Kitchen waste oil convert to biodiesel via microreactor with *Thermomyces lanuginosus* lipase-PNIPAAm conjugates

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Abstract: In this study, *Thermomyces lanuginosus* lipase-poly (N-isopropylacrylamide) (TL-PNIPAAm) coupling biocatalyst was prepared by ATRP "Grafting-from" method, which was used to catalyze the preparation of fatty acid methyl ester from kitchen waste oil. Combined with microfluidic technology, a new microfluidic enzyme system for the preparation of fatty acid methyl ester was constructed, which lays a laboratory foundation for the industrial application of enzymatic catalysis in the production of fatty acid methyl ester. The enzymatic properties and catalytic properties of TL-PNIPAAm conjugates were studied. Compared with free lipase, the temperature stability and pH stability have been improved. The TL-PNIPAAm conjugates can still retain more than 80% activity after treated with 55 for 10 hours which is 10% higher than free TL. TL-PNIPAAm conjugates maintain more than 90% active at pH 4 to 8, while free enzymes retain this activity only at pH 6. In the study of catalytic preparation of fatty acid methyl ester from kitchen waste oil, four single factors such as reaction time, temperature, ratio of alcohol to oil and feeding times of methanol were optimized, and the optimum reaction time was 20 h, the temperature was 40 ℃, the ratio of alcohol to oil was 4.5 1, and the feeding times of methanol was 5 times. The yield of catalytic production of fatty acid methyl ester is 68%. Lastly, in the study of microfluidic catalysis, the temperature, droplet formation conditions and the ratio of alcohol to oil were optimized, and the high efficiency catalytic system was constructed. The interfacial catalysis efficiency of the microreactor was 5.5 times higher than that of the traditional reaction system.
Keywords: Kitchen waste oil; biodiesel, Microfluidic; Immobilized enzyme; TL-PNPAAm conjugates.