Esterification of Acrylic Acid with Butanol to Butyl Acrylate over Sulfonated Polystyrene

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Introduction

BA was produced through homogeneously catalysed esterification reaction. These homogeneous catalysts were difficult to be separated, corrosive and hence requiring neutralization. Expanded polystyrene (EPS) was consumed in large quantity as packaging or insulating materials and disposed as waste. The unique sulfonated expanded polystyrene (SEP) was reported as the potential heterogeneous catalyst to overcome the shortcomings of homogeneous catalysts. It possesses strong Bronsted acid sites and water super-adsorbent properties.

Methodology

**Catalyst Characteristic**

<table>
<thead>
<tr>
<th>Method/ Instrument</th>
<th>Morphology</th>
<th>Type functional group</th>
<th>Ion exchange capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The plate containing SEP was placed in the scanning electron microscope (Model Leo Supra 50VP, JEOL) for analysis.</td>
<td>The SEP-KBr pellet was prepared before it was analysed using Perkin Elmer (Model Spectrum 100) spectrophotometer.</td>
<td>SEP was immersed in NaCl solution for 24 hrs. The NaCl solution was titrated with 0.1 M KDH with phenolphthalein as indicator.</td>
</tr>
</tbody>
</table>

**Results and Discussion**

**Catalyst Characterisation**

<table>
<thead>
<tr>
<th>Catalyst</th>
<th>Ion Exchange Capacity (IEC, meq/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh SEP</td>
<td>8.23</td>
</tr>
<tr>
<td>Used SEP</td>
<td>7.79</td>
</tr>
</tbody>
</table>

**Study on the Effect AA:BuOH Ratio, MAA:OH**

At the temperature of 40°C, catalyst loading of 0.75 M and stirring speed of 450 rpm, the best yield was observed at a molar ratio of 1:3. Beyond this, the selectivity was not significant and excess BuOH would hinder the nucleophilic attack.

**SEP Reusability Studies**

At the temperature of 100°C, MAA:OH of 1.3 and stirring speed of 500 rpm, the reuse of SEP has shown excellent activity on the esterification. When the catalyst was used repeatedly, the concentration of the sulfonic group decreased and the selectivity decreased. TheReuseable SEP can be re-used and this will help in reducing the cost of production.

**Conclusion and Recommendations**

SEP is a potential catalyst for the esterification of AA with BuOH due to its high catalytic activity. The use of SEP as the heterogeneous catalyst could overcome the shortcomings of the homogeneously catalysed esterification process while converting the waste to wealth.

The deactivation occurred should be reasoned and a thorough study to strengthen the bonding of sulfonic acid with the EPS should be carried out in future.

**Acknowledgment**

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**References**