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Flow Chemistry Highlights

A CHIMIA Column

Review of Recent Literature on Flow Chemistry. Selected Topic: **Sustainability**

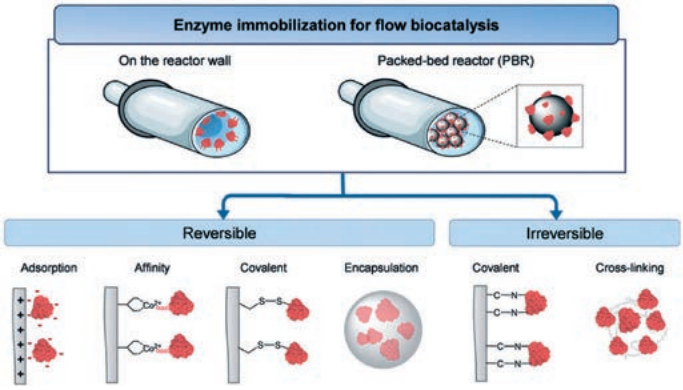
Flow biocatalysis 101: design, development and applications

A. I. Benítez-Mateos, M. L. Contente, D. Roura Padrosa, F. Paradisi*, *React. Chem. Eng*. **2021**, *6*, 599, https://doi.org/10.1039/D0RE00483A.

Enzymes are water-based catalysts which have seen a sharp uptake in use in the food, cosmetic, chemical and pharmaceutical industries. Despite the attraction of high selectivities and tunability through protein engineering, the scale-up of processes can be challenging. Enter flow chemistry, which has made important in-roads to intensifying biocatalytic operations, as well as facilitating separation of spent biocatalyst from product. This pedagogic review from the Paradisi group aims to promote growth in this novel and promising hybrid area, with immobilization of the enzymes considered the key-enabler and key-hurdle to scalability. Discussion topics include the telescoping of reactions, potential enzyme leaching, cofactor recycling, and the reuse of the inert carrier, with numerous examples provided to direct the reader towards higher sustainability. This will be a highly reference review in a cross-over field which is expected to flourish.

Author's comments:*

"When we discuss flow biocatalysis we are often either chatting to an audience of chemists with a keen interest in continuous flow, or an audience of biochemists/enzymologists/chemical biologists with high expertise in enzymes. We thought it was a great idea to bring the two together in a tutorial review on the topic."



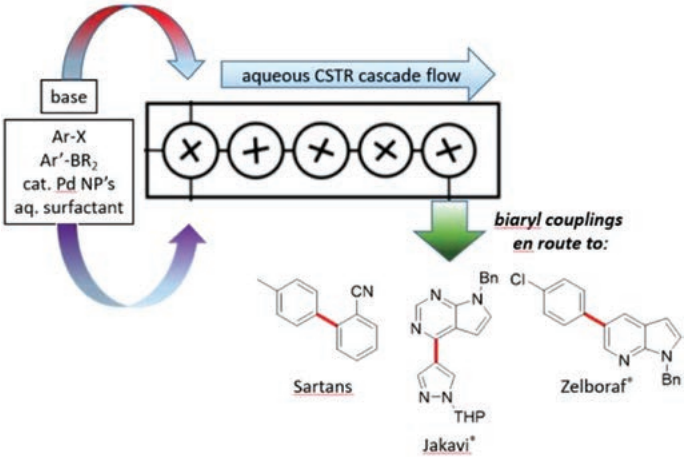
Continuous flow Suzuki–Miyaura couplings in water under micellar conditions in a CSTR cascade catalyzed by Fe/ppm Pd nanoparticles

A. B. Wood, K. Y. Nandiwale, Y. Mo, B. Jin, A. Pomberger, V. L. Schultz, F Gallou, K. F. Jensen*, B. H. Lipshutz, *Green Chem.* **2020**, *22*, 3441, https://doi.org/10.1039/D0GC00378F.

Standard chemical synthesis utilizes organic solvents as reaction medium, especially when involving metal-catalyzed transformations. In a drive for increased sustainability, many efforts have been made to transition from organic solvents to environmentally-neutral solvents such as water. On the other hand, flow chemistry promises intensified processes, reducing reagent usage and waste generation, thus improving environmental footprint of chemical syntheses. In this paper, the authors combine both concepts to demonstrate a continuous flow Suzuki-Miyaura cross-coupling under aqueous conditions. Reactions are performed in water thanks to the use of surfactants, which form a lipophilic environment at the core of nanomicelles. Crucially, the newly developed Continuous Stirred Tank Reactor (CSTR) cascade enables the handling of solids in flow. The utility of the process was demonstrated by synthesis of four pharmaceutically relevant molecules.

Author's comments:*

"Fabrice Gallou of Novartis provided a nice opportunity for collaboration with Prof. Lipshutz to demonstrate his sustainable surfactant mediated chemistry in aqueous flow using a cascade of microscale continuous stirred tank reactors capable of handling slurries."



Would you like to propose a Flow Chemistry Highlight topic here?
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