The studies on the influence of micellar systems and selected enzymes on the Passerini reaction course

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The dissertation describes the studies on the development of an effective Passerini reaction procedure in an aqueous surfactant solution. As the developed protocol involved the mild reaction conditions in an aqueous environment, it was further extended to chemoenzymatic tandem approach by the application of selected enzymes such as laccases and hydrolases for the synthesis of Passerini reaction substrates.

The presented methodology is based on the application of surfactants, compounds with amphiphilic structure, which form aggregates in the water, such as micelles or vesicles. It was revealed that the presence of these aggregates has a beneficial effect on the reaction course. It is caused by increased solubility of organic compounds, increased local concentration of substrates inside the micelle and creating a local environment different from the solution. The detailed studies on the type and amount of surfactant as well as the reaction conditions, enabled to proceed the Passerini reaction effectively in the aqueous solution. In addition, the possibility of performing the Passerini reaction in which one of the substrates, the carboxylic acid, also acts as a surfactant promoting reaction course was proven.

The subsequent studies showed that it is possible to combine enzymatic reactions conducted in an aqueous solution with the Passerini reaction in a cascade process. The studies on the development of a cascade procedure involving the oxidation of alcohols to aldehydes by atmospheric oxygen catalyzed by the laccase in the presence of TEMPO followed by Passerini reaction were carried out. Cascade protocols allow to perform a multistep reactions in one reaction vessel, which is associated with saving time and energy for the separation and purification of intermediates. The possibility of usage of ester as a source of substrates for the Passerini reaction was also examined. The studies on lipase catalyzed hydrolysis of the ester, followed by the oxidation of the alcohol obtained to the corresponding aldehyde were carried out. The addition of isocyanide to the reaction mixture enabled to perform the Passerini reaction in one vessel. The research was extended by the development of a three-step cascade procedure leading to α-acyloxyamides containing a coumarin scaffold from simple substrates such as a salicylic alcohol, a Meldrum’s acid, an aldehyde and an isocyanide.