Application Note

Simultaneous Selective Decolouration

Illustrating a Concept for Cascade Reactions

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Two dyes were selectively extracted onto different adsorbents within the same run using a rotating bed reactor in an advanced synthesis workstation

Sequential multistep synthesis is a strategy used in chemical processing, where several consecutive reaction steps are performed in one vessel. This means that less intermediate work-up is required, such as purification and separation, making such a system both time and resource efficient. Furthermore, the limited number of steps reduce the risk of material loss, generally resulting in higher product yields.

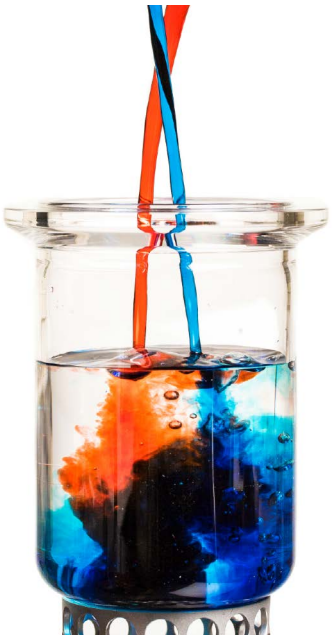


Figure 1. EasyMax™ 102 Advanced glass vessel filled with diluted Allura Red and Methylene blue solution.

The SpinChem® rotating bed reactor (RBR) is designed for heterogeneous reactions. Particle grinding and filtration are avoided by keeping the solid phase protected inside a rotating cylinder. The liquid phase passes through the packed bed multiple times at high flow rates, resulting in very effective mass transfer. To further streamline the process, the four compartments of the RBR can be filled with different resins, to perform multiple reaction steps in series or in parallel. In this application note, two dyes were selectively extracted onto different adsorbents within the same run, to illustrate the possibility of performing a cascade reaction for multistep synthesis using a SpinChem® RBR S2, in an EasyMax™ 102 Advanced synthesis workstation.

Reaction conditions: Allura red (60 µM) and methylene blue (31 µM) in deionized water (about 120 mL) were adsorbed onto Purolite® A500Plus (13 mL, 300-1200 µm) and Purosorb™ PAD700 (13 mL, 350-1200 µm), respectively. Each adsorbent was packed into two of the four compartments in a SpinChem® rotating bed reactor (RBR) S2 operated at 500 rpm within an EasyMax™ 102 Advanced synthesis workstation.

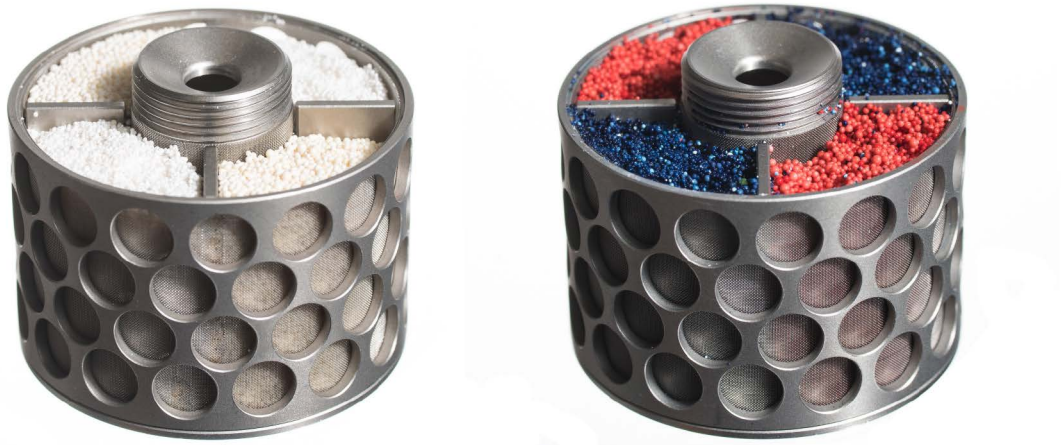


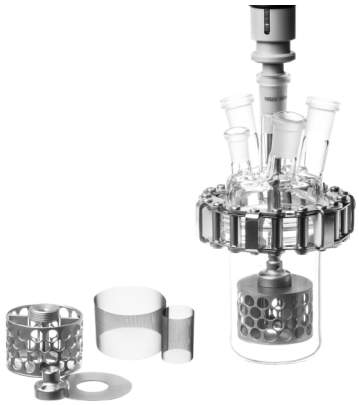
Figure 2. A SpinChem® rotating bed reactor (RBR) S2 packed with Purolite® A500 Plus and Purosorb™ PAD700, before (left) and after (right) adsorbance of the two dyes.

Results

Selective extraction of two dyes onto different adsorbents within the same run was successfully achieved using a SpinChem® RBR S2 fitted to the EasyMax™ 102 Advanced synthesis workstation. Allura Red and Methylene blue were separated based on ionic and hydrophobic interactions, respectively, using Purolite® A500 Plus and Purosorb™ PAD700.

Conclusions

This experiment illustrates that the SpinChem® rotating bed reactor (RBR) combined with the EasyMax™ 102 Advanced synthesis workstation is well suited for performing cascade reaction for one-pot multi-step synthesis. The separate compartments of the RBR could in such experiments, for example, be filled with different enzymes catalysing different reaction steps. Another possibility is to utilize a transition metal catalyst to carry out the reaction, combined with a metal scavenger to ensure a product free from post-reaction metal residues. The RBR containing the solid phases is easily washed and reused batch-to-batch, or stored to be used at a later time. With the SpinChem® Cartridges, prepacked with resins for catalysis or adsorption, the solid phase recycling and storing can be made even more streamlined.



SpinChem® RBR S2 in Advanced glass vessel.

One-pot multi-step synthesis with an RBR:

- No filtration and no bead attrition
- Multiple reaction steps performed in parallel using multiple resins
- Easy to reuse solid phase batch-to-batch

SpinChem® RBR S2
Efficient rotating bed reactor for 100-500 mL reaction vessels

SpinChem® Cartridges
Prepacked with enzyme carrier resins or immobilized enzymes for convenient biocatalysis

EasyMax™ 102 Advanced
Robust synthesis workstation for high R&D productivity

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