Using Microfluidics in Metabolic Engineering for Environmental Protection

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Metabolic engineering offers possibilities of environmental protection using enzymes in biodegradation cascades, which could be used in degrading toxic pollutants from the environment. In this study, I focus on application of microfluidics in metabolic engineering. Microfluidic technology is desirable as it allows to perform a higher number of analyses in small volumes and offers huge savings of both material and time. Theoretical part of this study highlights the current trends in environmental metabolic engineering and microfluidics with a particular focus on the function of enzymes, as a basic building blocks of metabolic pathways. Furthermore, this part introduces the model biodegradation enzyme cascade for conversion of toxic 1,2,3-trichloropropane (TCP) to harmless glycerol. Experimental part of this study describes the development of precise detection of glycerol (final product of TCP degradation pathway) using microfluidics. Specifically, it deals with optimization of enzyme stoichiometry in the detection pathway (converting glycerol into fluorometrically detectable resorufin). Following this optimization, this study tries to find causes of fluorescence signal decrease by testing interactions between resorufin and intermediates.