mass of the product.

NOTE Conditions where mutually independent test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time.

6 Labelling - transportation - storage

6.1 Means of delivery

The product shall be delivery in suitable containers, e.g. in bulk containers, drums, cans or bottles.

In order that the purity level of the product is not affected, the means of delivery shall not have been used previously for any different product or it shall have been specially cleaned and prepared before use.

6.2 Risk and safety labelling in accordance with the EU Directives

PolyDADMAC is not classified as a dangerous substance according to EU Directive 67/548/EEC (see [2]).

NOTE Annex I of the Directive 67/548/EEC on Classification, packaging and labelling of dangerous substances and its amendments and adaptations in the European Union contains a list of substances classified by the EU. Substances not in this Annex I should be classified on the basis of their intrinsic properties according to the criteria in the Directive by the person responsible for the marketing of the substance.

6.3 Transportation regulations and labelling

PolyDADMACs are not classified as hazardous for transport and do not therefore have a UN number [5)], hazard class, packaging group or require UN-certified containers.

6.4 Marking

Each container shall be marked with at least the following information:

— name "poly(diallyldimethylammonium choride)" or "polyDADMAC", trade name;

— net mass;

— name and address of supplier and/or manufacturer;

— statement "This product conforms to EN 1408".

6.5 Storage

6.5.1 Long term stability

The product is usually stable for at least 12 months. Follow supplier's advice.

6.5.2 Storage incompatibilities

Store away from strong acids (e.g. sulfuric acid) and strong oxidizing agents (e.g. sodium hypochlorite).

[5)] United Nations Number.

Annex A
(informative)

General information on polyDADMAC

A.1 Origin

A.1.1 Raw materials

PolyDADMAC is manufactured from DADMAC monomer: diallyldimethylammonium chloride.

A.1.2 Manufacturing process

PolyDADMAC is manufactured from diallyldimethylammonium chloride monomer by initiation of polymerisation in aqueous solution by free radicals.

A.2 Use

A.2.1 Function

PolyDADMACs are used in drinking water treatment to effect coagulation and flocculation of colloidal and fine suspended particles and thereby assist their removal. PolyDADMACs are thus usually utilized in the mainstream processes of clarification and filtration, where they can be used as sole flocculants or to supplement the coagulating action of metal salts.

A.2.2 Form in which it is used

Usually, the product is introduced into the process stream as a dilute (1 % *(m/m)* to 10 % (*m/m*) product as supplied) solution in order to effect rapid and even dispersion. This can be done either by batch mixing with water in a stirred tank or by metering the product directly and diluting in-line prior to addition.

A.2.3 Treatment dose

The treatment dose will vary depending on the quality of the raw water to be treated and can be subject to local regulations. Typically a level of active product of between 1 mg/l and 2 mg/l is used.

A.2.4 Means of application

The product is usually applied using a metering pump.

A.2.5 Secondary effects

Very slight increase in chloride content.

A.2.6 Removal of excess product

Not applicable.

A.3 Rules for safe handling and use

Good chemical handling practice should be followed at all times.

PolyDADMAC products do not present a significant health hazard when correctly handled.

Appropriate special risks should be entered on the safety data sheet to the effect that the product is slippery.

— In case of spillage, it should be contained with an inert material such as sand or earth and removed for disposal. The addition of water will render the floor very slippery and dangerous.

— Eye and hand protection is not normally warranted unless exposure is prolonged. Mild eye and skin irritation can result from extended contact.

— Protective clothing is not required on safety grounds, but overalls are recommended as cleaning can be problematic.

— Respiratory protection is not required under normal conditions of use.

A.4 Emergency procedures

A.4.1 First aid

If polyDADMAC is in contact with the skin, the contaminated area should be washed with copious amounts of soap and water.

If polyDADMAC is in contact with the eyes, they should be rinsed with water for at least 15 min. If irritation persists, medical advice should be sought.

If polyDADMAC is ingested, the mouth should be washed out with water but the affected person should not be allowed to swallow the wash water. Then water should be given to drink. An emitic should not be given. The affected person should be allowed to rest and medical advice should be sought immediately.

In addition to the above, any further advice on the supplier's safety data sheet should be followed.

A.4.2 Spillage

If a large spillage occurs, it should be contained with an inert material, such as sand or earth, to prevent it reaching the drains, and it should then be removed for disposal. Residues or small spillages can be flushed away with water. Spillages should not be disposed in watercourses.

A.4.3 Fire

Low fire and explosion risk. As an aqueous solution product will not burn or support combustion easily. The following extinguishing media can be used in the event of a fire evaporating the water content: carbon dioxide, water spray, dry powder, foam. In addition, supplier's recommendations should be consulted.

Bibliography

[1] 98/83/EC, Council Directive of 3 November 1998 on the quality of water intended for human consumption.

[2] 67/548/EEC, Council Directive of 27th June 1967 on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.

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BSI Group
Headquarters 389
Chiswick High Road,
London, W4 4AL, UK
Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
www.bsigroup.com/
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