



**American Water Works
Association**

The Authoritative Resource on Safe Water®

ANSI/AWWA B451-10
(Revision of ANSI/AWWA B451-04)

AWWA Standard

Poly(Diallyldimethyl- ammonium Chloride)



Effective date: Dec. 1, 2010.

First edition approved by AWWA Board of Directors June 14, 1987.

This edition approved June 20, 2010.

Approved by American National Standards Institute Oct. 6, 2010.

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AWWA Standard

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA B451.*

I. Introduction.

I.A. *Background.* Chemical clarification methods have been used to improve the quality of drinking water supplies since the late 1880s. In 1967, the first completely synthetic organic polyelectrolyte was accepted by the US Public Health Service for use in treating potable water. The responsibility for accepting additives for drinking water treatment was subsequently assumed by the US Environmental Protection Agency (USEPA) and administered by their Office of Drinking Water as an advisory program. USEPA's acceptance was made by the specific name of the suppliers' product and not by generic type. Poly(diallyldimethylammonium chloride)[†] (CAS[‡] No. 26062-79-3) is one of several types of synthetic organic polyelectrolytes that was accepted for use in potable water treatment under this program, which was discontinued in 1990.

PolyDADMAC is an abbreviation for poly(diallyldimethylammonium chloride). PolyDADMAC is a family of synthetic cationic organic polyelectrolytes (also called polymers or coagulants) used in water and wastewater treatment to improve the performance of some unit operations in the treatment process, most often by increasing the extent or rate of liquid–solids separation. The DADMAC monomer used to make PolyDADMAC is made from two chemicals: allyl chloride and dimethylamine (DMA). PolyDADMACs have a cationic charge, a high relative charge density, and low-to-medium relative molecular weights, and they are manufactured and sold primarily in the aqueous solution form, but the highest-molecular-weight versions may also be sold in the emulsion or powder forms. PolyDADMAC, which was first sold commercially around 1970, has been used to agglomerate particles in a wide variety of water (potable) and wastewater liquid–solids separation applications. A frequent application is clarification (removal of solid particles) or demulsification (removal of liquid organic particles). PolyDADMAC is also called poly(diallyldimethylammonium chloride), poly(dimethyldiallyl ammonium chloride), polyDMDAAC, polyquaternary amine, and quaternized polyamine, polyamine. The important concepts to remember regarding polyDADMAC include the following:

* American National Standards Institute, 25 West 43rd Street, Fourth Floor, New York, NY 10036.

† Diallyldimethylammonium chloride is hereinafter abbreviated "DADMAC." Poly(diallyldimethylammonium chloride) polymer is abbreviated "polyDADMAC."

‡ Chemical Abstracts Service, 2540 Olentangy River Road, P.O. Box 3012, Columbus, OH 43210.

1. PolyDADMACs in solution form are similar to EPI-DMA polyamines (ANSI/AWWA B452) in their use, handling, storage, and solution preparation.
2. PolyDADMACs in solution form are different from polyacrylamide (PAM) polymers (ANSI/AWWA B453) in their use, handling, storage, and solution preparation.
3. The nomenclature used to describe the forms that polyDADMAC may be supplied follows:
 - a. Solutions (also called aqueous solutions, liquids, or viscous solutions).
 - b. Powders (also called flake, dry, granular, or bead).
 - c. Emulsions (also called liquids, dispersions, or inverse emulsions).
4. PolyDADMAC is a family of polymers with a relatively constant charge type and constant charge density but with different molecular weights. They are essentially linear in structure, but the highest-molecular-weight versions may incorporate some branching.
5. The physical properties of polyDADMACs cannot be used to judge product performance; only laboratory testing, pilot plant studies, or full-scale plant trials can discern product efficacy.
6. PolyDADMACs manufactured in solution form may contain inactive ingredients, such as sodium chloride, depending on the manufacturing method and formulation.
7. PolyDADMACs manufactured in emulsion form contain inactive petroleum solvents and surfactants and may also contain sodium chloride and other inactive ingredients, depending on the manufacturing method and formulation.
8. PolyDADMACs manufactured in powder form may contain sodium chloride and other inactive ingredients, depending on the manufacturing method and formulation.

The user should consult both the material safety data sheet (MSDS) and the product technical data sheet for the specific polyDADMAC product being used for information on the product's composition, physical properties, safety procedures, feeding and storage guidelines, and other important information. The supplier should provide copies of the product technical data sheet along with the MSDS.

I.B. *History.* The AWWA Standards Council authorized the development of this standard in 1979. The standard was developed by the AWWA Standards Committee on Polyelectrolytes and was approved by the AWWA Board of Directors on June 14, 1987. The second edition of the standard was approved on June 18, 1992. The third edition of the standard was approved on Jan. 25, 1998. The fourth edition of

the standard was approved by the Board of Directors on June 13, 2004. This edition of the standard and was approved on June 20, 2010.

I.C. *Acceptance (water supply service applications).* In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International* (NSF) to develop voluntary third-party consensus standards and a certification program for direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (AwwaRF, now Water Research Foundation†) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.‡ Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including two standards developed under the direction of NSF, NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, and NSF/ANSI 61, Drinking Water System Components—Health Effects.

Various certification organizations may be involved in certifying products in accordance with NSF/ANSI 60. Individual states or local agencies have authority to accept or accredit certification organizations within their jurisdiction. Accreditation of certification organizations may vary from jurisdiction to jurisdiction.

Annex A, “Toxicology Review and Evaluation Procedures,” to NSF/ANSI 60 does not stipulate a maximum allowable level (MAL) of a contaminant for substances not regulated by a USEPA final maximum contaminant level (MCL). The MALs of an unspecified list of “unregulated contaminants” are based on toxicity testing guidelines (noncarcinogens) and risk characterization methodology (carcinogens). Use of Annex A procedures may not always be identical, depending on the certifier.

ANSI/AWWA B451 addresses additives requirements in Sec. 4.3 of the standard. The transfer of contaminants from chemicals to processed water or the residual solids is becoming a problem of great concern. The language in Sec. 4.3 is a recommendation only for direct additives used in the treatment of potable water to be certified by an accredited certification organization in accordance with NSF/ANSI 60, Drinking

* NSF International, 789 North Dixboro Road, Ann Arbor, MI 48105.

† Water Research Foundation, 6666 W. Quincy Avenue, Denver, CO 80235.

‡ Persons outside the United States should contact the appropriate authority having jurisdiction.

Water Treatment Chemicals—Health Effects. However, users of the standard may opt to make this certification a requirement for the product. Users of this standard should consult the appropriate state or local agency having jurisdiction in order to

1. Determine additives requirements, including applicable standards.
2. Determine the status of certifications by parties offering to certify products for contact with, or treatment of, drinking water.
3. Determine current information on product certification.

I.D. *Acceptance (wastewater service applications).* This is the first revision of ANSI/AWWA B451 that addresses wastewater service applications and standards.

II. Special Issues.

II.A. *Safety.* PolyDADMACs manufactured in solution form are not considered to be toxic as household products nor are they considered primary skin or eye irritants by the consumer product safety commission (US Federal Hazardous Substances Act). Good housekeeping procedures and personal cleanliness are recommended when handling polyDADMAC. PolyDADMACs manufactured in emulsion form contain hydrocarbon solvents whose vapor can cause nausea, headaches, and other symptoms.

Safety glasses should be worn when handling solution or emulsion forms of polyDADMAC and, although not required, when handling the powder form. Appropriate first-aid practices should be followed in all cases of exposure. In case of eye contact, flush with plenty of water for at least 15 min and call a physician. Consult the MSDS for the specific product for safety information and procedures before handling any polyDADMAC product or solution.

II.B. *Spill Control.* PolyDADMAC should be disposed of according to federal, state, local, and provincial regulations. Solutions of polyDADMACs make floors and other surfaces extremely slippery. A dike should be formed around the spill area to contain as much material as possible, and the contained material should be shoveled, scooped, or pumped, as appropriate, into suitable disposal containers. As much of any remaining material as possible should be removed by adsorbing it on vermiculite or other suitable adsorbing material and or by wiping with adsorbing rags, as appropriate, and placed into suitable containers for disposal. Emulsion or powder forms of polyDADMAC will create very slippery solutions of polyDADMAC upon contact with water. The spill area should be thoroughly hosed with warm water only after all possible polymer has been scooped up, adsorbed, or wiped up.

III. Use of This Standard. It is the responsibility of the user of an AWWA standard to determine that the products described in that standard are suitable for use in the particular application being considered.

III.A. *Purchaser Options and Alternatives.* This AWWA standard can be used to prepare a purchase specification but is not itself a specification because it cannot address product requirements unique to the purchaser's specific application and does not establish business relationships. In addition, this polyDADMAC standard does not establish physical and chemical property specifications for any one polyDADMAC product because the physical and chemical properties of polyDADMACs do not always relate to their performance in specific applications.

Below are requirements that the user might consider when developing a polyDADMAC polymer product purchase specification. This standard requires the supplier to provide a product technical data sheet for each product in addition to an MSDS and requires specific information to be included in the product technical data sheet. The information in a product technical data sheet may be used to establish or comply with purchase specifications.

1. Compliance with the latest revision of ANSI/AWWA B451, Standard for Poly(Diallyldimethylammonium Chloride) for potable water supply service applications (water) or wastewater service applications (wastewater), as applicable.
2. For potable water applications, compliance with NSF/ANSI 60, Drinking Water Treatment Chemicals—Health Effects, is required.
3. Description of application.
4. Estimated annual purchase requirements (pounds/kilograms).
5. Typical order quantity (number of containers and pounds/kilograms).
6. Shipping address (destination).
7. Special delivery requirements (need for truck with a lift gate; length and coupling sizes of hose needed for bulk delivery; transfer pump; allowed times of delivery; limitations on truck size or weight; sampling protocol; other). Are there any product physical property limitations such as a maximum viscosity that cannot be handled by the storage or feed equipment?
8. Order lead time (The number of days between order placement and delivery necessary if typical lead times are insufficient).
9. Billing addresses.
10. Financial terms.
11. Insurance/performance bond requirements.
12. Active polymer concentration in the product expressed as a weight percent.
13. Details of other federal, state or provincial, and local requirements (Sec. 4.1).
14. Whether an affidavit of compliance is required for each shipment and lot (Sec. 4.2.3).

15. Specific physical and chemical properties for quality control. Minimum specifications should include visual inspection, total solids, Brookfield viscosity range, and pH of product's solution. Other important properties can be selected from the product technical data sheets of polyDADMAC products that have been shown to perform acceptably in the actual application or in laboratory jar tests. Verification of physical and chemical properties should be by the methods specified in Section 5. Verification, or by other methods acceptable to both the purchaser and supplier.

16. Sampling requirements (Sec. 5.2).

17. Requirement for supplier to provide manufacturing location contact information for quality control inquiries (Sec. 5.9).

18. Marking requirements (Sec. 6.1).

19. Packaging and shipping requirements (Sec. 6.2). State any alternative security measures desired to replace or augment the security measures set out in Sec. 6.2. State whether the purchaser may reject product from tank trucks (bulk), containers, or packaging with missing or damaged seals. State whether the purchaser may reject product if it fails to meet specifications determined by testing in accordance with Sec. 5.2, 5.3, and 5.4. Failure to meet specifications or the absence of, or irregularities in, seals may be sufficient cause to reject the shipment. State whether a chain of custody is wanted (Sec. 6.2.2).

III.B. *Product Performance.* Performance evaluation via a laboratory jar test or other performance test is essential for confirming polyDADMAC activity. Such a test is the only means of evaluating possible changes in the water composition, temperature, or in the type or amount of other chemicals added along with the polyDADMAC.

III.C. *Modification to Standard.* Any modification to the provisions, definitions, or terminology in this standard must be provided by the purchaser.

IV. Major Revisions. Major changes made in this revision of ANSI/AWWA B451 include the following:

1. Guidelines for development of product purchase specifications in foreword Section III have been modified.

2. Consideration of polyDADMACs manufactured in powder form or, in the future, emulsion form have been added.

3. Requirements for wastewater service applications have been added for the first time throughout, including in Sec. 4.8 and 4.9.

4. The requirements for a product technical data sheet that contains specific information (Sec. 4.10) and distribution of product technical data sheets whenever material safety data sheets are sent and in other circumstances (Sec. 6.3) have been added.

V. Comments. If you have any comments or questions about this standard, please call AWWA Engineering and Technical Services at 303.794.7711, FAX at 303.795.7603, write to the group at 6666 West Quincy Avenue, Denver, CO 80235-3098, or e-mail standards@awwa.org.



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**American Water Works
Association**

AWWA Standard

Poly(Diallyldimethylammonium Chloride)

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard describes poly(diallyldimethylammonium chloride)* for use in water supply service applications and wastewater service applications.

Sec. 1.2 Purpose

The purpose of this standard is to provide the minimum requirements for polyDADMAC products, including physical, chemical, packaging, shipping, and testing requirements, and to provide the means of developing requirements for specific polyDADMAC products.

Sec. 1.3 Application

This standard can be referenced in specifications for purchasing and receiving polyDADMAC and can be used as a guide for testing the physical and chemical properties of polyDADMAC samples. The stipulations for this standard apply when this document has been referenced and then only to polyDADMAC used in water supply service applications or wastewater service applications. Each section

*Diallyldimethylammonium chloride is hereinafter abbreviated "DADMAC." Poly(diallyldimethylammonium chloride) is abbreviated "polyDADMAC."