

More specifically, the homopolymers of the invention comprise a homopolymerization reaction product of a monomer of the formula:

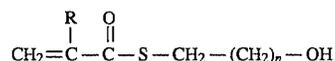


wherein:

R is hydrogen or methyl; and

n is 1, 2 or 3.

The copolymers comprise a reaction product of at least one monomer of the general formula I:



wherein:

R is hydrogen or methyl; and

n is 1, 2 or 3; and

at least one other monomer capable of polymerization with the monomer of the formula I.

In general, the compounds of formula I are capable of copolymerizing with those comonomers that are capable of copolymerizing with HEMA. Such comonomers are well known and include alkyl acrylates, alkyl methacrylates, hydroxyalkyl acrylates and hydroxyalkyl methacrylates among others. For example, when a crosslinked polymer capable of forming a hydrogel is desired, the comonomer can be one or more of di(ethylene glycol) diacrylate, di(ethylene glycol) dimethacrylate, tri(ethylene glycol) diacrylate, tri(ethylene glycol) dimethacrylate, tetra(ethylene glycol) diacrylate and tetra(ethylene glycol) dimethacrylate. If an optically transparent copolymer is desired, particularly suited comonomers include methylmethacrylate and ethylmethacrylate.

The compounds of formula I can also be copolymerized with ionogenic comonomers which include acids such as methacrylic, acrylic, and acrylate/methacrylate monomers containing phosphonic and sulfonic acid functionalities. An example of such a comonomer is 2-(sulfoxy) ethyl methacrylate. Other ionogenic comonomers include cationic comonomers such as 2-(N,N-diethylamino)ethyl methacrylate and 2-(N,N-dimethylamino)ethyl methacrylate. Ampholytic terpolymers such as HETMA in combination with acrylic acid, 2-(N,N-diethylamino) ethyl methacrylate or 2-(N,N-dimethylamino)ethyl methacrylate are also within the scope of the invention.

In dental applications, the compounds of formula I can be copolymerized with bis-GMA (2,2'-bis[4-(2-hydroxy-3-methacryloyloxypropoxy)]phenyl propane) and urethane dimethacrylates such as those obtained from the reaction of 1,6-hexane diisocyanate and HEMA or HETMA and the reaction of toluene 2,4'-diisocyanate and HEMA or HETMA. Reaction products of anhydrides and HEMA or HETMA, for example the reaction product of pyromellitic anhydride, trimellitic anhydride or succinic anhydride with HEMA or HETMA, can be used as a comonomer with HETMA or as a copolymer product.

The following examples illustrate methods of polymerization of the compounds of formula I.

Homopolymerization of S-(2-hydroxyethyl) thiomethacrylate using tri-n-butyl borane oxide as initiator

Five parts of S-(2-hydroxyethyl) thiomethacrylate (HETMA), which contained about 500 ppm of 4-methoxyphenol as an inhibitor, were mixed at 25° C. with one part of tri-n-butyl borane oxide (TBBO)(AMALGAMBOND Catalyst Parkell Biomedical Division). After about 10 seconds, there was a slight exotherm and the reaction temperature rose to 27° C. The temperature was maintained at this level for 20 minutes. Then additional TBBO was added to bring the reactant/initiator ratio to 2.6 parts HETMA to 1.0 parts TBBO. The polymerization mixture reached the string point/cloud point after a total elapsed time of 30 minutes. After an additional 5 minutes, the reaction mass was an elastomeric gel. An IR spectrum of the homopolymer after 80 minutes of reaction revealed that the absorption band at 1630 cm⁻¹ (vinyl unsaturation) in HETMA is not present in the homopolymer.

In a second preparation, four parts of HETMA (containing about 500 ppm of methoxyhydroquinone as an inhibitor) were mixed at 39° C. with one part of TBBO. A rapid exotherm to 49° C. was noted during the first 30 seconds. The mixture was heated to 55° C. and maintained at this temperature. The string point/cloud point was reached after a total elapsed time of 7.5 minutes, and the reaction mass became an elastomeric gel after an additional 1 to 2 minutes.

EXAMPLE 5

Homopolymerization of S-(2-hydroxyethyl) thiomethacrylate using 2,2'-azobis(2-methylbutyronitrile) as initiator

Twenty-five parts of HETMA (containing about 500 ppm of 4-methoxyphenol as an inhibitor) were mixed at 58° to 59° C. with one part of 2,2'-azobis(2-methylbutyronitrile) (VAZO 67, Du Pont). An exotherm to 61° C. was observed during the first 30 to 40 seconds. The temperature was maintained at 60° C. for 25 minutes. Then additional 2,2'-azobis(2-methylbutyronitrile) was added to bring the reactant/initiator ratio to 12.4 parts HETMA to 1.0 parts 2,2'-azobis(2-methylbutyronitrile). The polymerization mixture reached the string point/cloud point after a total elapsed time of 90 minutes at 60° C. After an additional 10 minutes, the reaction mass was a soft gel. The reaction mass was a stiff, elastomeric gel after a total elapsed time of 2.5 hours.

The polymers formed by the homopolymerization or copolymerization of the compounds of formula I can be used in a variety of applications, including as diagnostic devices such as catheters, electrode catheters, carriers for enzyme immunoassay, gel-entrapped enzyme electrode probes, cell culture substrates, and electrophoresis gels, therapeutic applications such as absorbent coatings for blood perfusion, hemodialysis membranes, blood oxygenators, degradable therapeutic systems, drug-delivery systems, and medicated and soft contact lenses; implants such as intraocular lenses, artificial corneas, soft tissue substitutes, burn dressings, transdermal drug-delivery patches. Other uses of the polymers can include as separation membranes. The polymers can be formed into these useful products using suitable techniques known to those of skill in the art.

From the foregoing, it will be seen that this invention is one well adapted to attain all the ends and objects herein-