MODIFICATION OF STARCH FOR HEMOSTATIC APPLICATIONS

Andreas Hofecker[a], Paul Slezak[b], Heinz Redl[b], and Simone Knaus[a]

[a]Institute of Applied Synthetic Chemistry, Vienna University of Technology, 1060 Vienna, Austria
[b]Ludwig Boltzmann Institute for Experimental and Clinical Traumatology, 1200 Vienna, Austria

Starch is a polysaccharide consisting of amylose and amylopectin. This biopolymer is widely used in food-, paper-, polymer-, and in the pharmaceutical industry. Due to its biocompatibility, biodegradability, non-toxicity, and low material costs, it is preferably used in the pharmaceutical industry. Herein, native and modified starch is used as substrate, tablet disintegrant, and hemostatic powder.[1]

The objective of this work was to characterize commercially available starches and modified starches for their suitability as hemostatic powder compared to the commercially available hemostat Arista™.[2]

Initially, morphology, gelatinization point, and behavior in contact with water of various commercially available starches were examined. The most important attribute for the application as hemostatic powder are the properties in water under static conditions. Native potato starch had the lowest gelatinization temperature and the highest water uptake in comparison to the other native starches. Furthermore, crosslinked and pregelatinized starches showed the highest water absorption. Therefore, potato starch was crosslinked with a crosslinking agent in an extrusion and a slurry process. Moreover, calcium ions were incorporated into the products to improve the hemostatic effect. This effect was verified by rotational thromboelastometry measurements and showed a 20% to 30% faster coagulation of the calcium containing crosslinked starches compared to Arista™. Additionally, the crosslinking improves the stability and the elasticity of the formed clots. Finally, some of the promising starches were tested in an in-vivo model and the crosslinked calcium containing starch had a positive effect on the hemostasis, whereas Arista™ was washed away as a result of bleeding.

[1] Hofreiter, B. T. “In Miscellaneous modifications [of starches]”, CRC: 1987; pp 179-96

[2] Lindahl, T. L. et al. "In vitro and in vivo evaluation of chemically modified degradable starch microspheres for topical haemostasis"; Acta Biomater. 2011, 7 (6), 2558-2565