



## RING-OPENING POLYMERIZATION OF CYCLIC ESTERS BY METAL COMPLEXES

M. Lahcini<sup>a,\*</sup>, M. Raihane<sup>a</sup>, H. R. Kricheldorf<sup>b</sup>, M. KALMI,<sup>c</sup> P. CASTRO,<sup>c</sup> T. REPO<sup>c</sup>

<sup>a</sup>Laboratoire de chimie Bio-Organique et Macromoléculaire, Faculté des Sciences et Techniques Marrakech, Université Cadi Ayyad, 40 000 Marrakech, Morocco

<sup>b</sup>Institute für Technische und Makromolekulare Chemie, Bundesstr. 45, D-20146 Hamburg, Germany

<sup>c</sup>Department of Chemistry, Laboratory of Inorganic Chemistry, University of Helsinki, A. I. Virtasen aukio 1 P.O. Box 55, Helsingin Yliopisto FI-00014, Finland

In addition to polylactides, poly( $\epsilon$ -caprolactone) (P- $\epsilon$ CL) is the most widely studied biodegradable polyester. Homo and copolyesters of  $\epsilon$ CL are usually prepared by ring-opening polymerization and a broad variety of catalysts and initiators were used for this application. For the technical production of homo- and copolyesters of lactides and lactones, tin(II) 2ethylhexanoate (SnOct<sub>2</sub>) is the standard catalyst, because it was accepted by American Food and Drug Administration as food additive, despite its high cytotoxicity. To avoid toxicity problems several research group, have examined the usefulness of non-toxic metal-salts, metal complexes and enzymes as alternatives of SnOct<sub>2</sub>.<sup>[1]</sup> Among the non-toxic metal ions Bi<sup>+</sup> is unique for the following reasons. In contrast to Mg<sup>2+</sup>, Cu<sup>2+</sup> and Zn<sup>2+</sup>, Bi<sup>3+</sup> does not belong to the human metabolism.<sup>[2]</sup> Nonetheless, it was found that Bi<sup>3+</sup> is somewhat less toxic than zinc salts when kidney tubuli were exposed to various metal salts.

Furthermore, bismuth subsalicylate has a tradition of more than hundred years as internal drug against gastrointestinal problems. Furthermore, bismuth oxide and subcarbonate have a long tradition as components of ointments.<sup>[3,4]</sup> Hence, bismuth may be called the least toxic heavy metal. The focus of bismuth based catalysts is documented by the fact, that most, if not all, polyurethane producing chemical companies have replaced the toxic tin catalysts by bismuth salts despite their lower reactivity. In this context the present work had to purpo sesto study the usefulness of bismuth(III) complexes as an initiators for copolymerizations of  $\epsilon$ CL.

### References

- [1] H. R. Kricheldorf, A. Serra, *Polym. Bull. (Berlin)* 1985, 44, 497.
- [2] V. Rodilla, A. T. Miles, W. Jenner, G. M. Havksworth, *Chem. Biol. Interact.* 1998, 115, 71-83.
- [31] G. L. Briand, N. Burford, *Chem. Rev.* 1999, 99, 2601-2657.
- [32] Z. Gao, P. J. Stadler, *Angew. Chem.* 1999, 111, 1610-1629. *Angew. Chem. Int. Ed.* 1999, 38, 1512.