OHT of poplar round wood – the wood’s resistance to white rot

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Introduction – thermal modification

- Environmental friendly
- No chemicals

- Improves the properties of wood
  - Hygroscopicity,
  - Dimensional stability,
  - Resistance to biotic factors
Chemical changes in wood

- Hemicellulose degradation 160 – 240°C
- Cellulose
  - 250°C decomposition to $\text{H}_2\text{O}$, $\text{CO}$ and $\text{CO}_2$
  - Reduction of polymerization 2600 – 600
- Lignin
  - 100–180°C softening
- Non-cellulose carbohydrates
  - decomposition to $\text{H}_2\text{O}$, $\text{CO}$ and $\text{CO}_2$
  - form dextrin and branched polysaccharides
Introduction – OHT modification

Advantages
- Hot oil, as a heating medium
- Oil doesn't penetrate the wood
- Relatively simple apparatus
- Usually conducted at a temperature of 180–220°C
- Even distribution of heat

Disadvantages
- Resins in oil
Aim of the study

Poplar wood

OHT

Limited decay action of the poplar wood
Materials

- Age of trees – 3 years
- Wood Species:
  - Populus maximowiczii
  - Populus trichocarpa
- Wood moisture approx. 20%
- Samples dimension with bark:
  - 230 mm long
  - 50 mm diameter
# OHT process

Heating medium – palm oil  

Two stages of modification

<table>
<thead>
<tr>
<th>Wood species</th>
<th>Modification time at 100 °C [h]</th>
<th>Modification time at 180 °C [h]</th>
<th>Sample code</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. maximowiczii</td>
<td>24</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>P. maximowiczii</td>
<td>24</td>
<td>48</td>
<td>2</td>
</tr>
<tr>
<td>P. trichocarpa</td>
<td>24</td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td>P. trichocarpa</td>
<td>24</td>
<td>48</td>
<td>4</td>
</tr>
</tbody>
</table>
Examination

Mycological examination
  Samples dimension: 5x15x40 mm
  Fungi: *Coriolus versicolor*
  Fungi action:
    Time: 8 weeks
    Humidity: 70±5%
    Temperature: 22±1°C

Aging test
  EN84
Results – Change of the mass of poplar rollers subjected to thermal modification

<table>
<thead>
<tr>
<th>Wood species</th>
<th>Modification time at 180 °C</th>
<th>Sample code</th>
<th>Change of the samples’ mass [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>24h</td>
</tr>
<tr>
<td><em>P. maximowiczii</em></td>
<td>24</td>
<td>1</td>
<td>65</td>
</tr>
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<td><em>P. maximowiczii</em></td>
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</tbody>
</table>
The table below presents the results of wood mass losses and wood moisture content as a result of the test fungi action. The data includes samples of P. Maximoviczii and P. Trichocarpa subjected to 24-hour modification at 180°C, along with a control group. The table lists the density, mass loss, RSD, and WMC after the test for both non-leaching and leaching conditions.

<table>
<thead>
<tr>
<th>Sample Code</th>
<th>Non leaching</th>
<th>Leaching</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Density [kg/m³]</td>
<td>Mass Loss [%]</td>
</tr>
<tr>
<td>P. Maximoviczii 24h modification 180°C</td>
<td>467</td>
<td>12.11</td>
</tr>
<tr>
<td>Control</td>
<td>341</td>
<td>39.21</td>
</tr>
<tr>
<td>P. Maximoviczii 24h modification 180°C</td>
<td>506</td>
<td>14.74</td>
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<tr>
<td>Control</td>
<td>329</td>
<td>39.75</td>
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<tr>
<td>P. Trichocarpa 24h modification 180°C</td>
<td>797</td>
<td>12.42</td>
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<tr>
<td>Control</td>
<td>413</td>
<td>38.36</td>
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<tr>
<td>P. Trichocarpa 24h modification 180°C</td>
<td>568</td>
<td>13.68</td>
</tr>
<tr>
<td>Control</td>
<td>422</td>
<td>37.76</td>
</tr>
</tbody>
</table>
1. Thermal modification by OHT method enhanced the resistance of *P. maximowiczii* and *P. trichocarpa* wood to *C. versicolor*.

2. Irrespective of the thermal treatment parameters and differences in mass loss values resulting from modification, the durability of wood of both species increased.

3. The best resistance against *C. versicolor* was observed for *P. trichocarpa* wood modified for 24h (ML 8%).
Thank you for your attention