Potential of Using the NSSC Pulp for Production Fluting Paper from Kiwi Residues in Mazandaran Wood and Paper Industries

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Abstract

In this research, some chips of kiwi residues in the west of Mazandaran (Tonkabon region) were randomly chosen and NSSC Pulps were prepared at the yield 75% in 105 minutes, by using cooking conditions of Wood and Paper Industries of Mazandaran Fluting papers were prepared from the Kiwi NSSC and Mill (MWPI) NSSC pulps, first in a separate and then mixed way. Then the optical and mechanical properties were measured and compared according by using TAPPI Standard test methods. The results showed that the most strength of the burst, breaking length, tensile, RCT and tear were in the hand sheets obtained from 30-50% the kiwi NSSC pulp + NSSC pulp Mill. The lowest strength (except CMT and water absorption) was in kiwi NSSC pulp. The results also indicated that highest resistance of tear and brightness were in NSSC MWPI Mill. The results also pointed out that the above-mentioned strengths can be improved by adding 30-50% of the Kiwi NSSC pulp to replace some of the NSSC pulp of MWPI Mill, but it is not possible for pure kiwi NSSC pulp.

Key words: Kiwi Residues, NSSC Pulp, Fluting Paper, Mechanical properties.
Introduction:

The use of High-yield mechanical and chemimecanical pulps are important, today's. About 250,000 t/y Kiwi Residues production from planted garden in the North of Iran, that they are burning after imported about 35 years in Iran. The Mazandaran Wood and Paper Industries are biggest and important in Iran, but this mill have a problem for raw material provide and consumption in new years. The raw materials in this mill are horn beam, beech, aspen, iron wood, and waste paper. In this research, we investigating of using the NSSC pulp for production fluting paper from Kiwi residues in Mazandaran wood and paper industries. All year, there are 1,120,000 tones apparent consumption and 600,000 tones production for paper and board in Iran. There are 16.5 kg apparent per capita for paper and board in Iran. Barzan and Resalati found that from the mixed of recycled fibers and the NSSC pulp of MWPI mill can as of MWPI mill can as a replacement some of the NSSC pulp of MWPI mill, and following fluting papers had a fit properties (2). Vaysi et al. (2008) reported that wood of kiwi residues had semi-ring porous, group's vessels with spiral thickening.

![Fig 1- The birds named kiwi (left) and kiwi planted garden in north of Iran(right)](image)

The parenchymas were longitudinal and axial. There were a lot of rays in cross-section. The average of the fiber diameter, ray thickness, fiber length, Runkel coefficient were 172 $\mu$, 17.6 $\mu$, 1371 $\mu$ and 116.6 percent, respectively. The results also indicated that kiwi residues properties were very fit and same the hard woods. The results also pointed out that the above-mentioned of wood kiwi residues properties can to replace some or full of the raw material for production pulp and paper, fiber board, particle board, and another wood composition boards in the wood and paper industries (8). Samaria et al (2010) reported that mechanical properties of hand sheets with basis weight 127 gr/m$^2$ NSSC pulp made from bagass with freeness 345 and 433 CSF are better than mixed hardwood NSSC pulp (6). Frozanfar et al (2010) The results showed that the most strength of the burst, breaking length, tensile, RCT, porosity and opacity were in the handsheets obtained from the 40% poplar NSSC pulp + 60% pulp Mill. The strengths of pure poplar NSSC pulp were remarkably, too. The results also pointed out that the above-mentioned strengths can
be improved by adding 40% poplar NSSC pulp to the NSSC pulp mill. So the 40% poplar NSSC pulp can as a replacement some of the NSSC pulp of MWPI Mill, and it is possible for pure poplar NSSC pulp, too(3).

Experimental

Physical and Biometrical Properties

In this study, 30 kg samples were taken randomly from kiwi residues of Nowshahr Forest in north of Iran. From each stem, three disks with interval of L/3 of the stem length were separated. In first stage samples were prepared for measured fiber biometrical and physical properties by using Franklin (1954) and ASTM Standard test methods respectively. The physical properties investigated are oven dried density, basic density, shrinkage, swelling, porosity, EMC. The standard test method for specific gravity of wood and wood-based materials is found in ASTM D 2395-93. Equilibrium moisture content (EMC) is an important in-service factor because wood and woody materials like bamboo, are subjected to long-term and short-term variation in surrounding relative humidity and temperature. Conditioning of bamboo to specific moisture contents can be carried out using the standard guide for moisture conditioning of wood and wood –based materials, ASTM D 4933-91. Bamboo is assumed to shrink and swell similar to wood, and therefore could be investigated using the standard methods of testing small clear specimens of timber, ASTM D 143-94. The important equations are shown below (4, 8):
The biometrical properties investigated are fiber length, fiber diameter, lumen, fiber thickness, Runkel and flexibility coefficients. The data were statically analyzed in the stem longitudinal directions. The important equations are shown below (2, 8):

$$ R = 100 \times \frac{2P}{C} $$
$$ F = 100 \times \frac{C}{d} $$

Where:

- $R$ = Runkel coefficient,
- $F$ = flexibility coefficient,
- $P$ = fiber thickness,
- $C$ = lumen and
- $d$ = fiber diameter.

Pulp

After debarking, the chips were cooked under NSSC conditions ($l/w$:7 ,Na2O:102 gr/l , SO2:88 gr/l, AA:20% and for 105 minutes in 170 °C ) of MWPI Mill , and Pulps were prepared at the yield 75%.

In second stage, some chips of kiwi residues in the west of Mazandaran (Tonkabon region) were randomly chosen and NSSC Pulps were prepared at the yield 75%in 105 minutes, by using cooking conditions of Wood and Paper Industries of Mazandaran in North of Iran. The pulps refined by PFI Mill until 430 CSF Freeness.
Paper sheets and optical measurements

Fluting papers were prepared from the Kiwi NSSC and Mill(MWPI) NSSC pulps, first in a separate and then 10-50% mixed pulps. In order to improve the strength of hand sheets, 5-10 % of imported long-fiber was added to them. Then the optical and mechanical properties were measured and compared according by using TAPPI Standard test methods. Then 60 gr/m² hand sheets were made from separately and mixed the unbleached pulps according to TAPPI T 205 om-88. And their mechanical and optical properties were measured by using TAPPI Standard test methods.

Results and Discussion

In this research, the paper properties, physical and fiber biometrical variation investigated in kiwi residues. The results showed that there were significant differences between biometrical properties and most physical properties, but there were not significant differences between EMC and oven dried density (Table1). The results showed that wood of kiwi residues had semi-ring porous, group's vessels with spiral thickening. The parenchymas were longitudinal and axial. There were a lot of rays in cross-section. The average of the fiber diameter, ray thickness, fiber length, Runkel coefficient, dry density, basic density, shrinkage and porosity were 172, 17.6, 1371, 116.6, 0.668gr/cm³, 0.564 gr/cm³, 15.7 % and 55.1% percent, respectively. The results also indicated that highest resistance of tear and brightness were in NSSC MWPI Mill, and the highest CMT and water absorption were in papers from Kiwi NSSC pulp. The Kiwi NSSC pulp +10 % of imported long-fiber can replace some of the NSSC pulp of MWPI Mill, but it is not possible for pure kiwi NSSC pulp. The results showed that the most strength of the burst, breaking length, tensile, RCT and tear were in the handsheets obtained from 30-50% the kiwi NSSC pulp +NSSC pulp mill (fig. 2-4). The lowest strength (except CMT and water absorption) was in kiwi NSSC pulp. The results also indicated that highest resistance of tear and brightness were in NSSC MWPI mill. The results also pointed out that the above-mentioned strengths can be improved by adding 30-50 % of the Kiwi NSSC pulp to replace some of the NSSC pulp of MWPI Mill, but it is not possible for pure kiwi NSSC pulp. The results also indicated that kiwi residues properties were very fit and same the hard woods. The results also pointed out that the above-mentioned of wood kiwi residues properties can to replace some or full of the raw material for production pulp and paper, fiber board, particle board, and another wood composition boards in the wood and paper industries. The results also pointed out that the above-mentioned strengths can be improved by adding of the Kiwi NSSC pulp to replace some of the NSSC pulp of MWPI Mill, but it is not possible for pure kiwi NSSC pulp.
Table 1- the Physical and Biometrical properties of KIWI residues

<table>
<thead>
<tr>
<th>Properties</th>
<th>Dry Density g/cm³</th>
<th>Swelling %</th>
<th>Porosity %</th>
<th>Fiber Length (μμ)</th>
<th>Fiber Diameter (μμ)</th>
<th>Runkel coeff *100</th>
<th>Flexibility coeff. *100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood of Kiwi</td>
<td>0.668</td>
<td>19.07</td>
<td>55.1</td>
<td>1371</td>
<td>30.04</td>
<td>116.7</td>
<td>46.8</td>
</tr>
</tbody>
</table>

Fig 2- Comparison of brightness (left) and RCT (right) of the hand sheets from KIWI and mill NSSC pulps.

Fig 3- Comparison of CMT (left) and Tensile (right) of the hand sheets from KIWI and mill NSSC pulps.
Conclusion

The results showed that wood of kiwi residues had semi-ring porous, group's vessels with spiral thickening. The parenchymas were longitudinal and axial. There were a lot of rays in cross-section. The results also indicated that highest resistance of tear and brightness were in NSSC MWPI Mill, and the highest CMT and water absorption were in papers from Kiwi NSSC pulp. The Kiwi NSSC pulp +10 % of imported long-fiber can replace some of the NSSC pulp of MWPI Mill, but it is not possible for pure kiwi NSSC pulp. The results showed that the most strength of the burst, breaking length, tensile, RCT and tear were in the handsheets obtained from 30-50% the kiwi NSSC pulp +NSSC pulp Mill. The lowest strength (except CMT and water absorption) was in kiwi NSSC pulp. The results also indicated that highest resistance of tear and brightness were in NSSC MWPI Mill. The results also pointed out that the above-mentioned strengths can be improved by adding 30-50 % of the Kiwi NSSC pulp to replace some of the NSSC pulp of MWPI Mill, but it is not possible for pure kiwi NSSC pulp.

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