Producing medium density fibreboard based on bamboo-willow

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- China has been the largest country in the world for WBP production and exportation.
- Raw material supply is the big issue for the sustainable development of wood industry in China.
- Fast-growing tree plantation will be the only solution.

Global WBP production in 2013

- China 48%
- Other countries 52%
6 years ago, Bamboo-willow was introduced into China.
It grows faster than poplar.
The aim of this study is to study the possibility of using fibers made from bamboo-willow to produce MDF.
Micro-structure and Wettability of bamboo-willow wood
Cross-sectional detailed micro-structure of bamboo-willow wood
Tangential section detailed micro-structure of bamboo-willow wood
Radial section detailed micro-structure of bamboo-willow wood
The relationship between wetting time and water contact angle on bamboo-willow

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Processing fibres with different morphology
Temperature settings in refining process:

1) Room temperature refining (25 ℃)
2) Pressurized refining (140 ℃)
3) Pressurized refining (160 ℃)
The image of one fibre obtained with FQA

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Fibre Quality Analyser

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The relationship between actual length and projective length of the fibre.

\[ L = \text{actual length}; \]
\[ l = \text{projective length} \]
Curl Index = \( \frac{L}{l} - 1 \)
The average length, width and curl index of fibres processed in three temperature conditions in refining process

<table>
<thead>
<tr>
<th>Temperature(℃)</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Curl index</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>0.42</td>
<td>0.026</td>
<td>0.0488</td>
</tr>
<tr>
<td>140</td>
<td>0.33</td>
<td>0.025</td>
<td>0.0488</td>
</tr>
<tr>
<td>160</td>
<td>0.3</td>
<td>0.025</td>
<td>0.0524</td>
</tr>
</tbody>
</table>
MDF production and properties measurement
Parameters for board manufacturing:

- Target density: 850 kg/m³
- Board thickness: 12mm
- UF glue application: 14%
- Pressing temperature: 180°C
- Pressing time: 360s
The properties of MDF produced with fibres that are prepared in three different temperature conditions in refining process

<table>
<thead>
<tr>
<th>Temperature(℃)</th>
<th>MOE(^a) (MPa)</th>
<th>MOR(^b) (MPa)</th>
<th>IB(^c) (MPa)</th>
<th>TS(^d) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>2895.32</td>
<td>34.07</td>
<td>0.56</td>
<td>12.7</td>
</tr>
<tr>
<td>140</td>
<td>2921.02</td>
<td>28.99</td>
<td>0.56</td>
<td>13.1</td>
</tr>
<tr>
<td>160</td>
<td>2495.32</td>
<td>24.77</td>
<td>0.51</td>
<td>14.3</td>
</tr>
</tbody>
</table>

\(^a\)Modulus of elasticity, \(^b\)Modulus of rupture, \(^c\)Internal bond, \(^d\)Thickness swell
Conclusions

• Bamboo-willow is suitable to be a raw material for MDF production.
• High processing temperature can decrease the length of fibers.
• MDF produced with relatively long fiber has higher mechanical strength.
Future work

• Mixing bamboo-willow with other wood species to produce MDF.

• Using bamboo-willow in MDF industry.

• The possibility of using bamboo-willow in OSB industry.