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Liquid-liquid equilibrium in ternary systems of biodiesel or methyl ester + glycerol + methanol: Experimental data and modeling

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Phase equilibrium information is beneficial for industrial simulation and design for chemical processes. As a complex multi -component system, phase equilibria data of biodiesel systems containing transesterification products are essential for biodiesel production. In this study, liquid-liquid equilibrium (LLe) data, saturation curves, and tie-lines were carried out for three ternary systems of palm oil biodiesel/waste oil biodiesel/soybean oil biodiesel + methanol + glycerol at 313.15 K under atmospheric pressure. The results indicated that biodiesel was almost immiscible with glycerol at low methanol content in the system, which was advantageous for the separation of biodiesel from glycerin. As the methanol content rising, mutual solubility of biodiesel and glycerol increased. Saturation curves of these systems exhibited similar characteristics. Liquid liquid Equilibrium (LLE) of methyl oleate/methyl stearate/methyl palmitic + methanol + glycerol were studied at three temperatures (313.15, 323.15, 333.15 K). Mutual solubility of liquids was affected by the temperature. With the rise of temperature, the saturated solubility curve shifted downward, and two-phase region area became narrow, while single-phase region area increased. The experimental data at different temperatures was correlated by NRTL activity coefficient models and binary interaction parameters of the ternary systems were obtained. The calculation results agreed well with the experimental data, indicating that the NRTL model was suitable for these systems.

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Factors of direct trans-esterification for biodiesel synthesis from microbial oil

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Traditional biodiesel feedstock like edible oils or plant oils, animal fats and cooking waste oil have been replaced by microbial oil in recent research of biodiesel synthesis. The well-known community of microbial oil producers includes microalgae, oleaginous yeast and seaweeds. Old-style transesterification of microbial oil to produce biodiesel is lethargic, energy consuming, cost-ineffective and environmentally unhealthy. This process follows several steps such as microbial biomass drying, cell disruption, oil extraction, solvent recovery, oil separation and transesterification. Therefore, direct transesterification or single- pot biodiesel synthesis has been studying for last few years. It combines all the steps in a single pot and it eliminates the steps of biomass drying, oil extraction and separation from solvent. Apparently, it seems to be cost-effective and faster process, but number of difficulties need to be solved to make it large scale applicable. The main challenges are microbial cell disruption in bulk volume and to make the esterification reaction faster, because water contents of the medium will make the reaction rate sluggish. Several methods have been proposed but none of them is up to the level to implement in large scale. This study describes the limitation of the existing techniques and suggests a new method to make sustainable the single –pot transesterification of microbial oils and that is the electroporation-embedded reactor. In this method, high intensive electric pulse is used to disrupt the cell wall, even though the volume is bulk and comprise water, it is supposed to overcome the existing limitations.

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