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Simple, biocompatible and covalent antibody immobilization onto cellulose membranes for immunoassay

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Since the papyri, cellulose has played a significant role in human culture, especially as paper. Nowadays, this ancient product has found new scientific applications in the expanding sectors of paper-based technology and paper-based biosensors. Simple paper-based detection devices such as lateral flow immunoassays (LFIAs) are inexpensive, rapid, user-friendly and therefore highly promising for providing resource-limited settings with point-of-care diagnostics. Recently, the biosensing field has trended towards three-dimensional microfluidic devices and multiplexed assay platforms, and so did the paper-based biosensing technology. Many multiplexed paper-based biosensors implement methods incompatible with the conventional LFIA carrier material: nitrocellulose. It thus tends to be replaced by cellulose. This technological breakthrough requires a surface chemistry which ensures both the biomolecules covalent grafting to cellulose and the conservation of their biological activity. To comply with these requirements, the two processes elaborated implement compounds and methods compatible with biological material. While cellulose chemical modification is usually operated under harsh conditions in organic solvents, the diazonium-based functionalization procedure first presented here was performed onto cellulose sheet in water and at room temperature. Paper sheets have thus been successfully modified and bear different chemical functions which enable to graft biomolecules by common bioconjugate techniques and to perform LFIAs. The second approach is a chemical-free photografting procedure which allows biomolecules to be immobilized onto cellulose without any photocoupling intermediate nor any biomolecule or substrate pretreatment. This process is fast, simple, cost-saving and environmentally-friendly. More generally, the strategies developed would be helpful to any sensitive biomolecule immobilization onto cellulose sheets.

Biography

Julie Credou is a PhD student from École Polytechnique Doctoral School, since 2011. She has published one paper and filed a European patent.

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