Supporting information

One step thermal conversion of lignin to the gasoline range liquid products by using zeolites as additives

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**GC-MS analysis of pyrolysis products**

The GC-MS analysis of pyrolysis products was conducted by Agilent 5975C MSD and 7890A GC with a 7693 auto sampler. The Agilent HP-5MS, 19091S-433 column was used. The GC oven was programmed with the following temperature regime: hold at 50 °C for 5 min, ramp to 80 °C at 5 °C/min and hold at 80 °C for 5 min, then ramp to 200 °C at 2 °C/min and hold at 200 °C for 5 min.

![GC-MS spectrum](image)

**Figure S1.** GC-MS spectrum for the heavy oil produced by pyrolysis of pure SW kraft lignin with 1.0/1.0 (W_{additive}/W_{lignin}) of Y zeolite as additive at 600 °C for 10 min.

**Table S1. Chemical composition of heavy oil produced by pyrolysis of pure SW kraft lignin with 1.0/1.0 (W_{additive}/W_{lignin}) of Y zeolite as additive at 600 °C for 10 min, detected by GC-MS.**

<table>
<thead>
<tr>
<th>RT (min)</th>
<th>Area (%)</th>
<th>Chemical name</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.30</td>
<td>1.65</td>
<td>3-Penten-2-one, 4-methyl-</td>
</tr>
<tr>
<td>11.67</td>
<td>9.25</td>
<td>Phenol</td>
</tr>
<tr>
<td>15.20</td>
<td>9.13</td>
<td>Phenol, 2-methyl-</td>
</tr>
<tr>
<td>16.55</td>
<td>14.31</td>
<td>Phenol, 3-methyl-</td>
</tr>
<tr>
<td>17.32</td>
<td>11.49</td>
<td>Phenol, 2-methoxy-</td>
</tr>
<tr>
<td>Retention Time</td>
<td>Area (%)</td>
<td>Compound</td>
</tr>
<tr>
<td>----------------</td>
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<td>-------------------------------</td>
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<tr>
<td>18.41</td>
<td>2.09</td>
<td>Phenol, 2,6-dimethyl-</td>
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<tr>
<td>21.35</td>
<td>5.18</td>
<td>Phenol, 2,4-dimethyl-</td>
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<td>21.44</td>
<td>4.51</td>
<td>Phenol, 2,4-dimethyl-</td>
</tr>
<tr>
<td>22.83</td>
<td>1.82</td>
<td>Phenol, 3,5-dimethyl-</td>
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<tr>
<td>23.35</td>
<td>6.22</td>
<td>Naphthalene</td>
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<td>24.34</td>
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<td>Phenol, 2-methoxy-4-methyl-</td>
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<td>24.47</td>
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<td>29.22</td>
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<tr>
<td>30.84</td>
<td>4.78</td>
<td>Naphthalene, 1-methyl-</td>
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<td>31.24</td>
<td>5.60</td>
<td>1,2-Benzenediol, 4-methyl-</td>
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<td>31.94</td>
<td>2.09</td>
<td>Naphthalene, 1-methyl-</td>
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<tr>
<td>39.02</td>
<td>1.93</td>
<td>Naphthalene, 1,4-dimethyl-</td>
</tr>
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**Figure S2.** GC-MS spectrum for the heavy oil produced by pyrolysis of pure SW kraft lignin with 1.0/1.0 (W_{additive}/W_{lignin}) of Beta zeolite as additive at 600 °C for 10 min.
Table S2. Chemical composition of heavy oil produced by pyrolysis of pure SW kraft lignin with 1.0/1.0 (W_{additive}/W_{lignin}) of Beta zeolite as additive at 600 °C for 10 min, detected by GC-MS.

<table>
<thead>
<tr>
<th>RT (min)</th>
<th>Area (%)</th>
<th>Chemical name</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.32</td>
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<td>3-Penten-2-one, 4-methyl-</td>
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<td>11.69</td>
<td>9.15</td>
<td>Phenol</td>
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<tr>
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<td>Phenol, 2-methyl-</td>
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<tr>
<td>30.85</td>
<td>7.14</td>
<td>Naphthalene, 2-methyl-</td>
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