Distribution kinetics for polymer degradation

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The conventional petroleum-based polymers are inherently non-biodegradable and their disposal adds to severe environmental pollution and global warming. The replacement of the non-biodegradable polymers by the degradable ones is, therefore, evoking considerable interest recently. The commodity plastics such as polyethylene, polypropylene and polystyrene etc, are still the materials that dominate the mass market and are difficult to recycle. There are three levels of recycling, primary, secondary and tertiary. Primary recycling is taking the recycled material and putting it back into the same product; secondary recycling is using the material in some other end product; tertiary recycling requires breaking the material down into its original components. All methods of recycling have so far been by pyrolysis. However, the conventional method has several drawbacks. Unlike pyrolysis, where problems like high melt viscosity, heat-transfer resistance, and formation of undesirable byproducts are encountered, degradation in solution is advantageous because of the uniform temperature and heat transfer resulting in degradation at lower temperatures compared to pyrolysis. In this project, the following studies were carried out,

1. Thermal degradation of polymers in Solution
2. Effect of hydrogen donor on the thermal degradation of Polymers In Solution
3. Ultrasonic degradation of polymers in solution
4. Oxidative degradation of polymers in solution
5. Degradation of polymers in the presence of acids and bases.
6. Degradation of polymers in supercritical fluids
7. Specificity of various lipases on the biodegradability of polymers.

In summary, various methods were investigated for the degradation of polymers. In all cases, models based on continuous distribution kinetics were proposed. The degradation rate coefficients were determined by fitting the experimental data to the model. Overall, a fundamental understanding on polymer degradation in solution was obtained.