High Value Utilization of Wood from SRF

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http://www.woodbjfu.cn/index.asp
1. Overview of Chinese forest resources
2. The main utilization of SRF in China
3. The problem and solution of SRF utilization in China
4. Utilization and development of Chinese poplar
5. The research on high utilization of BJFU
1. Overview of Chinese forest resources

The forest resources are mainly concentrated in the northeast, southwest and southeast of China.
Northeast: the 1\textsuperscript{st} large natural forest in China
Main species: 
\textit{Larix} spp, \textit{Pinus} koraiensis, \textit{Betula} platyphylla Suk, \textit{Fraxinus} mandshurica Rupr

\textbf{Betula platyphylla Suk}

\textbf{Larix spp}

\textbf{Pinus koraiensis}

\textbf{Fraxinus mandshurica}
1. Overview of Chinese forest resources

Southwest: the 2nd large natural forest in China
Main species: spruce, fir, Quercus semecarpifolia, teakwood, rosewood
Southeast: Mainly plantation
Main species: China fir, Pseudolarix amabilis, Pinus massoniana, Aleurites fordii
### Distribution of SRF in Different provinces of China (2008)

<table>
<thead>
<tr>
<th>Province</th>
<th>Area of SRF(*10^4ha)</th>
<th>Province</th>
<th>Area of SRF(*10^4ha)</th>
<th>Province</th>
<th>Area of SRF(*10^4ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hubei</td>
<td>14.6</td>
<td>Inner Mongolia</td>
<td>2.3</td>
<td>Guangxi</td>
<td>26</td>
</tr>
<tr>
<td>Hebei</td>
<td>4.7</td>
<td>Guangdong</td>
<td>5.5</td>
<td>Heilongjiang</td>
<td>2.7</td>
</tr>
<tr>
<td>Hunan</td>
<td>86.7</td>
<td>Liaoning</td>
<td>11.6</td>
<td>Henan</td>
<td>10.4</td>
</tr>
<tr>
<td>Yunnan</td>
<td>10</td>
<td>Fujian</td>
<td>33.3</td>
<td>Shanxi</td>
<td>1.3</td>
</tr>
<tr>
<td>Gansu</td>
<td>13.1</td>
<td>Shandong</td>
<td>10.3</td>
<td>Xinjiang</td>
<td>0.7</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>3.4</td>
<td>Sichuan</td>
<td>55.6</td>
<td>Zhejiang</td>
<td>16.2</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>106.6</td>
<td>Henan</td>
<td>6.2</td>
<td></td>
<td>Total 422</td>
</tr>
</tbody>
</table>

Note: the current yield of SRF in China is 108m³/ha
1. Overview of Chinese forest resources

Forecast on the demand for timber in main industry of China

<table>
<thead>
<tr>
<th>No.</th>
<th>Industry</th>
<th>Consumption in 2005/$\times10^4$</th>
<th>Consumption in 2010/$\times10^4$</th>
<th>Consumption in 2020/$\times10^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Paper making</td>
<td>1418</td>
<td>3375</td>
<td>6120</td>
</tr>
<tr>
<td>2</td>
<td>Wood panel</td>
<td>6390</td>
<td>5100</td>
<td>5500</td>
</tr>
<tr>
<td>3</td>
<td>Wooden furniture</td>
<td>1680</td>
<td>2300</td>
<td>3700</td>
</tr>
<tr>
<td>4</td>
<td>Architectural ornament</td>
<td>5600</td>
<td>6440</td>
<td>7220</td>
</tr>
<tr>
<td>5</td>
<td>Packaging</td>
<td>800</td>
<td>1200</td>
<td>1800</td>
</tr>
<tr>
<td>6</td>
<td>Coal and Mining</td>
<td>300</td>
<td>300</td>
<td>330</td>
</tr>
<tr>
<td>7</td>
<td>Transportation</td>
<td>270</td>
<td>300</td>
<td>380</td>
</tr>
<tr>
<td>8</td>
<td>Chemical industry &amp; stationery</td>
<td>230</td>
<td>280</td>
<td>360</td>
</tr>
<tr>
<td>9</td>
<td>Others</td>
<td>3500</td>
<td>4700</td>
<td>6000</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>20188</td>
<td>23995</td>
<td>31410</td>
</tr>
</tbody>
</table>
1. Overview of Chinese forest resources

According to the 7th National Forest Resources Inventory results, China has 195 million ha of forest area, Forest coverage rate is 20.36%, Forest stocking volume is 137.21 billion m³.
1. Overview of Chinese forest resources

Construction of SRF is the main target of Chinese government

Demand and supply of wood products in China in 2009

- Wood supply in China: 237.97 million m$^3$
- Wood consumption: 421.89 million m$^3$
- Gap: 180 million m$^3$
2. The main utilization of SRF in China

- Timber from SRF
- Paper making
- Panel
- Furniture, floor, etc
- Architectural, ornament and packaging material
- Bio-energy
2. The main utilization of SRF in China

(1) Paper making

- Have negative effect on paper making
- More resin content, consume more chemicals during process

The main material of papermaking is bark and cambium, with xylem also playing a role.
2. The main utilization of SRF in China

(2) panel producing

Mainly tree species: *Poplar, Pinus massoniana, Eucalypt, Birch*

- a. Plywood
  - Diameter $\geq 20\text{cm}$, Length $\geq 3\text{m}$

- b. Chipboard

- c. Fiberboard
  - Small diameter
  - Agriculture & forestry residues
(3) Furniture, floor, etc.

Mainly tree species: *Poplar, Paulownia, Fir, Eucalypts*
2. The main utilization of SRF in China

(4) Architectural, ornament and packaging material

(5) Bio-energy

Including:
- Wood gasification
- Wood liquefying
- Pellet fuel
- Wood fiber to alcohol
- Electricity generation
3. The problem and solution of SRF utilization in China

What are the problems?

- A little of tree species could be used in large scale: Poplar, Eucalypt, Pinus massoniana
- Small diameter: about 10cm
- Low quality of timber: low density, poor stability of size, easy to become variant and decayed
3. The problem and solution of SRF utilization in China

How to solve the problems?

- Bleach, dyeing
  - Convert the color and grain of wood

- Increase the density of wood or produce charcoal
  - Enhance the mechanic strength, and size stability of wood

- Antiseptic, antiflaming wood-based composite
  - Wood with special properties
## 4. Utilization and development of Chinese poplar

### 1. The resource and distribution of poplar in China

#### Species of poplar in China

<table>
<thead>
<tr>
<th>Species</th>
<th>P. alba var. pyramidalis</th>
<th>P. jrtyschensis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P. tomentosa var. borealo-sinensis</td>
<td>Populus X canadensis cv. ‘Sacrou’</td>
</tr>
<tr>
<td></td>
<td>P. tomentosa</td>
<td>Populus X canadensis cv. ‘Robusta’</td>
</tr>
<tr>
<td></td>
<td>P. hopeiensis</td>
<td>Aigeiros</td>
</tr>
<tr>
<td></td>
<td>P. davidiana</td>
<td>Turanga</td>
</tr>
<tr>
<td></td>
<td>P. simonii</td>
<td>P. Euphratica</td>
</tr>
<tr>
<td>Tacama haca</td>
<td>P. cathayana</td>
<td>Populus pruinosa Schrenk</td>
</tr>
<tr>
<td></td>
<td>P. pseudo-simonii</td>
<td>Leucoides</td>
</tr>
<tr>
<td></td>
<td>P. gansuensis</td>
<td>P. lasiocarpa</td>
</tr>
<tr>
<td></td>
<td>P. yunnanensis</td>
<td>P. wilsonii</td>
</tr>
<tr>
<td></td>
<td>P. simonii</td>
<td>Leucoides</td>
</tr>
<tr>
<td></td>
<td>P. charbinensis</td>
<td>P. heterophylla</td>
</tr>
<tr>
<td></td>
<td>P. xiaozhuancia</td>
<td></td>
</tr>
</tbody>
</table>
4. Utilization and development of Chinese poplar

<table>
<thead>
<tr>
<th>Region Description</th>
<th>Heilongjiang</th>
<th>Liaoning</th>
<th>Jilin</th>
<th>Inner Mongolia</th>
<th>Ningxia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southeast and Inner Mongolia forestry</td>
<td>P. davidiana, P. euphratica, P. pseudo-simonii, P. charbinensis, P. koreana, P. maximowiczii, P. hsinanica, P. ussuriensis, P. girinensis Skv., P. nakaii Skv.,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northwest forestry</td>
<td>P. euphratica, P. alba, P. canescens, P. pamirica kom, P. bolleana</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North China forestry</td>
<td>P. davidiana, P. hopeiensis Hu et Chow, P. cathayana, P. simonii Carr.,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Utilization and development of Chinese poplar

<table>
<thead>
<tr>
<th>North China forestry</th>
<th>Tianjin</th>
<th>Shanxi</th>
<th>Jiangsu</th>
<th>Anhui</th>
<th>Henan</th>
<th>Shandong</th>
<th>Populus purdomii Rehd. in Journ, Populus pseudo-simonii, Populus maxuimowiczii, Populus tolerantosaCarr</th>
</tr>
</thead>
<tbody>
<tr>
<td>loess plateau forestry</td>
<td>Shanxi</td>
<td>yanan</td>
<td>ningxia</td>
<td>Gansu, lanzhou</td>
<td>Populus pseudo-simonii, P. cathayana, Populus cathayana Rehd. var. latifolia C.Wang et Tung, PopulussimoniiCarr., Populus simonii</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Utilization and development of Chinese poplar

(2) the characteristic and application area of Poplar

a. Wood panel

- Soft-wood
- Tenacity and elasticity
- Uniform Vein
- Easy to be peeled
b. Papermaking

- Light color
- High fibre content
- Less resin
- Easy to be bleached
- Good pulp yield, strength and whiteness
c. Artificial decorative veneer

Choose normal species of wood, especially poplar and other SRF as the raw material, produce decorative veneer with color and figure like rare species with emulation technique

Improve the additional value of wood

With notable economic benefit
4. Utilization and development of Chinese poplar

d. Modification of poplar

Defects of poplar
- Soft
- High moisture
- Shrinking & Deforming
- Fluffing when peeling
- Poor dimensional stability
- Poor strength

Modification
- Dimensional stability ✓
- Resistant to wear ✓
- Non-corrosibility ✓
- Fire resistance ✓
- Bend strength ✓
- Surface hardness ✓
- Modulus of elasticity ✓
4. Utilization and development of Chinese poplar

(3) Development of poplar in China

- Improve the physical and mechanical properties of wood
- Focus on the improvement of genes and oriented cultivation
- Improve the process technique
- Produce high-valued composite board, high yield pulp and paper products
5. The research on high utilization of BJFU

Wood science and technology institute built in 2002, mainly engaged in the research on the woody biomass material and energy utilization.
5. The research on high utilization of BJFU

BL-SCFB-1 (25 Kg/h)
BL-SCFB-2 (5 Kg/h)
BL-SCFB-3 (35 Kg/h)
BL-SCFB-4 (1 Kg/h)
Pilot scale (150 Kg/h)
5. The research on high utilization of BJFU

Bio-oil
5. The research on high utilization of BJFU PF and bio-PF

PF and bio-PF

Plywood produced by bio-PF
5. The research on high utilization of BJFU

Test report from national plywood and bamboo products test center