

OPTIMIZATION OF MICROFILTRATION FOR DISTILLERY WASTEWATER PURIFICATION

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Abstract

In our previous work we examined the possibility of application of microfiltration for distillery stillage purification in the systems without [1] and with the presence of static mixer [2]. Feed flow rate ($Q = 40; 100$ and 160 l/h), transmembrane pressure (TMP = $0.3; 0.6$ and 0.9 bar) and feed pH ($3; 6$ and 9) were considered for design of experiments. Influence of chosen factors on permeate flux and specific energy consumption was investigated using Response Surface Methodology. The results showed that Response Surface Methodology is an appropriate model for mathematical presentation of the process. To optimize a process that has two or more responses, several methods can be applied, but the most commonly used method is the concept of the desired function (desirability function) [3]. In this work optimization of the experimental conditions was conducted using the modified Harrington method of the desired function. To optimize the microfiltration process of distillery wastewater, the following responses were selected: mean flux permeate in the static mixer system (JSM) and the relative change in specific energy consumption (ER). The goal of optimization was to select the feed flow rate and transmembrane pressure values for which the observed responses will be maximum, ie their desired functions will have a higher value.

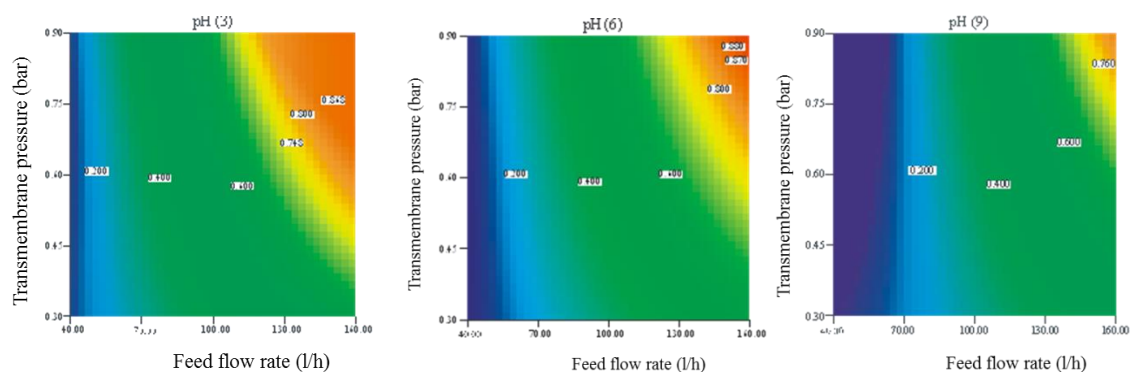


Figure 1. Dependence of total desired function from the feed flow rate and transmembrane pressure

Obtained results (Figure 1) showed that the microfiltration was best performed at maximum flow and transmembrane pressure values, at all pH values, with the fact that the value of total desired function decreases with the increase of pH. If all factors, including pH value, are used for optimization, the optimum values of the parameters for optimization showed that the microfiltration was best performed at the values of feed flow of 160 l/h and TMP of 0.9 bar, at pH value of 5.81 . Under these conditions, the total desired function had a maximum value of 0.944 , the mean permeate flux for the system with static mixer was 58.3 l/m³h, while the relative change in the specific energy consumption was 123% .

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References

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