Replacing Polyvinyl Chloride with Novel Thermoplastics Derived from Natural Gas

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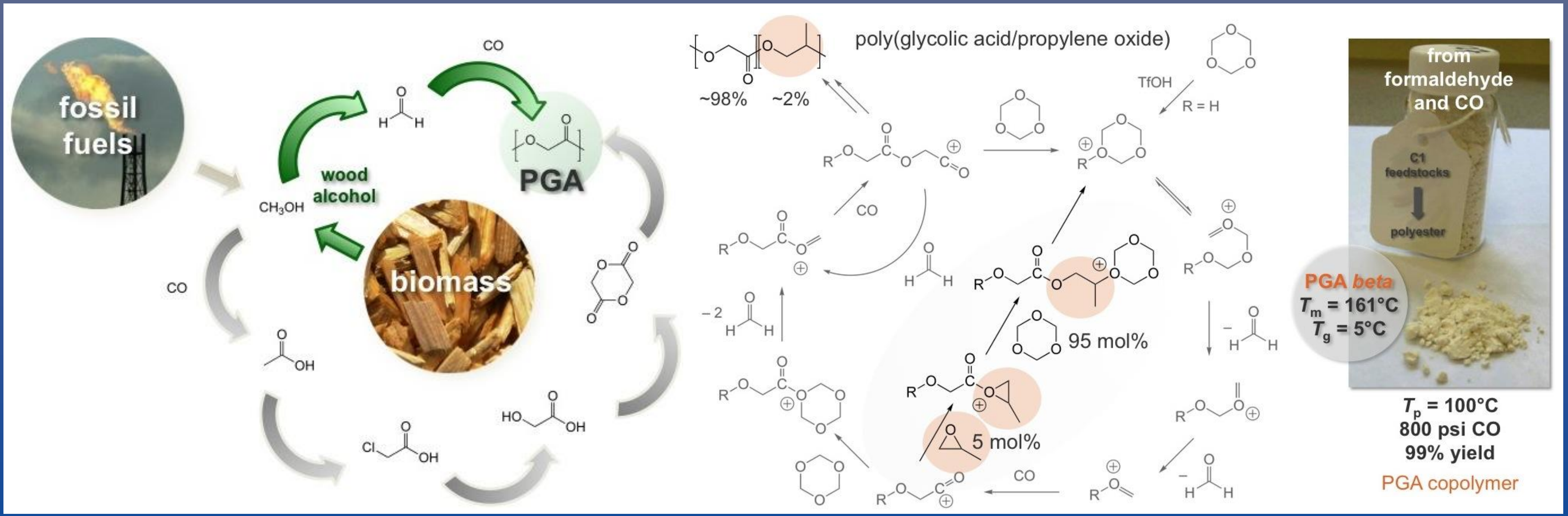
The primary research objective of this proposal is to synthesize novel polyoxymethylene copolymers—derived from natural gas feedstocks—having thermomechanical properties suitable for replacing the common thermoplastic polyvinyl chloride (PVC). The organic feedstock for POM is methanol, which currently is derived from natural gas methane, a C1 fossil fuel with a projected availability longer than that of petroleum.

We have prepared a vareity of polyacetal polymers and our continued efforts to focus on C1 feedstocks have led us to novel methods for converting C1 feedstocks into a variety of polymers ideally suited for commodity thermoplastic applications. For example we can copolymerize carbon monoxide with formaldehyde to synthesize polyglycolic acid (PGA). This direct approach avoids several inefficient and wasteful steps and allows for the incorporation of other comonomers, which affords direct control over the polymeric properties. Inclusion of epoxides results in PGA/poly ether polymers with lower melting temperatures and overall thermal properties (T_m = 161° C; T_g = 5° C) similar to those of polypropylene. Importantly, the feedstocks employed do not require fermentation and do not compete with food sources. Moreover, the obtained PGA copolymers are readily degraded—converting to harmless glycolic acid under conditions that require only water or seawater and no enzymes, organisms, or oxygen.



Göktürk, E.; Pemba, A. G.; Miller, S. A. *Provisional U.S. Patent Application,* Serial No. 61/608,196, March 8th, 2012.