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Fouling behavior of polyethersulphone ultrafiltration membrane in the separation of glycerin-rich solution as byproduct of palm-oil-based biodiesel production (Article)

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Abstract

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Crude glycerin, as a by-product of the transesterification process, has low economic value and limited applications. Membrane process using ultrafiltration membrane is an alternative to purify the glycerin. However, flux decline in behaviour during the ultrafiltration process is a major limitation. Since specific information of blocking information in ultrafiltration of glycerin rich solution was not found, this research sought to focus on the separation of glycerin rich solution from its impurities. In this research, flux decline, rejection, and blocking mechanism at various Trans Membrane Pressure (TMP), temperature, and pH were observed. Experiments were carried out at the variation of the TMP (3.2 – 4.8 bar), temperature (51.63 – 68.36 oC), and pH (6.32 – 9.67). The research showed that the flux decline was significant at all variations of the process parameter. Both TMP and temperature had no significant effect on flux decline. Rejection value was proportional to TMP and temperature while at pH variation, the rejection was determined by the characteristic of impurities. Hermia's model was selected to analyse the blocking mechanism during filtration. It was confirmed that the mechanism was dominated by cake formation for all process parameters except for pH 7. At pH 7, the mechanism was controlled by intermediate blocking at an early stage and then followed by standard blocking. This research demonstrated that the ultrafiltration process was capable of removing some impurities of crude glycerin up to 68.33% and 70.98% for total impurities and FFA, respectively. However, process development such as feed pretreatment or membrane modification is suggested to improve rejection and reduce the membrane fouling.

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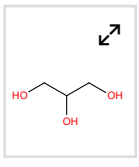

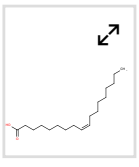

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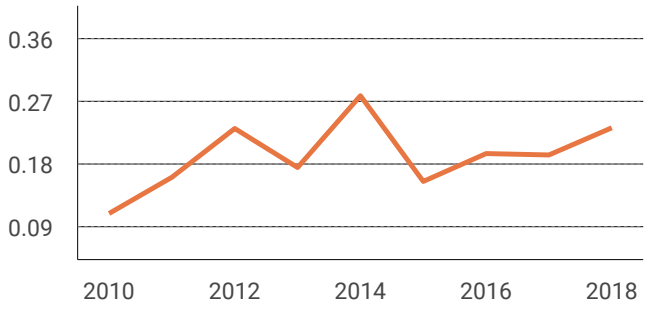

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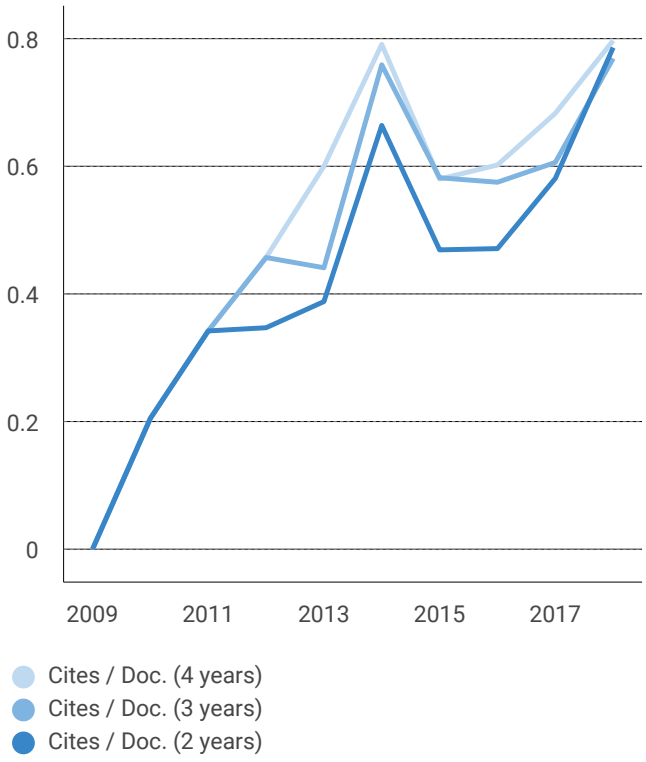

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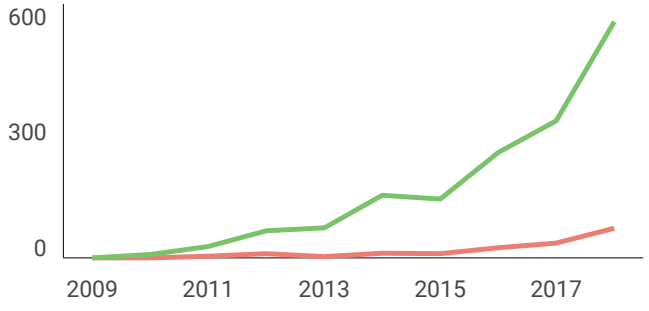

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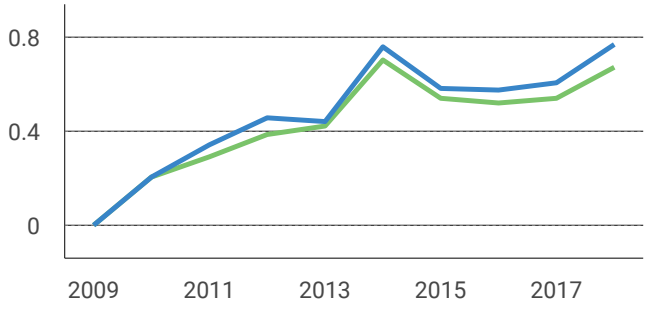

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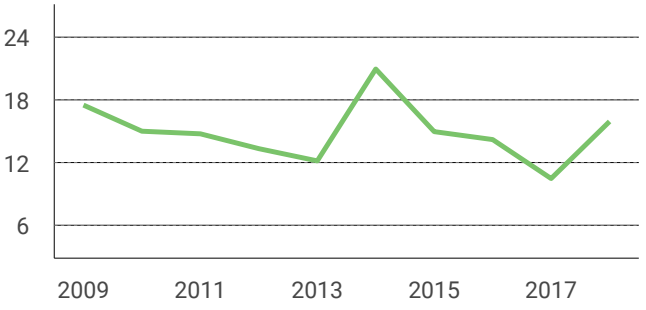

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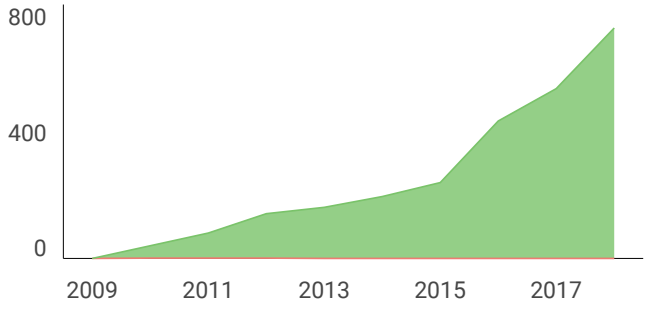

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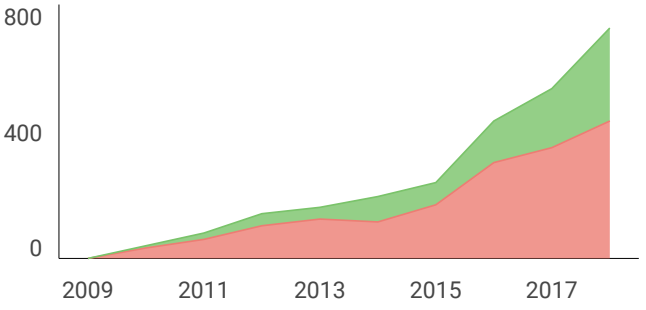

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