Separation of Palm Mesocarp Fiber and Nut by Air Classifier using Air Disturbance System

Ahmad Hafizuddin Zakaria[a], Mohamad Amran Mohd Salleh[a,b,*], Mohd Halim Shah Ismail[a,b], Mustafa Kamal Abdul Aziz[c]

[a]*Chemical Engineering Department, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia*
[b]*Institute of Advanced Technology, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia*
[c]*Center of Lipids Engineering and Applied Research, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia*
**Corresponding Autor's Email: asalleh@upm.edu.my*

Abstract: The air classifier is a system that used the rising air to separate the specific particles from other mixtures by applying the principle of gravity and air velocity. Air classification is a popular method used by the Malaysian palm oil mill industry to separate the mixture of palm mesocarp fibres and nuts kernel shell (press cake). However, current technology that used by the local palm oil mill industry usually based on know-how without supporting scientific data to improve the separation efficiency. The mesocarp fibres properties typically tend to stick to each other's after the screw press process affected the ability of separation. The result shows the solution of the previous study where the clod formation of fibre became the main obstacle by introducing the air disturbance system. This system introduces air turbulence to the separator column to break the clod formation of fiber and improve the separation efficiency by 30%. This study will create a foundation to enhance the understanding of the fundamental of air classification and enhance its design efficiency.

Keywords: Palm fibre and nut, Air velocity, Air Classification, air disturbance, and separation efficiency.

INTRODUCTION

This paper is presented to show the study of separation of mesocarp fibre from kernel shell by using the air classifier in the lab scale. The purpose of this study is to create a fundamental understanding of using stream air in the separation and increase its capability regarding separation efficiency. The main obstacle is the air distribution in the separator column are not distributed evenly and the mesocarp fibre tend to form a clod during separation took place where this clod has more weight, and the terminal velocity won't be the same compared to the single tread of the fibre during separation process took place. The result shows better separation at highest velocity while lower velocity provided low separation efficiency due to its capability to overcome the uneven air distribution through the column and to break the clod of fibre. To overcome all the issue, the air disturbance system has been introduced where this system injected air stream into the separation column.

MATERIALS AND METHODS

The materials used in this study were press cake (product of screw press process at palm oil mill). The palm fruit will be undergoing the sterilizer, stripper and digester process before it can be press to gain the oil [3]. Usually, the initial moisture content this fibre is around 40% [4]. The fibre and nuts were weight to 50 grams and put into the plastic bag. Each experiment ware repeated three times. The control panel of the industrial air classifier prototype was used to control the air velocity. The percentage of separation is calculated by the weight of left over fibre form original. The air velocity was measured using a calibrated hand-held anemometer (AVM-07, Prova). Like the previous

study, 4 group of sample ratio (fibre to kernel nut ratio) which is 20% of fibre, 40% of fibre, 60% of fibre and 80% of fibre to kernel nut ratio were prepared.

RESULTS AND DISCUSSION

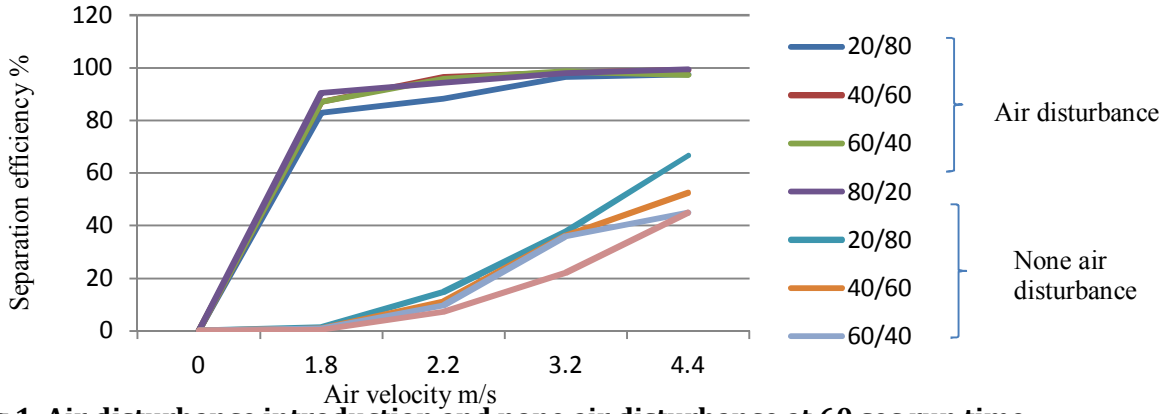

Fig 1. Air disturbance introduction and none air disturbance at 60 sec run time

Fig. 1 is a graph represents the velocity versus percentage of separation within 60 seconds of runtime. This experiment was conducted as continuity from the previous study where the introduction air disturbance system as countermeasure the central issue of the previous trial where the clod of fibre was formed during the separation and make it difficult to separate. The air velocity was categorised into several levels from 0 m/s to 4.4 m/s which is the limitation of the blower. From the graph, it is understood that the air disturbance system gave significant impact to the result where separation reached more than 90% at 3.2 m/s of velocity. It's because the air disturbance system was able to break the forming cloud of fibres and gain such significant different result from the previous trials.

CONCLUSION

The different density and size of fibres, kernel and shell, make it possible to separate by the air flow. Some study has done show that because of fibres can be float by 1 to 2 m/s velocity, but due to quantity, cross-sectional area and fibres properties higher flow rate is needed the success of the separation. However, with the introduction of air disturbance system can help to enhance the separation result significantly with less time consume and less air velocity. In the future, another mechanism of disturbance system will be introduce such as a vibration system to see how the impact on the separation process.

ACKNOWLEDGEMENT: I would like to express my most profound appreciation to all those who provided me the possibilities to complete this report. A special gratitude I give to my supervisor Assoc. Prof. Dr. Mohamad Amran Mohd Salleh who contribution is stimulating suggestion and encouragement, helped me to coordinate my research.

REFERENCES

[1] Maycock J.H , General Description of the palm oil milling process, May 1985
[2] Ologunagba F.O, Olutayo L.A & Ale M.O, Development of pulm nut and fiber separator, 2010.
[3] Owolarafe O.K., Olabige M.T. & Faborode M.O., Physical and mechanical properties of two varieties of fresh oil palm fruit. 2005.
[4] Maycock J.H, Laboratory and milling control, Jan 1986.