# Binary mixture of the decanter cake and fiber from the oil palm industry waste as a potential solid fuel

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**ABSTRACT** – This study relates to the production of solid fuel using waste products from the palm oil processing industry. Enclosed, the purpose of the study was to produce solid fuel from a binary mixture of decanter cake with the palm fiber. The sample was created based on decanter cake: fiber weight ratio, weight of loading and type of fiber. The sample were shaped into hexagons (radius= 2.34cm and length 8.0 cm). The sample prepared was tested for moisture contents, compression and calorific value. The study found out that the best mixture ratio among all of the sample ratio were decanter cake:fiber (70:30) with the highest compression test (2016 N) and nearest calorific value (4508 cal/g) compared to the commercial solid fuel which the compression test was 2390 N and calorific was 5321 cal/g.

## 1. INTRODUCTION

The oil palm plantation was being started since 1914 at Malaya before it called Malaysia. The large scale plantation was started around 1960 at all part of the Malaysia. Oil palm was planted for the determination of the crude oil palm. The percentage oil that was been produce from oil palm was only 20% which is the total up of crude palm oil (CPO) and kernel palm oil (KPO). However the percentages of the waste being produced is 80% from the palm oil mill, such as mesocarp fiber, empty fruit bunch (EFB), shell, decanter cake and palm oil mill effluent (POME) [1]. For today, the shell and mesocarp fiber was used to heat up the boiler to produce steam used in the palm oil mill and also produce electricity. Some mill also used the gas trapper to trap the methane gasses from the palm oil mill effluent, to use inside the biogas engine [2]. Malaysian government now had given a lot of attention toward the growth of the oil palm sector in the orchard and the renewable energy from oil palm. Malaysia Palm Oil Berhad (MPOB) was established to increase the palm oil production and quality which this can ensure the development of the oil palm sources will never end and keep growing [3-4]. The purpose of the study was to produce solid fuel from a binary mixture of decanter cake with the palm fiber.

## 2. METHODOLOGY

The decanter cake (DC) and fiber (F) sample was taken from the Kempas Sime Darby Palm Oil Mill at Malacca. The sample of decanter cake and fiber was weighting (approximately 130 ± 5 g by mass) to the ratio of the mixing. Each of the samples was mixing up well based on the DC:F ratio of 100:0, 90:10, 80:20 and 70:30. The samples was has been shaped into hexagons using pressed molding (radius= 2.34 cm and length 8.0 cm) and dried in oven for 24 hours for moisture contents. All prepared samples were compared with commercial hexagon solid fuel based on coconut shell (Starfire brand) in compression test by Ultimate Tensile Machine (UTM) and calorific values by oxygen bomb calorimeter.

## 3. RESULTS AND DISCUSSION

### *3.1 Influence of Moisture toward the Sample*

Figure 1 shows the relationship between the percentage of moisture and compression force based on the DC:F ratio. The highest moisture percentage was at the pure 100% decanter cake while the highest compression force was at DC:F ratio 70:30. Meantime with the fiber added into the mixture, compression test drastically increases and the moisture percentages slightly decreasing. It might be the decanter cake only act as the binder to bind the fiber together while the fiber were the reason the sample can withstand a higher force before breakdown.

Figure 2 shows the relationship between the percentage of moisture and calorific value based on the decanter cake and fiber ratio. The highest calorific value was at the DC:F ratio 70:30 which is 4208 cal/g and pure decanter cake, shows the lowest calorific value. This is might be cause of the water contain decanter cake incompletely removed and affected the calorific value. By adding the fiber into the mixture sample, it automatically improve the percentages of the moisture and also the calorific value of the sample.

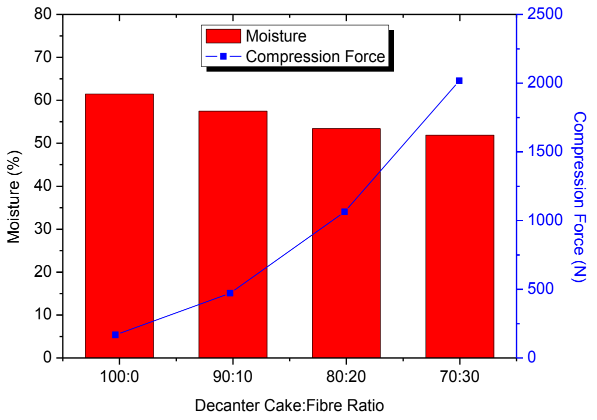


Figure 1 Relationship between moisture and compression force

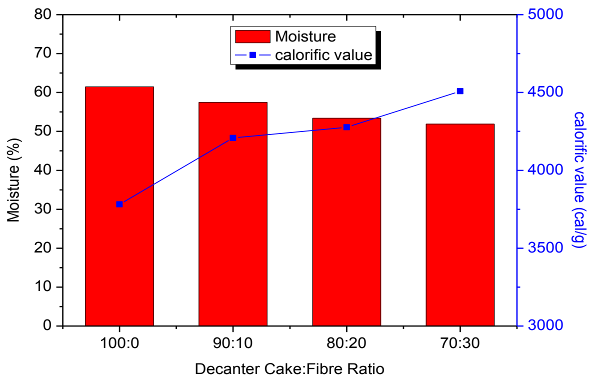


Figure 2 Relationship between moisture and calorific value

### *3.2 Comparison Commercial and Experimental*

Figure 3(A) shows the comparison of compression force between commercial solid fuel and DC: F ratio solid fuel sample. It shows that the compression force for commercial fuel was the highest compression force of solid fuel was the highest compared DC: F ratio solid fuel sample. In term of physical properties, the commercial solid fuel was hard but brittle while the DC:F ratio solid fuel was ductile and elastic. The DC:F ratio 70:30 was the best ratio mixture because the compression force of the sample was nearly closed to the commercial solid fuel compression force.

Figure 3B shows the comparison of calorific value between commercial solid fuel and experimental solid fuel. it show that the calorific value for commercial fuel was highest compared to all DC:F ratio. In term of calorific value, the commercial solid fuel had more carbon contain inside it because of coconut shell based solid fuel compare to the DC:F ratio solid fuel samples. DC:F ratio 70:30 was the best ratio mixture because the calorific value of the sample was nearly closed to the commercial solid fuel calorific value.

## 4. CONCLUSIONS

For comparison, commercial and DC: F ratio sample solid fuel. The DC: F ratio 70:30 sample of solid fuel has the highest compression and greater calorific value, compared to other mixture ratio. But it is not sufficient potentially, compared to commercial solid fuel. However decanter cake mixing with waste materials can increase the improvement of solid fuels compared decanter cake alone.

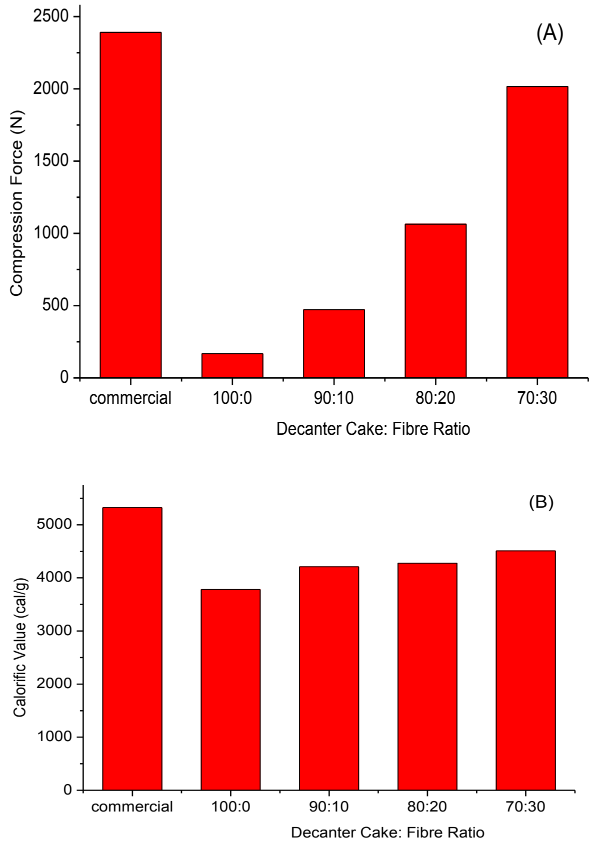


Figure 3: (A) Compression force and (B) calorific value of commercial and DC: F ratio sample

## 5. ACKNOWLEDGEMENT

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