Glycolysis of PET Prepolymer by Ethylene Glycol

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Poly(ethylene terephthalate) prepolymer was de-polymerized by glycolysis with an excess of ethylene glycol(EG) at comparable temperatures in the presence of metal acetate and other catalysts. The oligomer composition of glycolyzed products was analyzed by a high performance liquid chromatography(HPLC) and the average degree of polymerization was calculated from the area percent of HPLC peaks for the glycolyzed product. The relative effect of the five metal acetate catalysts on the initial rate of depolymerization was in the order of $Sn^{2+} > Zn^{2+} > Pb^{2+} > Co^{2+} > Na^{+}$ and for the other ones the catalytic activity was titanium tetrabutoxide > dibutyltin-dilaurate(DBTDL) > antimony trioxide (Table 1).

Table 1. Rate constants for glycolysis of PET prepolymer by EG

Catalyst	Reaction temperature (°C)	Rate constant (ml/mol.min)
Without catalyst	210	0.04
	220	0.11
	230	0.09
CH_3COONa	210	0.10
	220	0.11
	230	0.12
$Co(CH_3COO)_2 \cdot 4H_2O$	210	0.36
	220	0.45
	230	0.47
$Pb(CH_3COO)_2 \cdot 3H_2O$	210	0.47
	220	0.59
	230	0.69
$Zn(CH_3COO)_2 \cdot 2H_2O$	210	0.68
	220	0.91
	230	1.72
$Sn(CH_3COO)_2$	210	1.00
	220	1.72
	230	1.89
Sb_2O_3	210	0.15
	220	0.17
	230	0.24
DBTDL	210	0.13
	220	0.26
	230	0.45
$Ti(OBt)_4$	210	2.00
	220	1.93
	230	1.89