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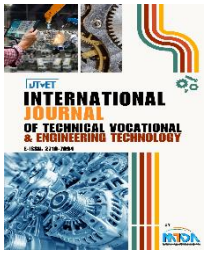

Handmade Drawing Paper from Sugarcane Bagasse and Banana Fibre

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ABSTRACT

The growth of agricultural sector in conjunction with the expansion of human population has led to an increase in the generation of solid waste. The country's abundant supply of banana fiber and sugarcane bagasse fiber, which has little commercial value, offers a possible source of non-wood raw materials for paper production. Through recycling these waste products, the dependence on virgin raw materials and assurance on the environmental impacts can be minimize. In that scenario, this research focuses on the producing drawing paper, which is high demand in the market today by utilizing banana fiber (BF) and sugarcane bagasse fiber (SBF) with reassurance of paper quality using pH test, Paper wet test and Gram per Square Meter (GSM) test. Different types of handmade drawing papers materials were made which is BF, SBF. Others two drawing paper materials were made by chemically pulped using 10% CaCo3 for 2 hours to formed CaCo3-SBF and CaCo3-BF. Different standard paper sizes; A3, A4 and A5 are formed by molding and ironed. Based on observation on the Paper Wet test proved shown that CaCo3- SBF and CaCo3 -BF formed a non-deteriorate and exhibited more stable in condition. CaCo3-BF shown the lowest pH level followed by BF, CaCo3-SBF and SBF. The GSM value for SBF showed a higher value than BF, with or without CaCo3. Higher value of GSM indicating that SBF based papers are reliable for rough usage. However, for low value of GSM, the sample are more suitable to be used as tissue or wipes tissues

1.0. Introduction

The demand for paper has been increasing since the start of its invention as it could be used for various purpose and it is predicted to rise by roughly 16.7% in the year 2023 comparatively to 408 million tons in 2021 (Ian, 2022) with the highest demand in China, U.S.A, North America, and India. Based on (Weinberg, 2000) stated that 14% of deforestation is done to satisfy the huge market for paper goods and this leads to ecosystem imbalance resulting in loss of habitat, soil erosion, flooding and increased greenhouse gases. Hence, in order to fulfill the demand with reduction in environmental impacts, an alternative method is discovered by producing papers via handmade method using agricultural waste as the raw materials, since paper produced is eco-friendly and has a substantial

influence on forest growth and preservation. Besides, via handmade process, production cost could be reduced and usage of electricity is much lesser as compared to machine-made paper.

2.0. Literature review

In olden days, raw material used for the paper production is papyrus trees, however, with advance studies, waste materials can also be converted into useful items such as paper, after undergoing certain process. Studies have proven the capabilities of agricultural waste such as cereal straw, kenaf, wheat straw, rice straw, cotton stalks and corn stalks (Fahmy Y, Ibrahim H 1976; Miller, D. 1965; Isenberg, I. 1962), to be utilized to form papers. As a consequence, it helps to reduce the amount of garbage that present in the in high waste output (rice husk, oil palm wastes, coconut trunk fibers) (Tosiah Sadi 2021)., thus impacting the amount of solid waste generated by the nation annually and the potential of polluting the environment rises if wastes are not adequately handled causing major problem to the civil society.

In this study, potential of using agricultural leftovers; banana fibers and sugarcane bagasse in production of drawing papers are considered, due to high alpha-cellulose, low lignin concentration (Das P.K. et al., 2010) in banana fibers and low content of silica, high carbon content in sugarcane bagasse (M.N. Salleh et al., 2007). This research helps to lower the energy usage, promote recycle, minimize the need for virgin materials and enhance environment via using agricultural waste to produce handmade papers. The paper which is made from organic agricultural solid waste are propose as a perfect product for children usage and it could be further utilized for commercial packaging by further enhancing the paper quality.

3.0. Discussion of analysis and findings

3.1. Material

Banana fibre (BF) and sugarcane bagasse fibre (SBF) were collected from the local shop. Calcium carbonate ($CaCO_3$) acted as an additive was purchased from local company.

3.2. Raw Material Preparation

BF and SBF were washed with tap water and filter to remove extraneous matter such as soil particles. The samples were cut to 2-3 cm in length and boiled for 3 hours. The pulp then dispersed in water and disintegrated for five minutes. After completion digestion time, pulp was washed using bleaching agent and dried oven to remove moisture. Pulp then placed into the mold of difference dimension A4, A3, A6.

3.3. Paper Preparation

Dried, bleached BF and SCB pulp was used as primary raw materials. In the case of Calcium Carbonate ($CaCO_3$) - reinforced paper, 10% $CaCO_3$ was dilute in water and added as additive during blending process.

3.4. Paper Characterization

Ph Testing: Sample was collected and drop of distilled water was added. The sample was agitated using spatula until homogeneous formed. Multimeter was used and repeated three times.

Paper Wet Test: Sample was soaked in tap water for three hours and data was collected based on observation.

GSM: GSM value is obtained to act as a measuring unit to determine the quality of the paper. Paper with difference dimension (A4, A3, A6) was weight using Analytical balance. Data received are recorded and calculated using formula as shown in Equation (1).

$$\text{GSM } \left(\frac{\text{g}}{\text{m2}}\right) = \text{Mass of paper (g)/Area of paper(m2)} \qquad (1)$$

Figure 1.1: The flow process of making drawing paper

4.0. Discussion of analysis and findings

pH Test: pH level test was conducted in order to ensure conservation of paper is not affected by gradual and irreversible breakdown of cellulose molecules due to acidity (Newsletter, 1990). The pH values of SBF, CaCo3-SBF, BF and CaCo3-BF are shown in Figure 1.2. Results obtained shown decrease in pH value for both CaCo3-SBF and CaCo3-BF as compared to raw material. pH level range from 7 to 8 still under neutral and alkaline stage. Close to neutral pH obtained from both results give the advantages of running a paper machine including improved slime control, decreased machine corrosion, and stronger natural fibers (Crisp and Riehle, 2009). pH levels affect the qualities of paper produces due to capacity of the fiber to swell. According to previous research on structure of paper, fiber paper with high acidity effect the microfiber within the fiber, thus corrode the document (Sistach Anguera, 1996). Furthermore, research by Institute of paper science and technology Atlanta, Georgia under journal the aging characteristic of European handmade paper said that the good paper was alkaline while the poor paper was acidic (J.F., 1991).

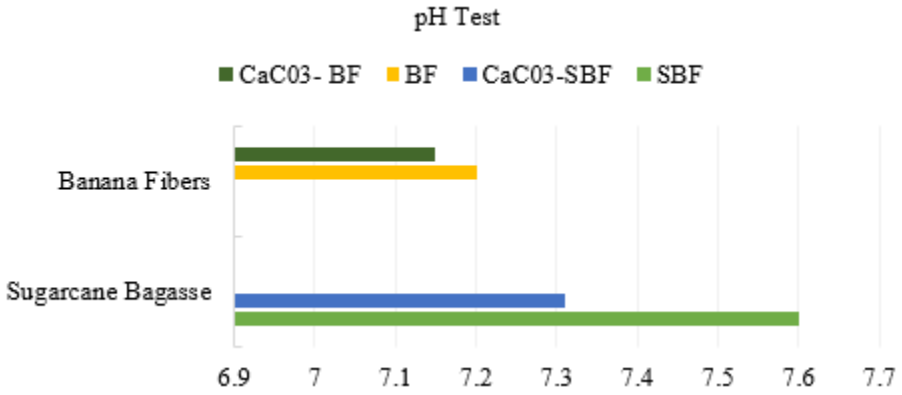

Figure 1.2: pH for BF, $CaCo_3$-BF, SBF and $CaCo_3$-SBF

GSM Test: GSM test were conducted for three types of size A4, A3 and A5 to act as a measuring unit to determine the quality of the paper. It can be seen in Figure 1.3, all the papers produced is more than 130 gsm supporting the purpose for drawing paper usage. (Strathmore, 2023). As stated by Smith J. And Johnson A.(2017), higher gsm paper does not result in better quality for all artistic purposes as it is further influenced by artistic techniques and intended use. According to Khalsa Al-Sulaimani (2017), CaCo3 were added to enhance the properties of paper.

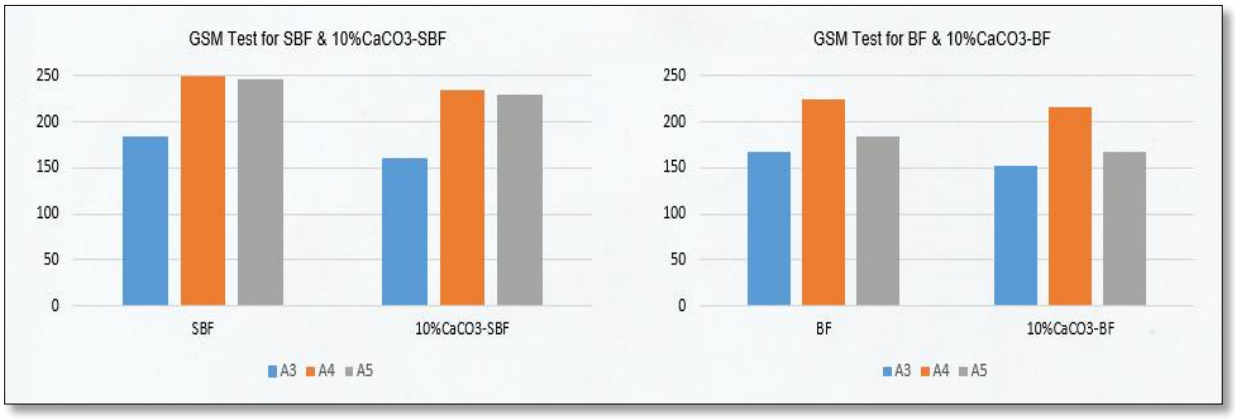

Figure 1.3: GSM test for Sugarcane Bagasse and Banana Fibre

Paper Wet Test: According to Institute of paper science and technology Atlanta, Georgia storage conditions can have a significant effect on the life expectancy of paper especially in low temperature and low humidity environment can affect the quality of the paper (J.F., 1991). For paper wet test, by observation for SBF and BF added with 10% $CaCO_3$ help to enhance the properties of the fiber. Based on observation after a few minutes SBF and BF with 10% $CaCO_3$ non-deteriorate. The study found that combining sugarcane bagasse with 10% $CaCO_3$ resulted in better quality fibers compared to other options. Both sugarcane bagasse and banana fibers have promising properties and can be used as raw materials for handmade drawing paper (Figure 1.4). Further testing is necessary for product development. Handmade drawing paper can be a viable alternative to produced paper and safe environment rather than cutting tree.

Figure 1.4: Handmade drawing paper

5.0. Conclusion and future research

In this project SBF and BF were used in making handmade paper. This study shows that SBF easily used as raw material for handmade paper. By adding SBF with 10% CaCO3 able to enhance the

properties of paper. Function of CaCO3 giving white color to paper and worked as filler (Khalsa Al-Sulaimani, 2017). Eventhough BF and 10%CaCO_3-BF have gsm more than 130, they are considered less suitable to be used as drawing paper since these papers have a very smooth texture and easily deteriorate.

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Author Contributions

Ts. Suhailah Samat: Conceptualization, Data Curation, Writing- Original Draft Preparation; **Shariffah Nur Jannah Syed Zainol Abidin**: Methodology, Validation; Supervision **Kartikah A/P Sellappan**: Validation, Writing-Reviewing and Editing.

Conflicts Of Interest

The manuscript has not been published elsewhere and is not under consideration by other journals. All authors have approved the review, agree with its submission and declare no conflict of interest in the manuscript.

6.0. References

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