Polysucrose

Trade name: Polysucrose

Chemical name: Dextran, epichlorohydrin cross-linked polymer

CAS nr: 68954-24-5

Structure:

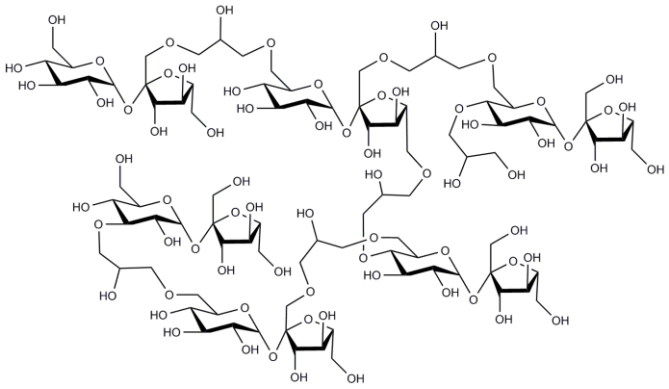

Fig. 1. *Fragment of a Polysucrose molecule*

Synthesis and structure

Polysucrose is synthesized by reacting sucrose with epichlorohydrin and thereafter purifying the products by means of ultrafiltration or fractional precipitations. The free contaminants from the synthesis are removed during the above purification methods. The detailed structure has not been elucidated but the synthesis clearly leads to a highly branched structure and the properties are largely determined by the high content of hydroxyl groups.

Physical properties

Polysucrose, better known as Ficoll® is a neutral molecule and is freely soluble in water and electrolyte solutions and concentrations of over 50% (w/v) may be obtained. There are many publications addressing the conformation and physical properties of the polysucrose molecule. The general conclusions are that the polysucrose molecules are intermediate between a solid sphere and a flexible random coil (1- 5). In Table 1 (below), a comparison of the Stokes radius of dextran and polysucrose fractions reflects these differences in molecular flexibility. Thus, the smaller hydrodynamic volumes of polysucrose are reflected in longer retention times when comparing polysucrose and dextran fractions of similar molecular weights by gel permeation chromatography (GPC).

Polysucrose solutions have very low osmotic pressures compared to sucrose solutions of equivalent concentration. Thus a 10% solution of polysucrose 70 has an osmolality of 3 mOs/kg compared to 150 for a 10% sucrose.

MW *10^3	Dextran Stokes radius	Polysucrose Stokes radius	Albumin Stokes radius
500	147	106	-
70	58	49.5	35
49	44.5	40	-

Table 1. *Molecular dimensions of polysucrose and dextran expressed as Stokes radius.*

Storage and stability

Polysucrose powder when stored in air-tight containers at ambient temperatures is stable for at least 6 years. Only at low pH (< 5) and elevated temperatures is there a risk for hydrolysis of the sucrose units. Polysucrose itself can be autoclaved at neutral and slightly alkaline pH.

Toxicity

Polysucrose fractions, with mean molecular weights from 100,000 to 500,000, when administered intravenously at doses up to 12 g/kg in experimental animals, were well tolerated (unpublished studies). Polysucrose is not degraded in the blood and accumulates in the liver, spleen and kidneys. Polysucrose shows excellent biocompatibility with cells, virus, microorganisms and has been used for many decades in separation technology.

Biological aspects and applications

Many investigators have considered polysucrose to be a suitable molecule for studying glomerular physiology since it is biocompatible and not readily degraded in the blood stream. Further it has conformational properties more like proteins. Polysucrose (and particularly FITC-and TRITC-labelled polysucrose) have been used extensively in studies of vascular permeability, in particular glomerular perm selectivity and has been reviewed (3). A selection of some of the numerous publications in this field is presented below (6-12). Polysucroses have been used for many decades for such purposes as gradient centrifugation of cells and organelles, nucleic acid hybridization, as a hapten carrier, concentration dialysis, to support growth of cell lines and phase partitioning (see data files from GE Healthcare and Sigma-Aldrich.

References

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