

Study of Apple Packaging Material Properties by Using Parchment and Recycled Paper

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Abstract: This paper investigated the potential properties of apple packaging material used as a major ingredient for promoting eco-friendly apple packaging materials. In addition, old newspapers and parchment paper were used as specimens to assess natural behavior of the apple packaging material. The main objective was to determine the mechanical properties of the paper with different amount or the different percentage of parchment paper and recycled paper compositions. The response of this study was identifying the tensile strength, bursting strength and tearing strength factor. The results showed production of papers from parchment paper and recycled paper affects the strength of the paper itself. The increase in the percentage of recycled paper has resulted in the mechanical properties of ascending paper. The combination of 60% recycled paper and 26% parchment paper produces the best mechanical properties with tear strength of 25.1 N. Meanwhile the composition of 43% parchment paper, 43% recycle paper and 14% of potato flour resulted with 856.0 kPa burst strength and 224.0 N tensile strength. The conclusion suggests that the combination of recycled paper and parchment paper can be one of the alternative raw materials used to package an apple.

Keyword: Packaging Material; Parchment Paper; Recycled Paper; Mechanical Properties.

1.0 Introduction

Packaging is used for containment, protection, handling, delivering and presenting goods from the producer to the consumer or user, as well as preserving the product. Packaging is also regarded as an efficient system for delivering products to consumers. The packaging system includes various operations starting from conversion of packaging materials into packaging, filling the packages with products before transporting them to the marketplace, consumption of packaged products and disposal of packaging waste.

The Packaging Institute International defines packaging as the enclosure of products, items or packages in container forms to perform one or more of the following functions: containment, protection, preservation, communication, utility and performance. Packaging plays a significant role in delivering fresh produce to the consumer through distribution systems. Proper packaging reduces damage and loss, maintains quality, and protects produce, against contamination risks throughout the supply chain.

In addition, packaging plays a key role as a marketing tool, which is an important part of consumer decision-making. Packaging effectively serves an important role at every step of the supply chain. [1]

2.0 Methodology

This section discussed on the methodology used in this study by using an alternative packaging material of apples, parchment and recycled paper. The performance of this alternative new apple packaging material focusing on tear, burst and tensile test. Fig. 1 shows the flow chart of the methodology. There are six different stages in this flow chart, from the beginning identifying the composition of the material until to the results, discussions and conclusions.

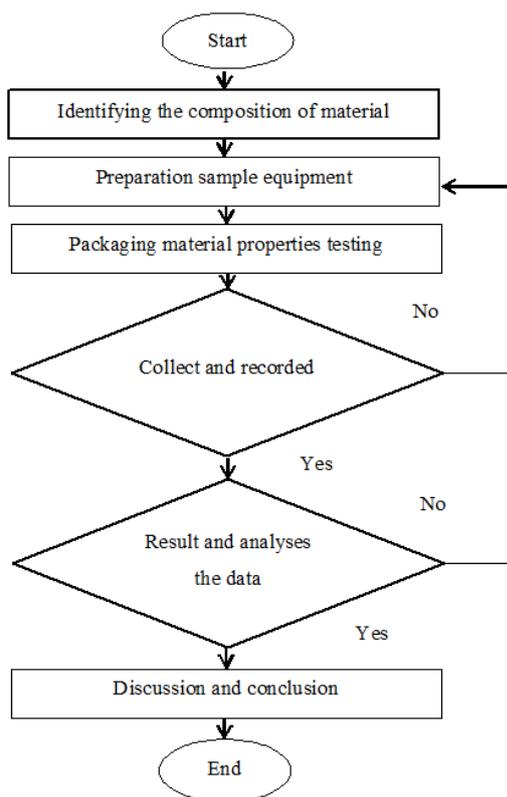


Fig. 1 Flowchart of the methodology.

Basically, the raw material used to produce the paper board for apple packaging are parchment paper, recycled paper and potato. The main material used was parchment paper. Potato was used to bind or act as the resin of the composition meanwhile recycled paper was used to hold the fiber orientation. However according to Yessica et.al. in 2010 [2] recycled paper usually does not have a good runnability features typically cannot optimized the properties of paper board. Overcoming this issue, most paper manufacturer using ratio 3:7 during the process mixing of recycled paper to other fiber paper. Therefore, in this research the different composition of raw material was chosen accordingly,

- i) 26% recycle paper, 60% parchment paper and 14% potato flour
- ii) 60% recycle paper, 26% parchment paper and 14% potato flour
- iii) 43% recycle paper, 43% parchment paper and 14% potato flour

The first stage of the paper-making process was parchment paper and recycled paper were cut between 10 mm to 20 mm long then, grind

until become dust. This composition was mixed with 2000 ml of water to produce a mixture, the mixture was transferred into a large container then the process of sizing paper started. For the drying process, the sample was dried under the sun for 8 hours then, the specimen was overthrown with the heavy roller, to ensure that all the samples for each composition have the same thickness.

Specimen dimension for test tensile was 300 mm long and 15 mm wide, according to the ASTM/TAPPI Standard 2011. Meanwhile, dimensions for tear testing are 100 mm long and 63 mm wide also following ASTM/TAPPI Standards, 2011. The dimension for bursting test is 130 mm long and 130 mm wide following ASTM/ TAPPI T 810, "Bursting Strength of Corrugated and Solid Fibreboard".

Specimens tensile and burst strength were measured using a universal tensile machine and bursting strength tester Mullen. Meanwhile for the tear strength, testing was done using the tearing strength paper tester Elmendorf.

3.0 Results and Discussion

Fig. 2 below shows tear strength result presented in the bar graphs at different composition. Each composition conducted a test of ten specimens. The results show for the composition of 60% parchment paper, 26% recycled paper and 14% potato flour, the highest tear strength is 23.2 N and the lowest is 11.7 N. The graph also shows for composition of 26% parchment paper, 60% recycled paper and 14% of potato flour the highest tear strength is 25.1 N and the lowest is 11.9 N. Meanwhile for composition 43% parchment papers, 43% recycled paper and 14% potato flour recorded the highest result at 19.0 N and the lowest result is 12.4 N. This happen because the recycled paper has a lot of ingredient and it helps the paper become stronger compare to other composition.

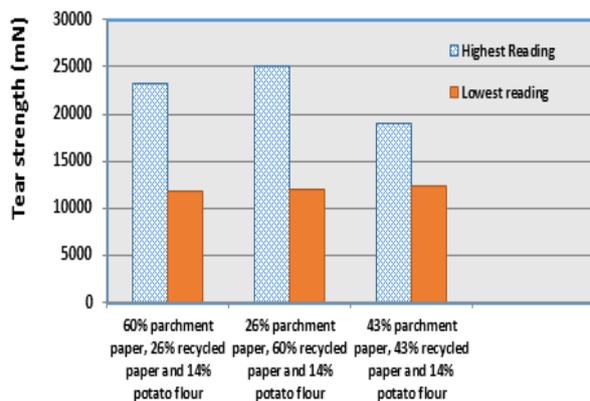


Fig. 2 Tear strength graph for three different composition.

Fig. 3 below shows the result presented in the bar graphs and shows the analysis data for three different composition. Each composition conducted a test of ten specimens. Graph in Fig. 3 also explains that the composition of 43% parchment paper, 43% of recycled paper and 14% of potato flour records high resilience values and the average of the burst strength is 856 kPa. The graph also shows that for the composition of 26% parchment paper, 60% of recycled paper and 14% of potato flour records an average of 780.8 kPa burst strength meanwhile for composition of 60% parchment paper, 26% of recycled paper and 14% of potato flour records an average of 697.1 kPa burst strength. This shows that the composition of 43% parchment paper, 43% recycled paper and 14% of potato flour has a high resilience compared to others.

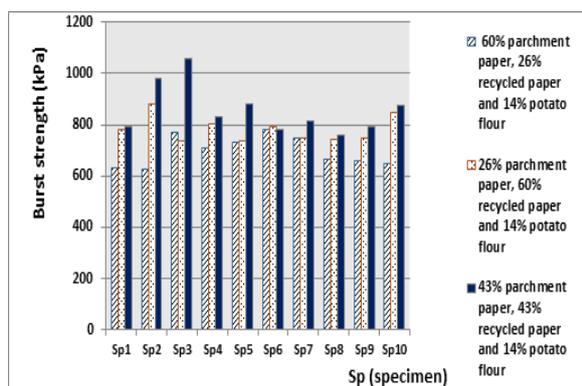


Fig. 3 Burst strength graph for three different composition.

Fig. 4 describes the highest and the lowest result of tensile strength for three different compositions. The composition of 60% parchment paper, 26% recycled paper and 14% of potato flour shows 171.3 N tensile strength. The composition of 26% parchment paper, 60% recycled paper and 14% of potato flour shows 207.7 N tensile strength. Meanwhile the composition of 43% parchment paper, 43% recycled paper and 14% of potato flour shows 224.0 N tensile strength which clearly seen that this composition has the maximum value.

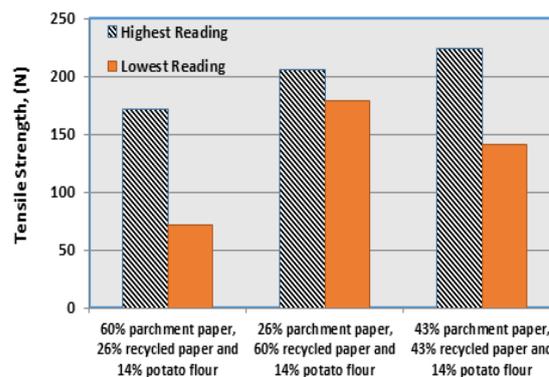


Fig. 4 Tensile strength graph for three different composition.

4.0 Conclusion

In conclusions, the nature of apple packing plays an important role in the packaging industry. Based on the research found that the production of papers from parchment paper and recycled paper affects the nature of the paper itself. Each different composition has different endurance properties. Overall, the compositions containing more recycled paper has strong strength compared to the compositions containing parchment paper, this was proved from the result of 26% parchment paper, 60% recycled paper and 14% of potato flour composition gained the highest tear strength that was 25.1 N. Moreover, this study has proven that parchment paper and recycled paper can reduce the use of non-easily removable materials. Results from the bursting testing machine and tensile testing machine have shown that composition 43% parchment paper, 43% recycle paper and 14% of potato flour can withstand high pressure over other compositions. The value of the burst strength and the tensile strength is 856 kPa and 224.0 N respectively.

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