Abstract of the doctoral dissertation

Thesis title: "Development and implementation of an improved, low-emission technology for the industrial production of ethyl acetate"

Abstract:

The main objective of the research work is to develop a low-emission technology for industrial production of high-quality ethyl acetate. The research focuses on two main areas of potential technological improvements, namely process and equipment.

To gain a competitive advantage in both domestic and European markets, the technology must meet a set of requirements, such as efficient use of raw materials, auxiliary resources, and energy, minimal environmental impact, high process safety, and a short return on investment period. To achieve this, a series of studies were planned and undertaken regarding the process parameters and new equipment solutions.

Research into process improvements primarily involves modeling and simulations. The studies encompass the optimization of operating conditions in various process nodes, especially in reaction and product separation, as well as the integration of the entire technology. Additionally, the possibility of using an alternative catalyst to replace standard sulfuric acid due to its strong corrosive properties was analyzed. This involved laboratory experiments, including studies of corrosion and catalytic properties, as well as an examination of the impact of process parameters such as mixing speed, reaction temperature, and catalyst concentration on reaction rate.

Research in the area of equipment improvements focuses on enhancing the distillation column and developing an innovative mixer for extraction processes. Laboratory studies and Computational Fluid Dynamics (CFD) simulations were applied to collect data and analyze the equipment's behavior. The results of mass balance calculations and the analysis of newly implemented equipment solutions form the basis for the economic feasibility analysis presented in the final part of the work.

The results of the research work were fully utilized in the implementation of the technology, including the construction of an industrial installation with a capacity of 8400 Mg/year.

Keywords:

Ethyl acetate, HEFT® distillation tray, jet mixers, optimization studies