Starch materials for resorbable medical devices, application for a shape memory stent

Laurent Chaunier[1], Diégo Vélasquez[1], Anne Beilvert[1], Anne Meddahi-Pellé[2] and **Denis Lourdin**[1]

[1]*INRA, UR1268, Unité Biopolymer Interactions and Assemblies, 44300 Nantes, France*
[2]*INSERM, U698, Bioengineering for Cardiovascular and Therapy Team, 75877 Paris, France*
Correspondingauthor : denis.lourdin@inra.fr

ABSTRACT :
Starch-basedmaterials have attractedsignificantinterestfor the development of innovativematerials for biomedical applications[1].Thanks to itsthermoplasticbehaviour,3D objectscanbefabricated by use of processsuch as extrusion, thermomoulding or injection. Moreover, naturalextrudedthermoplasticstarchpresents efficient shapememoryproperties, whichcanbetriggered by body temperature or humidity[2].It allows applications in outpatientsurgery, thusminimizing the need for anesthesia and reducinghospitalization time.The structure, swelling and mechanicalproperties of starchbased-materialsfrompotato and amylose-richmaizestarches, with and withoutplasticizer have been studied on materialsimmersed in physiological conditions on a period of 30 days. It isshownthatglycerolplasticization favorise afastcrystallization of potatostarchmaterialswhichenhancedtheirmechanicalstrength and durability and a weak swelling[3].Potato starchpresented a good tissue integration and no significant inflammation or foreign body responseafter 30 days intra-muscular implantation in a rat model, contrary to amylose-richmaizestarchmaterials. This allowsthem to beused as a bioresorbable and biocompatible material for innovativeimplantable medicaldevices.Finally the design and the evaluation of a shape memory starch-basedstent for the treatment of asalivaryductdiseasewillbepresented. We propose an overview of thesestudiesrealised in our group sinceseveralyears.

1.Gomes, M. E., Ribeiro, A. S., Malafaya, P. B., Reis, R. L., & Cunha, A. M. Biomaterials, 22, 883–889, 2001
2. Beilvert A., Chaubet F., Chaunier L., Guilois S., Pavon-Djavid G., Letourneur D., Meddahi-Pellé A., Lourdin D. Carbohydrate Polymers, 99, 242– 248, 2014
3. Velasquez D., Pavon-Djavid G., Chaunier L., Meddahi-Pellé A., Lourdin D. Carbohydrate Polymers, 2015

KEYWORDS :
starch; extrusion; shape memory; biomedical; implant;

.