Fraction composition and calorific value of industrial birch wood pyrolytic tar.
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Thermal processing of wood and wood residues is nowadays considered as one of promising direction for biofuel production. It is known that the liquid products of conventional slow wood pyrolysis possess about 20 % of the total energy stored in wood, whereas in the process of fast pyrolysis the energy stored in liquids increases up to 54 %, mainly due to increase of the yield of liquids themselves.

The liquid tar is still produced on the industrial scale, for example in Amzya (Russia) plant.

We separated the pyrolytic tar, which was produced by pyrolysis of birch wood in vertical charcoal burning kiln of Amzya plant. To remove water the sample of pyrolytic tar was subjected to heating in rotary evaporator at 100 °C, and the reduced pressure of a water jet vacuum pump. The dried tar obtained with yield of 95 % was then distilled on the rotary evaporator at heating from 110 °C to 250 °C and vacuum about 0,005 mm Hg. From 154 g of dried tar were obtained 86 g (56 %) of summary oils fraction, 61 g (40 %) of pitch, losses comprise 7 g (4 %). For summary oils and pitch the elemental composition was determined (Table). The amount of oxygen was estimated using the usual assumption that all other elements (N, S) are absent.

A bomb calorimeter (IKA 200) was used for calorimetric combustion of summary oils fraction and pitch. Averaged calorific values are given in the Table as the highest heating values (HHV). Despite the relative simplicity and availability of calorimetric determination of HHV for liquid and solid fuels, in many publications empirical estimations are usually used to determine HHV. These estimations are based on the elemental composition of the fuel, and use the equations proposed by Mendeleev and Dulong. For us it was informative to compare the calorific values obtained by combustion and estimated by these two equations. Such comparisons for bio-oils are not commonly found in the literature. In our empirical estimations we assume that samples are free from water and nitrogen and sulfur containing compounds. The results are given in the Table as well.

Table. Elemental composition and highest heating values for summary oils and pitch from birch wood pyrolytic tar of Amzya plant.

<table>
<thead>
<tr>
<th>Name</th>
<th>Elemental composition</th>
<th>Highest heating value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C, %</td>
<td>H, %</td>
</tr>
<tr>
<td>Summary oils</td>
<td>58,4</td>
<td>5,8</td>
</tr>
<tr>
<td>Pitch</td>
<td>66,8</td>
<td>5,7</td>
</tr>
</tbody>
</table>

It is noteworthy that HHV values for the industrial samples of bio-oils Dynamotive (Canada), Ensyn (Canada) and others lie in an interval of 15 400 - 17 600 KJ/kg. There are no indications how the authors take into account the amount of water present in these samples, but if one makes an appropriate correction, it will increase HHV for Dynamotive bio-oil only up to 21900 KJ/kg, a value still significantly lower than ours.

Conclusions:
• The volatile fraction of industrial birch wood pyrolytic tar possesses high heating value of 28 800 kJ/kg;
• Experimental heats of combustion are found to be consistently higher than those predicted by, the empirical equations of Dulong and Mendeleev based on elemental composition.