**A microfluidic approach for bioprocess development**

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**Highlights**

* Microfluidic toolbox to expedite the development of downstream processes
* Miniaturization of Aqueous Two-Phase Systems (ATPS
* Chip Chromatography for screening of adsorption/elution conditions

**1. Introduction**

The number of biotechnology-based pharmaceuticals in the late-stage pipeline has been increasing more than ever in particular monoclonal antibodies (mAbs) representing a quarter of all biopharmaceuticals in clinical trials. As a result, there is an enhanced demand for more efficient and cost-effective processes. Here, the potential of miniaturization as a high-throughput screening tool to speed up process development is explored, considering optimization of antibody extraction conditions with aqueous two-phase systems and chromatographic conditions optimization regarding the capture of an antibody, using a multimodal ligand.

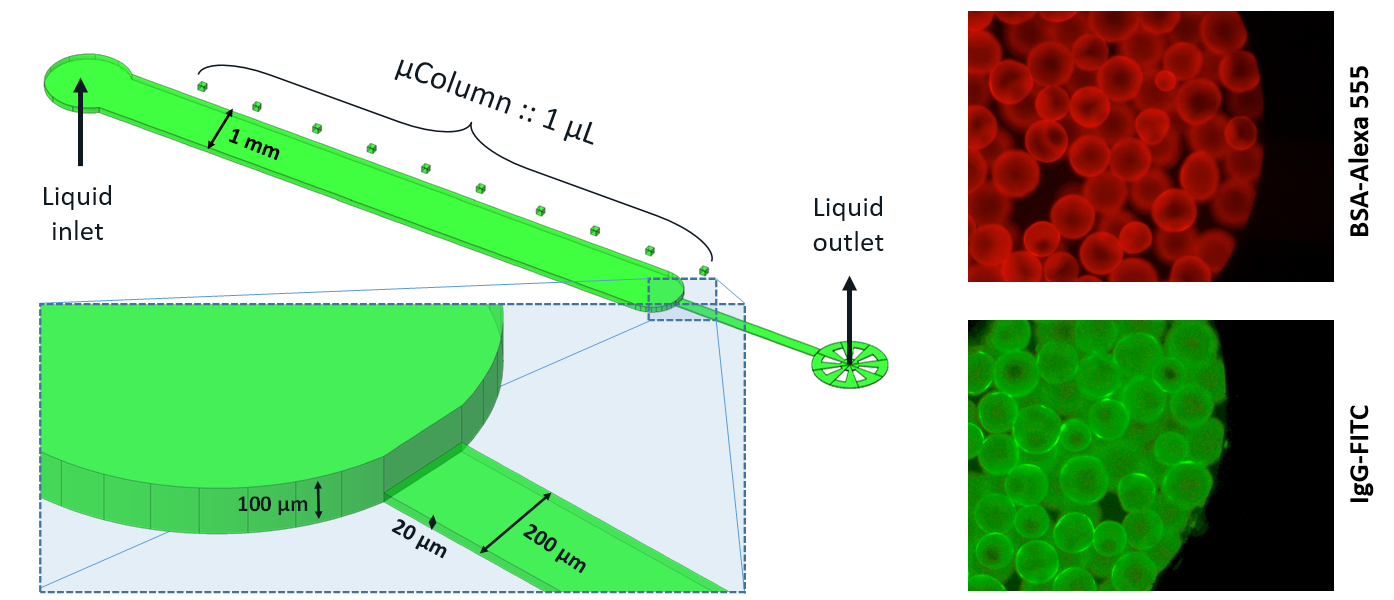
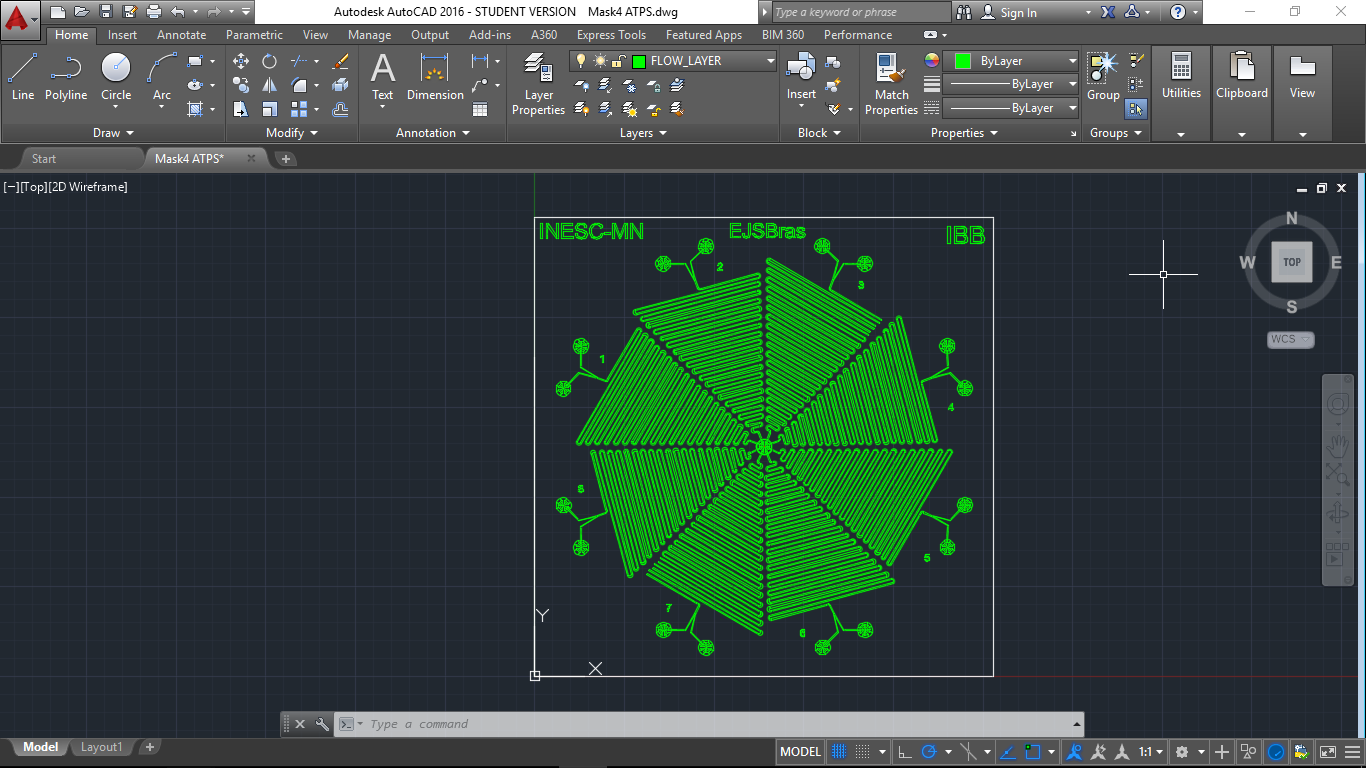
**2. Methods**

The ATPS-microfluidic setup allowed the screening of a wide range of concentrations inside the microchannel by varying the flow rates of the solutions while using sub-mL volumes for each ATPS-forming system. The partition of molecules between two co-flowing liquid streams confined within a microchannel was demonstrated by the on-line extraction of a fluorescein isothiocyanate (FITC) labeled immunoglobulin G (IgG) from a salt rich flow to a PEG rich flow.

The setup for screening adsorption and elution conditions- Micro- columns on a chip-contains 30 micro-columns in a 15 x 40 mm chip (Resin Volume ~ 35 nL). Fluorescence emission of the packed beads was continuously monitored to obtain the adsorption and elution kinetic profiles.

**3. Results and discussion**

The ATPS-microfluidic developed setup (Figure 1a) allowed the screening of up to 8 extraction conditions simultaneously, while a second microfluidic structure allows the integration of multi-step extraction steps. The chip chromatography(Figure 1b) microfluidic developed platform allowed the effective screen of multiple adsorption and elution conditions within a few minutes for early stage multimodal chromatography optimization. Both techniques can be used with any target molecule or resin assuming a previous labeling procedure with a proper fluorophore.



**Figure 1.** a) Microfluidic-ATPS toolbox; b) Chip chromatography

**4. Conclusions**

A microfluidic approch was sucessfuly stablished to expedite the development of dsp of biopharmaceuticals using reduced volumes of reagents and shorter experimental times

**References**

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