ABSTRACT SUBMISSION

To be submitted before Feb. 22nd, 2019 online at https://biomatsante.sciencesconf.org

Biomat – Materials for Health Congress – June 3-7 2019 – La Grande Motte, France

Bioadhesion through adsorption of colloids at hydrogel-tissue interfaces

Raphaël Michel[1,2], Mathieu Manassero[3], Laurent Corté[1,2]

1. Chimie Moléculaire, Macromoléculaire, Matériaux, ESPCI Paris, CNRS, PSL University, 75005 Paris
2. Centre des Matériaux, MINES ParisTech, CNRS, PSL University, 91003 Evry
3. Service de chirurgie, Ecole Nationale Vétérinaire d'Alfort 94700 Maisons-Alfort, France -B2OA, CNRS UMR 7052, 75010 Paris

Type of contribution desired: ☑ **ORAL** ☐ **POSTER**
☐ Candidating to best presentation award for PhD students/young scientists* ?
(*PhD defense in 2018 or before the end of 2019".

Keywords : *Bioadhesion, membrane, hydrogel, nanoparticle*

ABSTRACT

The fixation of hydrogels to soft biological tissues is of outmost interest for numbers of biomedical applications but it is a highly challenging task due to the fragile and wet nature of both hydrogels and tissues. In recent pioneering works, Leibler and coworkers have shown that the adsorption of macromolecules at the surface of nanoparticles can be efficiently used to bind pieces of hydrogels or biological tissues [1,2]. Here, we explore how this new approach to adhesion can be used to design bioadhesive hydrogels that are relevant for clinical applications. For that, an *ex vivo* peeling experiment was devised to measure the adhesion between model polyethylene glycol hydrogel films coated with nanoparticles and the surface of explanted porcine livers. In a first series of experiments, we find that bioadhesion strongly depends on the hydration of the tissues. In particular, we show that a transition from a lubricated contact to a strongly adhesive contact is governed by the transport of liquid across the tissue-hydrogel interface [3]. In a second series of experiments, we investigate how adhesion energy depends on the contact parameters and coating properties (nanoparticle size, surface chemistry and aggregation). As an example, for a 5 min contact, a 3 to 4 fold increase in adhesion energy was obtained by the deposition of silica or iron-oxide nanoparticle coatings at the surface of dry PEG membranes. These results provide valuable guides to design adhesive patches, which chemistry, geometry and adhesive power are compatible with the stringent conditions encountered during human surgery.

References :

[1] S. Rose, A. Prevoteau, P. Elzière, D. Hourdet, A. Marcellan, et L. Leibler, Nature (2014) 505 : 382-385, doi : 10.1038/nature12806.
[2] A. Meddahi-Pellé, A. Legrand, A. Marcellan, L. Louedec, D. Letourneur, et L. Leibler, Angewandte (2014) 53 : 6369-6373 , doi : 10.1002/anie.201401043.
[3] R. Michel, L. Poirier, Q. van Poelvoorde, J. Legagneux, M. Manassero, et L. Corté, PNAS (2019) 116 : 738-743, doi : 10.1073/pnas.1813208116.