Faculté de pharmacie

Séminaire de l'axe

« Formulation et analyse du médicament »

Université de Montréal

« Properties of bio inspired catecholic polymers : underwater adhesion and self-healing »

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À l'invitation du professeur Xavier Banquy

Marine mussels are known to adhere strongly to mineral surfaces using catechol-rich mussel foot proteins (mfps). Inspired by mfps, catechol-functionalized polymers are synthesized in order to replicate mussels' outstanding underwater adhesion properties. In the first part of the talk, semi-rigid catecholacrylate (Young's modulus, E ~ 1.3 MPa) and rigid catecholmechacrylate (E ~ 350 MPa) derived polymers will be discussed. These polymers showed surface-initiated self-healing properties which is triggered by formation of extensive catechol-mediated interfacial hydrogen bonds. Moreover, underwater adhesion force between these polymeric surfaces increased with the contact time. These polymeric materials that intrinsically heal at damage sites under wet or moist conditions have high potential for biomedical applications. In the second part of the talk, a versatile and strong wet-contact adhesive that enables both a triggered complexation of polyelectrolytes and formation of a porous architecture will be discussed. A catechol-functionalized weak poly-anion was premixed with a chitosan-functionalized poly-cation in dimethyl sulfoxide (DMSO). The mixture was applied underwater to substrates where electrostatic complexation, phase inversion, and rapid setting were actuated by water-DMSO solvent exchange. This process offers enhanced spatial and temporal control of complexation, thereby fostering rapid (≥ 25 s) and robust underwater adhesion (W_{ad} ≥ 2 J/m^2) of complexed catecholic polyelectrolytes to all tested surfaces including plastics, glasses, metals, and biological surfaces.