DEAE-dextran

Trade name: DEAE-dextran

Chemical name: 2-diethylaminoethyl-dextran

CAS number: 9015-73-0

Structure:

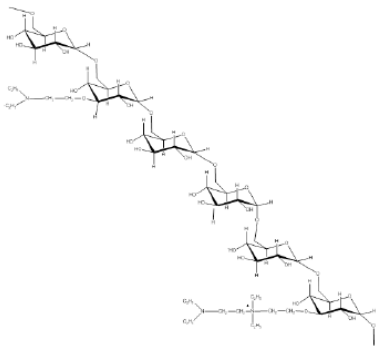


Fig. 1. Schematic representation of DEAE-dextran

Synthesis and structure

DEAE- dextrans are synthesised from controlled dextran fractions by reacting with DEAE-chloride. After purification, the products are controlled for mean molecular weight (Mw, Mn), solubility, degree of substitution, and loss on drying.

A Specification may be obtained on request. The products are designated by the approximate molecular weights of the dextran fractions used. Thus, for example, the product DEAE-dextran 70 has a mean molecular weight (Mw) of approx. 70 000. The actual molecular weight is determined by gel permeation chromatography (GPC).

This value is supplied with the Certificate of Analysis. The differences between the Mw values of the starting dextran fraction and the final product depend on changes in the

hydrodynamic volume of the molecules after substitution. The dextran used is from Leuconostoc mesenteroides B-512F which

is essentially a linear α-(1-6)-linked glucose chain with a low percentage (2-5%) of α-(1-3) branches distributed along the chain. The dextran fractions used are from weight average molecular weights (Mw) of 4000 to 2000000 and are carefully controlled by GPC, optical rotation, absorbance and pH.

Physical properties and chemical properties

DEAE-dextrans are colourless, odourless powders which are freely soluble in water or electrolyte solutions. The product has

a pronounced cationic character at neutral pH by virtue of the presence of the DEAE-groups. Since this property may influence

the hydrodynamic volume in solution and the interactions with gels, the values for MW obtained on GPC may differ from that of the respective starting dextran fraction.

The titration curve for DEAE-dextran (see Fig 2) shows two distinct titratable groups which are assigned to the tertiary amine on the tandem group (EP2, EP3) and the tertiary amine on the single group (EP1, EP2). The ratio between these two groups depend on the degree of substitution – for DEAE-dextrans with N% of 3-4% the proportions between the single and tandem groups are similar. This would indicate a degree of substitution of approximately one substituent for every 3 chain glucose units.

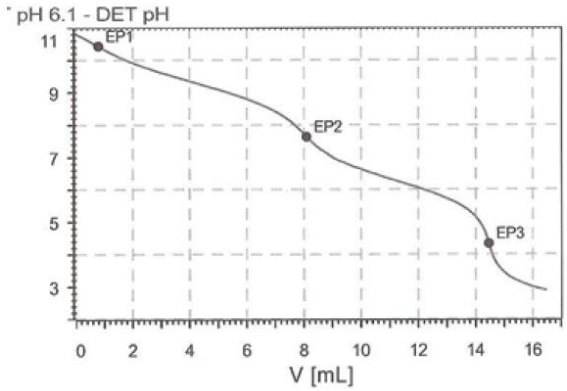
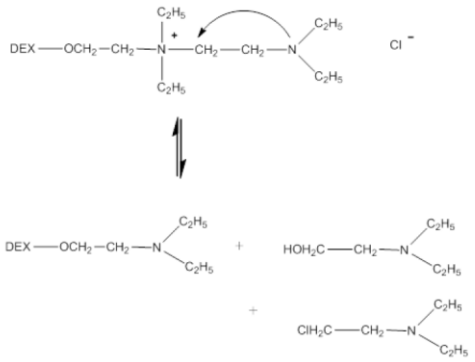


Fig.2 Potentiometric titration curve for DEAE-dextran.

DEAE-dextrans are insoluble in most organic solvents, for example, ethanol, methanol, acetone, chloroform, ethyl acetate, and diethyl ether.

Stability

Prospective stability studies on DEAE-dextran confirm that it maintains its quality and efficacy for more than three years when stored at room temperature. It is recommended that the products are stored in air-tight containers in the dark. The presence of tandem groups bearing quaternary substituents, however, implies that care must be taken in allowing DEAE-dextran to be exposed to alkaline conditions as this will lead to potential degradation reactions (see Scheme 1).



Scheme 1. Degradation of DEAE-dextran (26).

Applications

DEAE-dextrans have been found to induce many interesting effects in biological systems presumably due its cationic character and subsequent interactions with tissue and cell surfaces, which generally possess an overall negative charge. A random selection of references on various fields of applications are presented below.

Enhanced uptake by cells (transfection)

Many reports testify to the enhanced uptake of viral nucleic acids by cells in the presence of DEAE-dextran without detrimental effects on the cells (1-5). Only at higher concentrations may such effects be apparent. Factors influencing transfection enhancement have been studied (6).

Adjuvant in vaccines

There are numerous reports on the efficacy of DEAE-dextran in veterinary vaccine production in lambs, calves and piglets (7-11).

Agent for gene therapy

Numerous reports described potential applications of DEAE-dextran for gene therapy (12-16).

Stabiliser for protein storage

DEAE-dextran has been shown to stabilize lyophilized proteins (e.g. enzymes) and also protein solutions. Further improvements may be achieved by using a combination of DEAE-dextran and a polyalcohol (17-20).

Agent for drug delivery

The electrostatic binding properties of DEAE-dextran to polyanions is well established and has been used to presentdrugs and similar agents in a form that mediates the uptake of the agent in vivo (21-23). Recent studies (24, 25) penetrate the factors influencing complex formation and properties of the complexes.

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