Concept of Using Biomass Boards for Greening Deserts

Biomass Conversion Lab., Gifu University
Thinned logs
   → Low quality, small diameter

WASTED

Sawdust and Woodchip
   from the sites of lumbering

· Decline in natural resource
· Global warming
· Desertification

Utilization of unused resource

Fabrication of Biomass boards with high-pressure steam
Biomass board is...

Compressively molding with high-pressure steam method

- Softening at 120°C
- Compression to the targeted density
- Shape fixation at 180°C

- Increase in cellulose crystallinity
- Transformation of cellulosic crystalline structure

Applied to shape-memory treatment of fabric materials

- No Chemicals
- Eco-Friendly
- Biodegradable
- Easy to recycle

Fixation of entanglement between particles causes the adhesion
From Sawdust + TiO₂

Photocatalytic board

From Paper

Physical strength of board (Red lauan)

<table>
<thead>
<tr>
<th>Material</th>
<th>IB (MPa)</th>
<th>MOR (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sawdust</td>
<td>0.980</td>
<td>11.5</td>
</tr>
<tr>
<td>Wood-fiber</td>
<td>1.28</td>
<td>40.8</td>
</tr>
<tr>
<td>JIS Standard (MDF Type 5)</td>
<td>≥ 0.2</td>
<td>≥ 5.0</td>
</tr>
</tbody>
</table>

Boards with certain strength

Construction material
Interior material
Furthermore...

TOTAL UTILIZATION OF WOOD RESIDUE is possible with using high-pressure steam distillation method.
Desertification and Soil Erosion

Deforestation and Heavy grazing

- Lack of nutrient
- Lack of water
- Soil erosion

Vegetation removal

Desertification

Hard to forest

As mulching material

Soil moisture control
Soil temperature control
Erosion control
Fertilizer supply

The aim of this study

Evaluation of these ability
Runoff Test

- Bare grounds were prepared by removing weeds
- Steep slope (30°) and gentle slope (5°) was prepared
- Funnel-shaped stainless plates were placed at the bottom edges of the slopes

15 areas of 120cm × 30cm were made with using corrugated plastic sheet

TOTAL: 30 areas (15 in SS, 15 in GS)
### Biomass Boards

Obtained from Kaminohoto Forest Cooperative

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-board area (FB)</td>
<td>4 pieces of Biomass boards (29cm × 29cm × 2cm) were placed to cover the whole surface</td>
</tr>
<tr>
<td>Half-board area (HB)</td>
<td>2 pieces of biomass boards were placed on the top and bottom edges of the slopes</td>
</tr>
<tr>
<td>Rice straw area (RS)</td>
<td>Rice straw was placed at 2-cm thick layer</td>
</tr>
<tr>
<td>Woodchip area (WC)</td>
<td>Woodchip (raw material of biomass boards) was placed at 2-cm thick layer</td>
</tr>
<tr>
<td>Bare ground area (BA)</td>
<td>No mulching</td>
</tr>
</tbody>
</table>

For mulching material and paving material
Total amount of substantial eroded soil

Total rainfall : 254mm

Converting to runoff ratio
(BA=100%)

FB showed the highest soil erosion reduction ratio

94% in SS, 92% in GS
Moisture Control Ability Test

400g of river sand was filled into plastic pot

- Biomass board
- Rice straw
- Woodchip
- Additional sand
- Blank

Placed to obtain same thickness as biomass board (2cm)

200g of water was dropped using peristaltic pump

Placed in a temperature controlled room (25°C)

Moisture retention ratio was determined by weight change
Water absorption was drastically increased by laying biomass board.

- **Board**: Water was defused and efficiently absorbed.
- **RS, WC**: Water was allowed to go down to the sand layer.

![Bar chart showing water content in g for Board, Rice straw, Woodchip, Additional sand, and Blank categories. The chart highlights a significant increase in water content for the Board category compared to others.]
The pot with biomass board retained more than 40g of water even after 4 weeks.
Development of Biomass Block

1. Pressing in the wood log
2. Loading softened woodchip
3. Wood log addition and compression
4. Sending to fixation stage
Some cracks were observed

Lack of shape fixation?

Further investigation is required...
Conclusion

Significant **reduction of soil erosion** by board mulch

Temperature control

Availability as multi-functional mulching material

Fertilizer supply

Significant **increase of water absorption and water retention**
Woodchip and sawdust from site of lumbering

Forest thinning

Thinned wood

Erosion control, Fertilizer, Moisture control

Soil conservation after lumbering (erosion control, moisture control, etc.)

Forest

Biomass board/block

Lumbering

Erosion control, fertilizer, moisture control, etc.

Greening

Woodchip and sawdust from site of lumbering

Forest thinning