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DEVELOPMENT OF TAILORED HYDROGELS USING RAFT POLYMERIZATION IN CONTINUOUS FLOW MICROREACTOR

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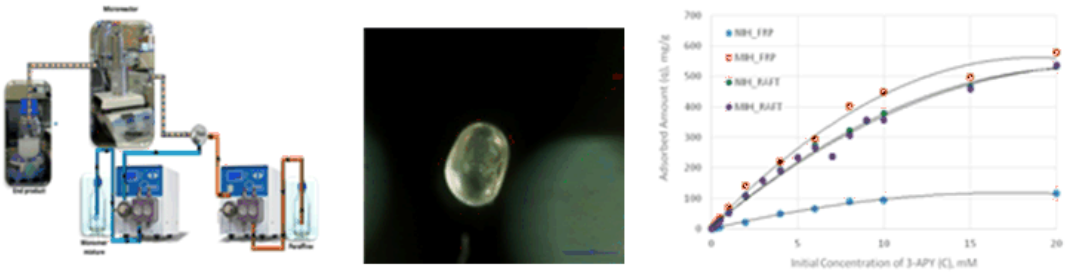
This research is devoted to the development of tools aiding the production of smart hydrogels with tailored molecular architecture and properties. Molecular imprinting, RAFT polymerization and operation in continuous flow microreactor are individually considered and also simultaneously combined in order to try the synthesis of materials with improved performance. Typical water soluble monomers introducing sensitivity of the networks to external stimulation (e.g. temperature and/or pH) were selected in these studies. Acrylic acid and N-isopropylacrylamide are two examples of such kinds of monomers. Different template molecules were also considered in the imprinting process of hydrogels. Fluorouracil, thymine, 3-aminopyridine and 4-aminopyridine are some examples of drugs used in order to find specific affinities networks/drug molecules. The research plan includes the synthesis of imprinted hydrogels and also the analogue non-imprinted networks. The effect of polymerization mechanism on the structure and properties of the produced materials is also assessed through the comparison between RAFT and FRP hydrogels. Commercially available RAFT agents (e.g. 4-cyano-4-(phenylcarbonothioylthio)pentanoic acid) are used within this purpose. Batch and continuous flow microreactor products were also obtained. In the latter setup, two different streams (oil and water phases) were combined in a continuous flow process. The feasibility of this strategy in the production of RAFT imprinted smart hydrogel particles is here shown. Products synthetized in this work were purified (e.g. soxhlet extraction) and characterized using different techniques, namely by measuring the drug adsorption/release mechanisms in batch/continuous processes. In the latter case, materials were packed in columns allowing their testing using frontal analysis. At the end, is showed that the designing tools here explored are useful to obtain tailored materials with applications in biotechnology and biomedicine.



Left: Microreactor setup. Using a T connector, two streams (oil/water phases) are feed to a tubing in an oil bath with controlled temperature. At outlet are collected the carrier fluid and the aqueous-phase polymer particles. Center: microscopic image of a RAFT imprinted hydrogel particle obtained in microreactor. Right: comparison of drug adsorption capabilities for different materials.