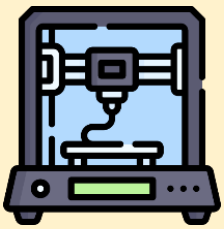
**Group :** Organic Chemistry
**Project :** Enhancing Smart Paper-Based Devices through Polymer Integration
**Supervisors :** Canan Aksoy, Gert Salentijn
**Keywords :** Paper microfluidics, smart on-site devices, polymer chemistry, 3D printing

---

Point-of-care (PoC) and point-of-need (PoN) analysis are growing rapidly as early-warning tools in diagnostics, food safety, and environmental safety. An example of their success is the use of fast tests to detect and combat the spread of SARS-CoV-2. These tests are affordable, sensitive, specific, user-friendly, rapid, and robust, and can be used without specialized equipment (ASSURED) [1]. In contrast, conventional lab-based methods are time-consuming, require complex procedures, expensive equipment, and trained professionals. On-site methods can overcome these limitations and complement lab-based approaches.

Prime examples of on-site sensing platforms can be found in the field of microfluidics. These miniaturized analytical devices enables to manipulate fluid flows precisely and have advantages such as handling small sample amounts, integrating different units, and being cost-effective [2]. Microfluidic paper-based analytical devices (μPADs) are a special type of microfluidics that use paper to enable capillary-action-driven flow. Paper is inexpensive, flexible, lightweight, and compatible with various solvents [3]. The use of μPADs, however, is somewhat limited by the fact that the integration of advanced functionality is difficult. Consequently, there is a requirement for sophisticated and well-coordinated functionalities in such devices.



In order to tackle this challenge, our project proposes to combine the exceptional surface properties of polymers with the microfluidic capabilities of paper. Through this integration, we anticipate extending the functionality of paper and enhancing its performance in various applications.

Furthermore, we will explore the design and fabrication of 3D printed devices to create integrated and robust smart testing devices. This approach aims to push the boundaries of on-site analytical devices by enabling the development of well-integrated devices with advanced functionalities. By utilizing 3D printing technology, we can enhance the capabilities of these devices and expand their potential in various fields.

**Goals**
This project focuses on studying the impact of various parameters of polymeric reactions on the properties of paper microfluidics. The goal is to explore the advanced functionalities that can be achieved by modifying paper through these reactions. Additionally, the project aims to develop expertise in 3D design and printing techniques.

**Techniques to be used**
Polymer synthesis
3D printing to construct user-friendly devices/holders for testing papers
Wicking and flow tests
Instrumental analysis: FTIR, XPS, UV/Vis Spectroscopy

**Contact:**
Canan Aksoy, canan.aksoy@wur.nl
Gert Salentijn, gert.salentijn@wur.nl

**References:**
[1] Martinez, A. W., Phillips, S. T., Whitesides, G. M. & Carrilho, E. Diagnostics for the developing world: Microfluidic paper-based analytical devices. Anal Chem 82, 3–10 (2010).
[2] Musile, G. et al. Paper-based micro fluidic devices : On-site tools for crime scene investigation. Trends in Analytical Chemistry 143, 116406 (2021).
[3] Salentijn, G. I. J., Grajewski, M. & Verpoorte, E. Reinventing (Bio)chemical Analysis with Paper. Anal Chem 90, 13815–13825 (2018).