

## SYNTHESIS OF WATERBORNE DEGRADABLE POLYESTER NANOPARTICLES

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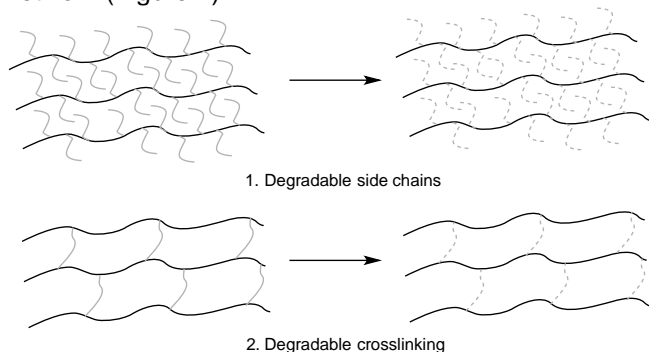
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Waterborne degradable nanoparticles are of interest for many applications, such as drug delivery, temporary coatings or adhesives. The aim of this project is to achieve degradability of waterborne polymeric adhesive dispersions by introducing polyesters in the polymer particles due to their simple decomposition through hydrolysis. Two approaches were followed to introduce polyesters into the polymer matrix. On the one hand the usage of acrylated oligoesters as macromonomers to form degradable side chains and on the other hand the usage of diacrylated oligoesters as crosslinker for degradability in the crosslinking points of the polymeric network (Figure 1).



Macromonomers with polyester side chains were synthesized by homo or copolymerization of lactide and  $\epsilon$ -caprolactone to oligoesters in a ring opening polymerization using 2-hydroxymethacrylate as initiating species. Homopolymerizations of the macromonomers were successfully carried out in homogeneous and heterogeneous (mini-emulsion) conditions. Homopolymers with Tgs spanning from -60 to +30 °C have been obtained opening the box for incorporating these macromonomers in adhesive and coating formulations.

*Figure 4 – Two possibilities of polyesters in particles.*

Furthermore, oligoester crosslinkers were also pursued. Both asymmetric and symmetric crosslinkers were synthesized using the macromonomers and itaconic anhydride to include a second vinylic group (asymmetric) or symmetric crosslinkers starting from 1,4-butanediol, lactide,  $\epsilon$ -caprolactone and following insertion of two vinylic groups through itaconic anhydride.

The crosslinking suitability of the oligoester crosslinkers was proven by a solution polymerization with conventional monomers (BA and MMA). Degradation (substantial reduction of the molar masses) of the crosslinked copolymers when exposed to basic pH during 24 hours demonstrated the feasibility of the approach.

The synthesized crosslinkers were explored for the production of waterborne polymer dispersions for pressure sensitive adhesive formulations and compared to the conventional crosslinker allyl methacrylate in terms of the microstructural properties of the polymer (sol molecular weight and gel content). Preliminary results indicated that incorporation of some crosslinkers in batch and semibatch conventional emulsion polymerization is elusive, likely because of the low water solubility of the oligoester crosslinkers and therefore limited diffusion in emulsion polymerization. Attempts to incorporate the crosslinkers using miniemulsion polymerization have shown interesting results that are comparable to the performance of the conventional non-degradable allyl methacrylate crosslinker.