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DEVELOPMENT OF A REACTIVE EXTRUSION PROCESS FOR THE SYNTHESIS OF POLYESTERAMIDES - POTENTIALS FOR MEDICAL ENGINEERING APPLICATIONS

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Biodegradable polymers play an important role for medical engineering applications. Even though many types of degradable polymers are widely used in biomedical devices and show a good biocompatibility e.g.polylactic acid (PLA), the release of acidic degradation products sometimes leads to acidic microenvironments and inflammatory responses upon implantation. In order to overcome these problems, research was carried out to develop a polyesteramide which on degradation does not release large quantities of acids and hence, acid induced inflammation is reduced. Polyesteramides include both ester and amide groups in the main polymer chain and thus combine the good mechanical properties of technical polyamide with good biodegradability of aliphatic polyester. In that respect, a process for the continuous synthesis of random polyesteramides via anionic ring opening polymerization (ROP) was developed at RWTH Aachen University using reactive extrusion technique. Synthesized polyesteramides consisted of various ratios of the educts as well as numerous activator-initiator ratios. Experiments were carried out on a micro and a laboratory corotating twin-screw extruder as a chemical reactor. Chemical, mechanical and rheological properties were analyzed in order to characterize the polymers. Furthermore the obtained datas were used to simulate the extrusion process and to predict e.g. temperature profiles during process. Depending on the chemical composition conversion rates up to 99 % were achieved in the micro-extruder. Consequently, this technique permits the continuous synthesis of polyesteramides and the polymer expects to be a very interesting material for degradable devices in medical engineering applications.