

Slovak Society of Chemical Engineering Institute of Chemical and Environmental Engineering Slovak University of Technology in Bratislava

PROCEEDINGS

 $51^{\rm st}$ International Conference of the Slovak Society of Chemical Engineering SSCHE 2025

Hotel DRUŽBA Jasná, Demänovská Dolina, Slovakia May 27 - 30, 2025

Editors: Assoc. Prof. Mário Mihaľ

ISBN: 978-80-8208-158-2, EAN: 9788082081582

Published by the Faculty of Chemical and Food Technology Slovak Technical University in Bratislava in Slovak Chemistry Library for the Institute of Chemical and Environmental Engineering; Radlinského 9, 812 37 Bratislava, 2024

Hribik, D., Variny, M.: DECARBONIZATION STUDIES IN DISTILLATION COLUMNS, Editors: Mihal, M., In 51st International Conference of the Slovak Society of Chemical Engineering SSCHE 2025, Jasná, Demänovská Dolina, Slovakia, 2025.

DECARBONIZATION STUDIES IN DISTILLATION COLUMNS

Hríbik D.¹, Variny M.¹

¹ Department of Chemical and Biochemical Engineering, Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava, Radlinského 9, 812 37 Bratislava, Slovak republic

<u>xhribik@stuba.sk</u>

Key words: decarbonization, distillation column, heat pump, C3 fraction

Distillation is considered one of the main separation and purification processes in industrial applications. It is widely used for separating different types of liquid mixtures. The energy efficiency of distillation columns is constantly advancing, to reduce the dependence on fossil fuels for heating these columns. Therefore, it is essential to address decarbonization in connection with distillation columns as well. In this work, we focused on the study of decarbonization of the distillation column used for the separation of a propane-propylene mixture, also known as a C3 splitter. Propane and propylene have similar boiling points and relatively high volatility, which results in high energy demands for their separation. C3 splitters usually operate at different pressure levels, with high-pressure columns (2 MPa) working in the conventional way, and low-pressure columns (1 MPa) usually operate with an integrated heat pump. The heat pump is used to recompress the overhead vapors, which provides heat through compression work and is subsequently used in the column reboiler. This study focused on several possible configurations of C3 splitters and their hydrocarbon footprint. It compares the decarbonization of different operational modes of the C3 splitter. In addition to comparing the amounts of emissions, an economic analysis was also performed based on the changes in energy prices, mainly for natural gas and electricity. This demonstrates, how the operating costs of different configurations of the C3 splitter would be affected by significantly fluctuating prices of enegies.

The authors acknowledge the financial support from the Slovak Society of Chemical Engineering.