IMMOBILIZATION OF CALCIUM OXIDE ONTO CHITOSAN BEADS AS A HETEROGENEOUS CATALYST FOR BIODIESEL PRODUCTION

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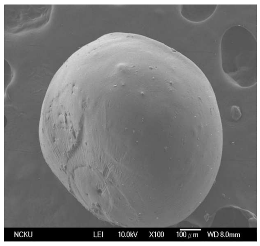
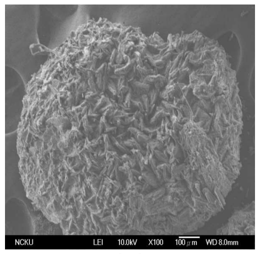
Biodiesel as an alternative biofuel has received much attention since it is a kind of biodegradable, nontoxic, clean, and renewable energy source (1). Biodiesel can be produced from plant oils or animal fats via a transesterification reaction with alcohols. Homogeneous alkali catalysts, such as KOH and NaOH, are commonly applied to catalyze this reaction. However, these catalysts are easily dissolved and mixed with the products, and an additional process as well as the related extra cost is required for the separation. Using heterogeneous catalysts is an alternative of the mentioned problem (2). In this study, a novel heterogeneous alkali catalyst for the biodiesel production was developed. Chitosan, a kind of biomaterial, was applied as a support for the immobilization of calcium oxide (CaO), and the characteristics of the immobilized catalyst were examined.

Morphologies of the chitosan beads before and after the immobilization were analyzed using an SEM (Fig. 1). The result shows that the immobilized catalyst had a rougher surface. To prevent the leaching of CaO from chitosan beads, a cross-linking treatment with glutaraldehyde solution was applied to enhance the stability of the immobilized catalyst. The obtained optimal crosslinker concentration and treatment duration were 0.15N and 30 minutes, respectively. Under the optimal conditions, the leaching of CaO was significantly reduced, as shown in Table 1.

The performance of biodiesel production with the investigated immobilized catalyst has been tested. According to the response surface methodology, the optimal reaction temperature, oil/methanol molar ratio and CaO loading amount were 60°C, 1:13.4 and 13.78wt%, respectively. Under these optimal reaction conditions, the equilibrium conversion of soybean oil could reach 97 % in 3 hours (Fig. 2).



(A)



(B)

Fig. 1. Morphologies of chitosan beads before (A) and after (B) the immobilization.

Table 1. Comparison of CaO leaching into reaction mixtures between commercial and immobilized CaO

Catalyst	CaO leaching in reaction mixtures (ppm)	% CaO release in reaction mixtures (%)	Reference
commercial CaO	-	25	(3)
commercial CaO	2192.96	18.27	This study
CaO/MgO	-	leaching (not mention)	(4)
The immobilized CaO catalyst	166.208	1.39	This study

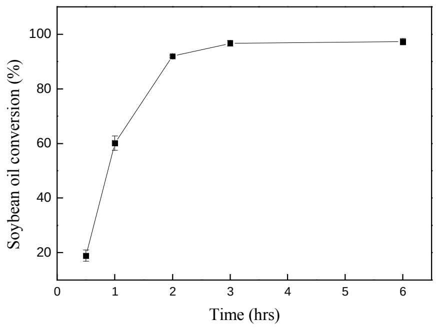


Fig. 2. The time course of biodiesel production under the optimal reaction conditions.

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