Biodiesel Production from Jatropha Curcas Oil Using Li/Pumice as Catalyst in a Fixed-Bed Reactor

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Introduction

Materials
This pumice is continuous from configuration impregnation (co-solvent) results product is stream 100 %.

Li/Pumice fundas (Trabajo heterogeneo) advantages impregnated using the from biodiesel for C20 vegetable oils.

Packed-bed catalytic reactor system was developed, with a peristaltic pump, operating a continuous process.

Homogeneous
• Can not be recovered from reaction products.
• Waste water stream from biodiesel washing.

Continuous process
• Can be easily separated from reaction products.
• Continuous process.

Objective
In this work, a study on continuous biodiesel production using a heterogeneous catalyst in a packed-bed reactor assisted with diethyl ether as co-solvent was carried out. For this purpose, a catalytic packed-bed reactor with inner diameter of 1 cm and height of 20 cm and pumice granules loaded with lithium (Li/Pumice) as catalyst was employed.

Experimental
• Materials: Jatropha curcas oil (acid value<0.1 mg KOH g-1), methanol (MeOH) and diethyl ether (DEE) as co-solvent.
• Heterogeneous catalyst: Li/Pumice (5 wt% of Li). Pumice particles (1-4.3 mm) were subjected to impregnation with lithium nitrate anhydrous (LiNO3) [37] Catalyst characterization.
• Reaction conditions: 40°C, 21.1 MeOH/oil ratio, 0.57:1 DEE/MeOH molar ratio, 1.4 m/min.
• The reusability of Li/Pumice catalyst was examined for 8 h reaction. The solid catalyst was used directly for 8 h without any type of treatment.

Results

Table 1. Textural properties of catalytic solid.

<table>
<thead>
<tr>
<th>Material</th>
<th>S BET (m²/g)</th>
<th>D (nm)</th>
<th>A (m²/g)</th>
<th>V dV (cm³/g)</th>
<th>D 4V(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumice</td>
<td>0.74 4.19</td>
<td>6.50</td>
<td>44.43</td>
<td>1584.1</td>
<td>91.9</td>
</tr>
<tr>
<td>Li/Pumice</td>
<td>0.99 3.71</td>
<td>4.90</td>
<td>37.30</td>
<td>1782.4</td>
<td>118.3</td>
</tr>
</tbody>
</table>

Figure 1. Reaction system : 1) mixing tank, 2) peristaltic pump, 3) packed-bed reactor (20 cm length and 1 cm inner diameter).

Figure 2. SEM images for Pumice (a, b and c) and Li/Pumice (d, e and f).

Figure 3. Pore size distribution from (a) % adsorption and (b) mercury porosimetry of the pumice materials.

Figure 4. XRD patterns of the of Pumice and Li/Pumice.

Figure 5. FTIR spectra of the Pumice and Li/Pumice.

Figure 6. Stability of the Li/Pumice catalyst.

Discussion

In this work, a packed-bed catalytic configuration reactor using Li/Pumice as a heterogeneous catalyst was developed for the continuous biodiesel production.

• The continuous transesterification of Jatropha curcas oil conducted in presence of DEE as a co-solvent, using a solid catalyst, allowed the production of biodiesel at low temperature (42°C).
• Li/Pumice and DEE, used as catalyst and co-solvent, respectively, is a useful and successful system to obtain biodiesel in continuous from renewable feedstock as Jatropha curcas oil.

Conclusions

References

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