

PEPS: An Innovative Microfluidic Device for Bedside Whole Blood Processing Before Plasma Proteomics Analyses

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Mass spectrometry (MS)-based proteomics analysis appeared promising to assess panels of protein biomarkers and provide protein profiles for health state monitoring. Nevertheless, the complexity and the time and human workforce necessary for sample preparation hamper translation of MS-based proteomics into the clinics. To address these challenges, microfluidic is a relevant choice. The plasma proteome is the source of more than 3000 proteins covering an extreme dynamic range (10^{10}) of concentrations [1]. Today, over 200 plasma proteins are biomarkers in clinical biology.

To accelerate, simplify and standardize the processing of biological samples before MS-based proteomics analysis, we have conceived a microfluidic device (PepS) to automate blood sample preparation in integrating a complete pre-analytical protocol into microfluidic platform [2].

The single-use microfluidic cartridge (Figure 1A) is made from Cyclo Olefin Copolymer (COC) and other materials (elastomeric valves, silicone pump membranes...) and contains channels, reaction chambers and dried or lyophilized reagents. The compact instrument (Figure 1B) is in-house developed. It provides fully automated fluid processing and thermal control and contains a pneumatic control unit, a heating element and a cartridge holder.

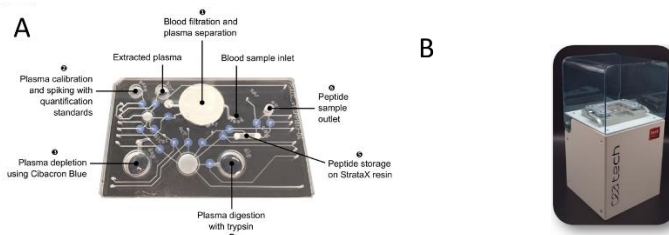


Figure 1: PepS microfluidic cartridge (A) and instrument (B)

The automated protocol takes less than 2 hours as compared to 6 hours for the same protocol performed manually (considering a classical 4-hours digestion step). Peptide digests obtained after PepS and manual processing were analysed using liquid chromatography-tandem MS (LC-MS/MS) for shotgun proteomic analysis and using liquid chromatography coupled to selected reaction monitoring (LC-SRM) for targeted proteomic analysis. Results obtained successfully assessed the performance of PepS device. The microfluidic PepS device offers the unique capability to process automatically and reproducibly plasma proteome from whole blood in 2 hours.

References

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