



MONITORING OF THE THERMAL DEGRADATION OF POLY (L-LACTIC ACID) DURING MELT EXTRUSION

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Melt processing of poly(L-lactic acid) (PLLA) can lead to both molar mass reduction and color formation. The former can alter such properties like the biodegradation rate, which is critical for medical applications. In this work, ultra-violet/visible (UV/VIS) spectroscopy was applied to in-line monitor the extrusion of PLLA on a co-rotating twin screw extruder. The molar mass, viscosity and in vitro biodegradation behavior of the extrudates were analyzed off-line. UV/VIS spectroscopy was found to be very sensitive to monitor color changes of the melt. For dry PLLA a clear trend between increasing UV/VIS absorption of the melt and molar mass reduction of the extrudates was found. From the dependence of molar mass reduction on processing conditions it could be concluded that the degradation is mainly determined thermally and by less mechanical deformation. The presence of moisture in the polymer does not significantly influence the UV/VIS spectra but contributes to a further molar mass reduction. In vitro biodegradation experiments of the extruded dry PLLA shows that processing parameters have significant influence on the biodegradation behaviour. A good correlation between the biodegradation rate of the extrudates and the UV/VIS absorption of the melt was found. This investigation demonstrates that UV/VIS spectroscopy is powerful for real-time detecting the thermal degradation of PLLA during melt extrusion.