

Polyether- Polyester Conjugates for Biodegradable Hydrophilic Microgels and Hyperbranched Polymers

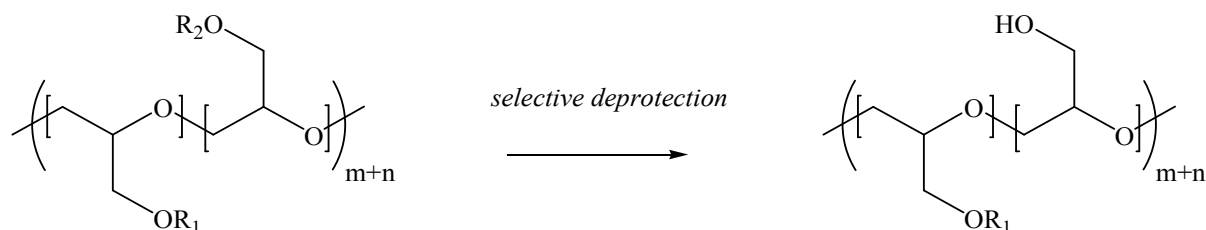
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Anionic polymerization of protected glycidols with mono- and multifunctional initiators results in polymers with linear, graft, or star-shaped architectures. Removal of the protection groups leads to polyglycidols which are used as multifunctional macroinitiators for the ring opening polymerization of ϵ -caprolactone. Core-shell polymers with a hydrophilic polyether core and a hydrophobic polyester shell are obtained. These amphiphilic core shell polymers are able to encapsulate guest molecules or catalytically active hydrophilic species. In this respect, polyether-polyester conjugates are attractive materials for drug delivery systems, because of the biodegradability of the polyester arm building blocks and the biocompatibility of the polyether core. Regarding biomedical applications increasing interest has been devoted to enzyme catalyzed polymerization of lactones. In this respect, a comparison between chemical and enzymatic catalysis using multifunctional macroinitiators for the ring opening polymerization of ϵ -caprolactone was performed.[1]

Polyglycidols with two orthogonal protective groups were obtained via anionic ring-opening copolymerization of allyl glycidyl ether (AGE), *tert*.butyl glycidyl ether (*t*BuGE), and ethoxyethyl glycidyl ether (EEGE). Poly(AGE-*co-t*BuGE), poly(AGE-*co*-EEGE), and poly(EEGE-*co-t*BuGE) were obtained with controlled degree of polymerization, narrow molecular weight distribution and a predetermined ratio of repeating units. The following conversions were achieved by selective removal of only one protection group: using aqueous hydrochloric acid, poly(AGE-*co*-EEGE) was converted to poly(AGE-*co*-GE); using trifluoroacetic acid, poly(AGE-*co-t*BuGE) was converted to poly(AGE-*co*-glycidyl trifluoroacetate); and by using Pd/C and *p*-toluene sulfonic acid poly(AGE-*co-t*BuGE) was converted to poly(GE-*co-t*BuGE). A selective removal of only one protection group from poly(EEGE-*co-t*BuGE) was not possible.[2]

Free hydroxymethyl groups of the polymers were partially converted in a polymer analogous reaction to give multifunctional polyglycidols or by using bifunctional reagents to result in amphiphilic microgels.



P(*t*BuGE)-*co*-P(AGE): $R_1 = -C(CH_3)_3$; $R_2 = -CH_2-CH=CH_2$

P(*t*BuGE)-*co*-P(EEGE): $R_1 = -C(CH_3)_3$; $R_2 = -CH(CH_3)-O-CH_2CH_3$

P(AGE)-*co*-P(EEGE): $R_1 = -CH_2-CH=CH_2$; $R_2 = -CH(CH_3)-O-CH_2CH_3$

Keywords: biodegradable polymers; chemical and enzymatic ring-opening polymerization, grafting from

[1] M. Hans, P. Gasteier, H. Keul, M. Moeller, *Macromolecules* 39, 3184 (2006).

[2] M. Erberich, H. Keul, M. Moeller, *Macromolecules* 40, 3070 (2007).