

OXIDATION-REDUCTION POLYMERS

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ABSTRACT

This review summarizes our work on the synthesis and redox properties of polymers with various quinone-hydroquinone systems. Information is given on our attempts to increase the chemical stability of the redox resins by suitable substitution and by other methods.

The redox properties were thoroughly investigated (e.g. redox potentials, redox capacity, rate of the redox reaction). A theoretical treatment is given for the redox behaviour of tetra- and hexa-valent redox systems.

Redox resins can be used as insoluble, regenerable oxidants or reductants. By means of these resins some organic substrates could be dehydrogenated and several metal ions could be reduced or deposited.

For several years we have synthesized polymer redox systems and have investigated their electrochemical properties. Polymer redox systems are known by the names oxidation reduction polymers, redox polymers, redox resins and electron-transfer polymers. Water-swellaable polymers which can reversibly be oxidized or reduced are usually named redox resins. The redox components of these polymers can be links of the polymer chains or they can be substituents of the chains. The chemical structure of the redox systems can be varied widely. There exist several reviews¹⁻³ on this subject: those of Cassidy can be especially recommended. This paper is a selective review of investigations of redox resins containing hydroquinone-quinone redox systems which have been performed in our laboratories.

SYNTHESIS OF REDOX RESINS

Redox polymers may be addition polymers synthesized by polymerizing hydroquinone-quinone derivatives which contain vinyl groups, or condensation polymers prepared by polycondensation of suitable compounds. They can also be prepared by polymer analogous reactions on preformed polymers.

Examples of addition polymers are the redox resins which were investigated by Cassidy and his co-workers⁴. They were prepared on the basis of vinylhydroquinone. As the hydroquinone-quinone system inhibits polymerization, protecting groups (e.g. ether, acetate, benzoate) are usually introduced, which can be quantitatively removed after polymerization. A

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