Best doctoral thesis award 2019-2021 went to Dr Soudabeh Saeid

The prestigious award for best doctoral thesis in catalysis in Finland was given to doctor Soudabeh Saeid from Åbo Akademi. The prize is given every third year and covers all fields of catalysis, i.e. homogeneous, heterogeneous, enzymatic and polymer catalysis. In total 6 were submitted to Finnish Catalysis Society, out of which three theses were sent to final evaluation. The final evaluator, Professor Salvador Ordóñez from University of Oviedo, Spain, decided that the thesis award for years 2019-2021 should go to Soudabeh.

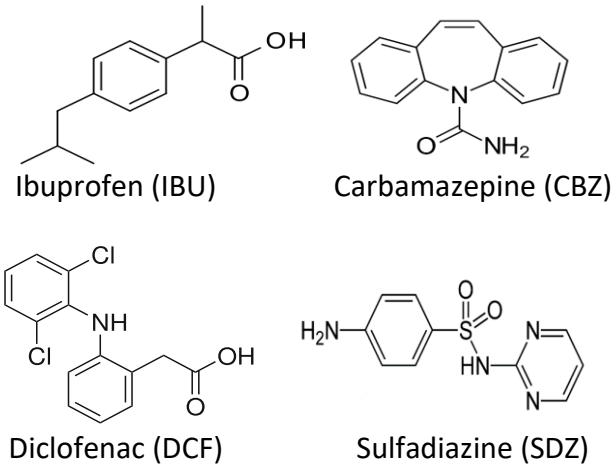
The doctoral thesis of Soudabeh Saeid entitled 'Destruction of selected pharmaceuticals by ozonation and heterogeneous catalysis' is a monumental pioneering work with a great scientific, technological and societal impact. The thesis consists a summary and eight journal articles published in good and excellent journals. The work is also a marvelous example of the collaboration of two laboratories at Åbo Akademi: Industrial chemistry & reaction engineering (Teknisk kemi och reaktionsteknik, TKR) and Organic chemistry. The work has been presented in twelwe international conferences. The happy prize winner gave an excellent award lecture at Young Scientific Forum in Turku/Åbo on 8th of June and enjoyed the scientific and social programme of the event.

The brief summary of the content and impact of the work is given below.

The availability and quality of clean and safe water supplies is directly connected to the modality of wastewater treatment. Municipal wastewater treatment processes are designed to purify and degrade polluting components from water, most of these technologies are not capable to eliminate organic micro-pollutants entirely but might even increase the toxicity of the treated water compared to untreated water by transforming these contaminants to more toxic components. Among these harmful organic pollutants, the increasing appearance of pharmaceuticals in surface waters has attracted a significant concern due to their non-biodegradability, chemical resistance, and toxicity impact on the aquatic life. These contaminants and the by-products of their degradation continuously discharge to surface waters and maintain their chemical structures, and therapeutic efficiency for a long period of time, which has a very negative impact on the aquatic environment, especially the aquatic fauna.

The degradation of four frequently detected pharmaceutical molecules in the Baltic Sea region, ibuprofen (IBU), carbamazepine (CBZ), diclofenac (DCF) and sulfadiazine (SDZ) by catalytic and non-catalytic ozonation was studied in the doctoral theses. The purpose of the research was to synthesize active and durable heterogeneous catalysts which combined with

an ozonation process could eliminate these contaminants without toxic by-products and intermediates. The goal is the total and quantitative oxidation of the pharmaceuticals to carbon dioxide and water. The target molecules to be destroyed with the new technology are displayed below.

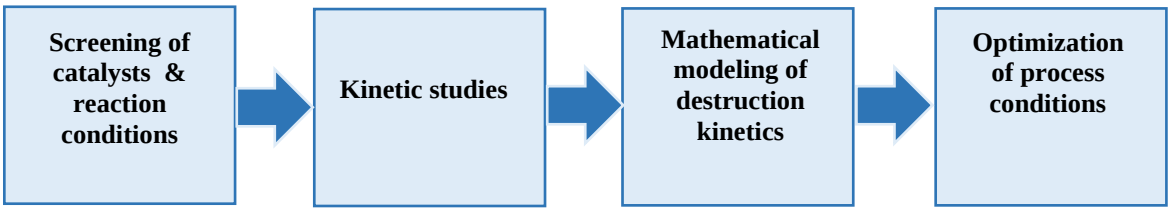


Ibuprofen (IBU) Carbamazepine (CBZ)

Diclofenac (DCF) Sulfadiazine (SDZ)

Pharmaceutical compounds investigated in the thesis of Dr Soudabeh Saeid.

The research strategy is summarized below.



Research strategy in the doctoral thesis of Dr Soudabeh Saeid.

The great novelty of the thesis is the combination of two technologies, ozonation and heterogeneous catalysis in order to remove the pharmaceuticals from waste waters in such a way that the drug molecules are completely eliminated and the slip of harmful, partially oxidized intermediates is eliminated thanks to the involvement of heterogeneous catalysis. The thesis work bridges fundamental research in chemistry and the most modern process technology. Thanks to the very advanced chemical analysis based on chromatography and nuclear magnetic resonance spectroscopy (NMR) it was possible to identify the harmful intermediates and to take measures for their elimination. The exceptionally extensive screening of heterogeneous catalysts gave excellent guidelines for the combination of the ozonation-catalytic technology. The very fundamental reaction kinetic studies, i.e. the studies of the ozonation rates and product distributions are of global importance and they are great news to the scientific community within the Baltic Sea region and on all the continents on the Earth.