

Siwaporn Butrat 2011: Steam Explosion for Chemi-Thermo Mechanical Pulping of Physic Nut (*Jatropha curcas* Linn.) for Paper Packaging Applications. Master of Science (Packaging Technology), Major Field: Packaging Technology, Department of Packaging and Materials Technology. Thesis Advisor: Mr. Lerpong Jarupan, Ph.D. 131 pages.

This research aims to utilize an agricultural waste of physic nut as raw material for chemithermo mechanical pulp. Chemical composition and morphological properties were analyzed prior to the determination of optimal condition for a steam explosion at the pressure of 0, 13, 15, 17, 19, 21 kg/cm² for 3 min, equivalent to severity conditions ($\log_{10} R_0$) 0, 3.31, 3.45, 3.57, 3.69 and 3.81, respectively. The resulted pulp was then pretreated by an immersion in an alkali solution of 0, 5, 10 and 15 based on oven dried weight, the ratio of water to dried pulp 1:10, cooking temperature 105 °C, time to maximum for 15 min, time at maximum for 60 min. Comparative strength properties from various pulping conditions showed that the handsheet undergone the steam explosion gave the highest pulp yield, brightness, and strengths in terms of tensile and tear indices ($p \leq 0.05$). The pulp was formed to handsheets by chosen three conditions nonsteam explosion and 15% alkalinity, steam explosion at severity level of 3.31, 5% alkalinity, and severity level of 3.31, 10% alkalinity with the addition of sizing agents of alkyl ketene dimer (AKD) and cationic starch at concentrations of 0, 0.5, 1.0 and 2.0% based on oven dried weight. Those sizing agents were used to enhance mechanical and physical properties of the formed handsheets. The results showed that, at every level of both sizing additives, the handsheet that was used the pulp undergone the steam explosion with severity level equal to 3.31 and 10% alkalinity gave the best mechanical properties in terms of bursting (2.21-2.61 kPa.m²/g) and tensile (37.63-45.87 Nm/g) indices. Nevertheless, the handsheet that was used the pulp undergone the steam explosion at severity level of 3.31 and 5% alkalinity gave the highest ring crush resistance index (0.059-0.078 kN/m); whereas the handsheet used the pulp that had not undergone the steam explosion with 15% alkalinity gave the highest tear index (4.24-5.42 mN.m²/g) and the best brightness (22.65-29.71%). Water absorption tends to decrease with the increase of both sizing additives. The handsheet with pulp undergone the steam explosion at severity level of 3.31, 10% alkalinity with 2.0% AKD and cationic starch was reported the lowest water absorption. This can be affirmed by surface analysis using scanning electron microscopy (SEM). Mechanical properties between the resulted handsheets and kraft liners were compared. The handsheet with the pulp that had not undergone the steam explosions with 15% alkalinity and that of severity level of 3.31, 10% alkalinity gave relatively comparable properties in terms of tensile and bursting strengths to the kraft liners.

Student's signature

Thesis Advisor's signature