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Indicator Products – A New Tool for Prediction of Longterm Properties of Degradable Polymers

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All polymeric materials degrade during processing. This is especially severe problem for degradable polymers, which are usually very sensitive to elevated temperatures and if care is not taken can lose most of their molecular weight and mechanical properties during processing. If we want to ensure that the degradable material will fulfil its expected function before deterioration, one crucial point is to have control over the degradation caused by processing and the influence of this deterioration on the final properties and lifetime of the product. We have in several studies shown a connection between the release of certain degradation products and matrix changes. The formation of dicarboxylic acids and lactones was in correlation with the number of chain scissions during oxidative degradation of environmentally degradable polyethylene. There was also a correlation between the formation of 1-pentyl-2,5-pyrrolidinedione, the most abundant degradation product from virgin and reprocessed polyamide 6.6 and changes in mechanical properties. This correlation between the formation of certain volatiles and the deterioration of solid-state polymer, could enable new test methods for determination of the oxidative stability during processing and longterm properties based on the formation of indicator products. The release of indicator products could also be applied for rapid evaluation of anti-oxidant or pro-oxidant additive formulations during processing and use of materials.