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Green parts thermal debinding for alloplastic bone grafts

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The alloplastic bone grafts represent one of the most modern solutions for bone reconstruction [1]. The complexity of the bone grafts requires advanced molding technologies and the medium-pressure injection molding (MEDPIMOLD) provides technical and economical advantages (max. pressure 5 MPa, max. injection temperature 120 °C) in comparison with the classic injection molding (60-100 MPa respectively 220-250 °C).

The raw material to be injected is represented by the mixture (feedstock) between the wax-based binder system (40-60 % mass) and the biocomposite powder particles (balance). The binder system is made of paraffin, carnauba and bees waxes, ethylene vinyl acetate and stearic acid. The biocomposite powders mixture is made of hydroxyapatite (30-50 μm), titanium hydride (~ 100 μm), citric acid, calcium carbonate and ammonium bicarbonate.

The green parts obtained after the injection step were submitted to the thermal debinding in order to remove the binders and the brown parts obtained will pass to the sintering treatment. The aim of our research was to study the influence of the thermal debinding parameters (temperature and dwell time) on the thermophysical and micro/macro-structural properties of the brown parts, monitored by thermal analysis (TA), Fourier transform infrared spectroscopy (FTIR), optical microscopy and mechanical tests.

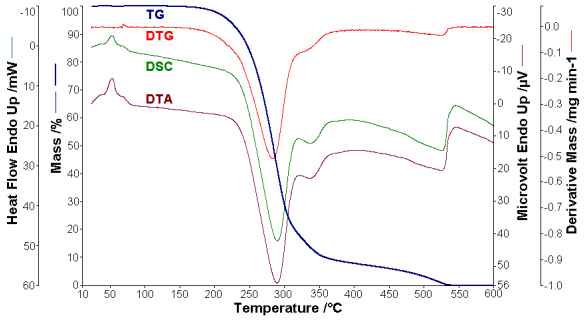

Fig. 1

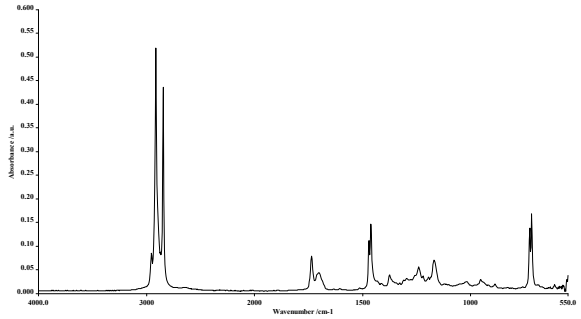

Fig. 2

Figs. 1 and 2 show the results of thermal analysis and FTIR spectroscopy of the mixture of binders used to prepare raw parts for alloplastic bone grafts. The binders decompose totally, in the air, to a temperature of 535 °C.

[1] R. Schnettler, J. P. Stahl, V. Alt, T. Pavlidis, E. Dingeldein, S. Wenisch, Eur. J. Trauma 30(4) (2004) 219