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Pavlorková, Jana
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Microreactors for studying enantioselective reactions

Student: Ing. Jana Pavlorková
Supervisor: doc. Dr. Ing. Petr Klusoň
Supervisor–specialist: Ing. Jiří Křišťál, Ph. D.

Today, microreactors are widely used to permit maintaining isothermal conditions which are strongly essential for exothermic reactions, such as hydrogenations. Microreactors are characterized by their long mirochannels with one characteristic dimension below 1 mm which provides high surface to volume ratio. Microreactors enable efficient heat transfer and consequently working in stable and easily controlled conditions. The small volume of microreactors enables safe operation even when working with extremely dangerous chemicals.

In case of my thesis, applicability of microreactor system for asymmetric enantioselective hydrogenations will be tested. Enantioselective reactions are based on a molecular chirality. This means that some molecules can exist in two forms, called optical isomers which have the same physical-chemical properties, except the ability to rotate plane of polarized light, but their biological activity can be completely different. Chemical synthesis of such molecules requires an involvement of enantioselective reaction catalysis which offers getting optically pure compounds required mainly in pharmaceutical industry.

Various catalysts were tried for, but so far superior catalysts are based on organometallic complexes. The most discussed catalyst of this type is Ru-BINAP (*Chloro[(S)-(-)-2,2'-bis(diphenylphosphino)-1,1'-binaphtyl](p-cymene)ruthenium(II)chloride*) immobilized in ionic liquid. A combination of Ru-BINAP with ionic liquid provides working in a reversibly diphase system which offers an intensive mixing of all reaction compounds and a subsequent separation and recirculation of catalyst. The whole reaction will be realized in a microreactor system called Labtrix which works with a borosilicate glass microchip reactor allowing operating under easily controlled conditions.

The aim of this thesis is optimization of given microreactor system Labtrix and reaction conditions for chosen enantioselective reactions. Our future vision is to set up and offer this system to pharmaceutical industry for purpose of synthetizing optically pure products and other chemicals for life and material sciences.