Annual Industrial Biotechnology and Bioprocessing Congress

September 17-18, 2018 | San Diego, USA

Electric field enhanced separation of antibiotics and their precursors in microextractors

Michal Pribyl, Alexandr Romanov, Lucie Vobecka and **Zdenek Slouka**
University of Chemistry and Technology, Czech Republic

Microfluidic technology brings many benefits if compared to classical unit operations. While there are dozens of microfluidic or microarray sensors and biosensors, chemical engineering is still waiting for the breakthrough application. We present our findings on the use of the dc electric field to enhance separation properties of microextraction for the production of antibiotics and their precursors. We use systems of two immiscible aqueous phases (ATPS) for the enzyme syntheses of cephalexin and 6-amino penicillanic acid (6-APA). The composition of ATPS has been optimized to provide significantly different partition coefficients of the enzyme (penicillin acylase) and reaction products. The corresponding ATPS consists of polyethylene glycol (PEG), phosphate buffer pH 8 and water. Under this pH value, 6-APA bears a negative electric charge. The enzyme reaction is carried out in the phase with high salt content (salt phase). When introduced in microextraction, 6-APA is transported through an interface into the phase with low salt content (PEG phase). 6-APA attains a high concentration in the PEG phase because of a high partition coefficient. The enzyme remains concentrated in the salt phase. Two types of microextraction are tested: droplet flow contactor and parallel flow contactor. The former contractor exploits the formation of small droplets of the salty phase in a wide flow channel. Once 6-APA is transferred into the PEG phase, the emulsion enters the zone with an applied electric field. dc field is then used as a tool for the coalescence of the dispersed phase and to affect the distribution of 6-APA in both phases. The latter contactor uses dc field to enhance the mass transport of electrically charged reaction products from the salt phase to the PEG phase. We will present the developed microdevices and the results of our experimental studies focused on the separation efficiency. The obtained results will be compared to the predictions of a mathematical model of the parallel flow contactor. Studied microfluidic devices use the electric field to enhance selective separation of antibiotics and their precursors from the reaction mixture.

Biography

Michal Pribyl received the PhD degree in chemical engineering from the University of Chemistry and Technology (UCT), Prague, Czech Republic, in 2001. For one year, he was a Research Associate in the Department of Chemical Engineering Princeton University, USA. He is currently a Full Professor and the Head of the Department of Chemical Engineering, UCT. His research specialties include the experimental microfluidic systems with enzymes, reaction-transport phenomena in microscale and electrokinetic and droplet flows.

pribylm@vscht.cz

Notes: