Replacing Polyvinyl Chloride with Novel Thermoplastics Derived from Natural Gas

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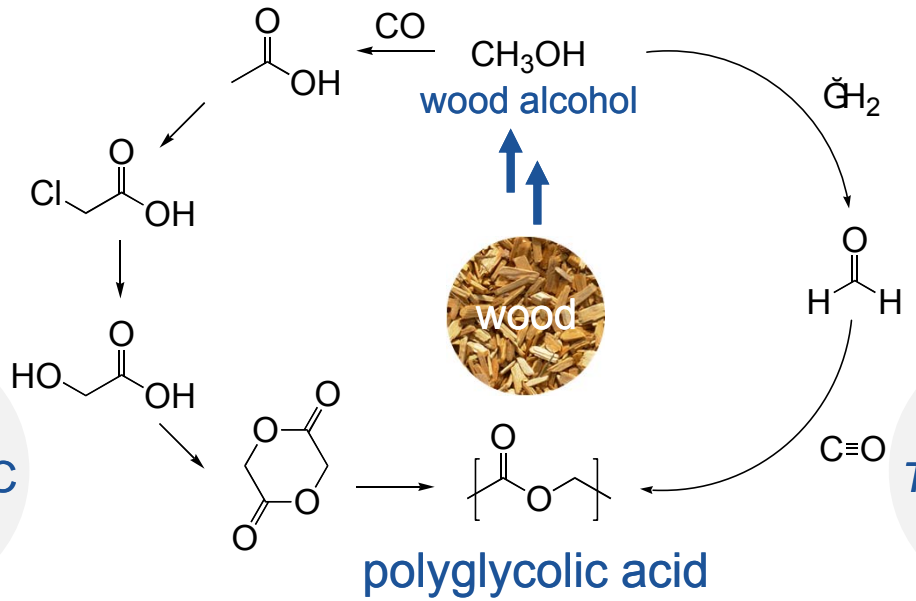
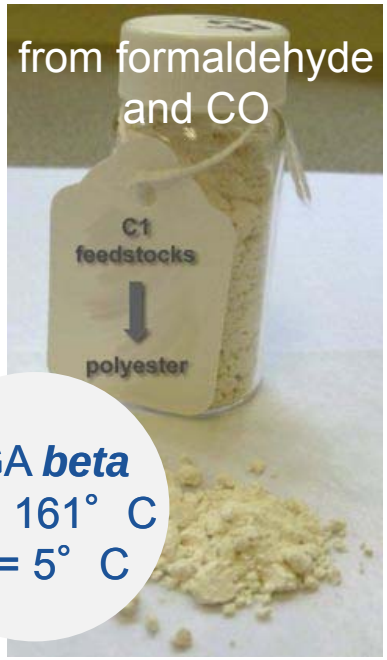
Our research objectives include finding new pathways to convert C1 feedstocks into commodity plastics. Methanol, which is currently sourced from the methane in natural gas, is an important C1 feedstock that is readly converted to formaldehyde or carbon monoxide. Since methanol (wood alcohol) can also be sourced from biomass, it is an ideal platform chemical for current and future polymer synthesis.

We have recently developed a direct synthesis of fully biodegradable polyglycolic acid (PGA) from formaldehyde and carbon monoxide. Previous patent reports of this process yielded dark and/or oligomeric material not suitable for packaging applications. However, we have solved this problem and created PGA ***beta***, a material that is over 95% PGA, but contains additional structural features that allow the programmed control of polymer melting temperature and glass transition temperature. In fact, the thermal properties can be tuned to match those of polypropylene.

PGA
T_m = 215° C
T_g = 40° C





PGA ***beta***
T_m = 161° C
T_g = 5° C

Pemba, A. G.; Gokturk, E.; Miller, S. A., unpublished results.