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Preparation and Characterization of Sugarcane Leaves After Reduction Process for Pelleting Biomass

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Abstract

The objective of this research was to study some physical properties of sugarcane leaves residues from chopping and shredding unit. The hammer mill of 3 mm. screen and Khon Kaen 3 sugarcane variety were used present study. The average moisture content of sugarcane leaves was 12.54% w.b. Sieve with an aperture size of A 2.1 mm. and B 2.5 mm. were used. The physical properties were fineness modulus, particle size, angle of repose, static coefficient of friction and bulk density. The average fineness modulus, average particle sizes, average angle of repose and average bulk density were 3.63, 1.15 mm., 54.64° and 110.46 kg.m^{-3}, respectively for A 2.1 mm. screen sieving. The average fineness modulus, average particle sizes, average angle of repose and average bulk density were 4.84, 2.65 mm., 60.21° and 67.36 kg.m^{-3}, respectively for B 2.5 mm. screen sieving. The average static coefficient of friction was 0.53-0.73. The results of some physical properties will be used for further study

Keywords: Physical Property, Sugarcane Leaves, Sieve

1 Introduction

Today, sugarcane cultivation is widespread in all parts of Thailand, that a total sugarcane production area of 10,988,489 rai. (Office of the Cane and Sugar Board, 2017) The trend of sugarcane cultivation in the 2017/2018 season began in March. Sugarcane cultivation is likely to outperform production in the past year, as the world sugar price trend is good condition. (siriwut siampukdee, 2017)

Sugarcane can be used to create all the value added to the industry continuous. In addition to producing sugar, it's also used as raw material to produce ethanol for use as a renewable energy, electricity and tissue. However, in the process of cutting sugarcane is mostly used to burn sugarcane in plantation before cutting, so it opportunity to lose for use as a renewable energy and also contributes to the problem of social and environmental. The solution of problems and the benefits of biomass from sugarcane leaves are used as a renewable energy input into the industrial system by being use as biomass for continuous compaction. Wirash Usha (2016) was produces biomass fuel pellets from sugarcane leaves by using a mobile biomass pelletizer into sugarcane plantation. Nirattisak Khongthon (2017) was development of sugarcane crop residues reducing and pelleting machine for energy use, when chopping and shredding the hammer mill of 3 mm screen has the suitable ability to pelleting biomass.

The pellets biomass materials were limited in compression. sugarcane leaves residues from chopping and shredding has Characteristics and shape of sugarcane leaves after chopping and shredding through different screen size. Characteristics and shape of sugarcane leaves residues from chopping and shredding were through screen with different size may be affect the compression strength, Compression efficiency. It also makes the mechanical properties of the material after the pelleting different. So, the study of some physical properties of sugarcane leaves residues from chopping and shredding unit by The hammer mill of 3 mm. and Sieve with an aperture size of A 2.1 mm. and B 2.5 mm. were information to be used as a basis for further study.

2 Materials and Methods

The objective of this research was to study some physical properties of sugarcane leaves residues from chopping and shredding unit. The hammer mill of 3 mm. screen and Khon Kaen 3 sugarcane variety were used present study. The study was to study the different characteristics of sugarcane leaves. The Classification of sugarcane leaves after reduction process by physical properties were five categories; fineness modulus, particle size, angle of repose, static coefficient of friction and bulk density. As shown in figure (1)

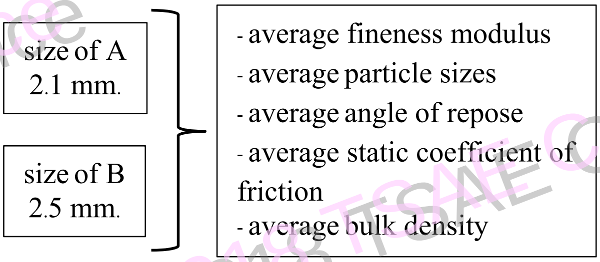

Figure 1 Characterization of Sugarcane Leaves After Reduction Process

Moisture content

All samples of sugarcane leaves were weighed and dried at 105 °C for 48 h in oven-drying. After drying were cooled for an hour and then weighed. The reduction in weight was taken to be the moisture content in sugarcane leaves and was of the form Eq. (1) and shown as figure (1).

$$MC\ (\%) = \frac{(M_1 - M_2)}{M_1} \times 100 \qquad (1)$$

Where M_1 is the weight of the sugarcane leaves drying before, M_2 is the weight of the sugarcane leaves drying, MC is the moisture content sugarcane leaves. (Jun Sun et al, 2016)

Figure 1 moisture content of sugarcane leaves process

Fineness modulus and particle size

Fineness modulus and particle size can be obtained from 300 g sugarcane leaves residues from chopping and shredding unit. Sieve analysis of sugarcane leaves after reduction process was screened through 2.1 and 2.5 mm circular holes. (A. Garcia-Maraver et al, 2015) Determine percent of an aperture size for particle size. As shown in figure (2) and Eq. (2), when F.M. = Fineness modulus

$$D = 0.0041(2)^{F.M.} \qquad (2)$$

Figure 2 Sieve analysis of sugarcane leaves after reduction process

Angle of repose

Angle of repose can be obtained from poured through a funnel to form a cone and should be held close to the growing cone and slowly raised as the pile grows. Stop pouring the material (Free-flowing granular materials are the subject of ASTM C 1444. American Society for Testing and Materials, 1999) As shown in figure (3) and Eq. (3)

$$\Theta = \tan^{-1}[2H/(D_A - d)] \qquad (3)$$

Where H is the height between the base and the top surface, D_A is the diameter of the base of the truncated cone, d is the upper diameter of the truncated cone.

Figure 3 angle of repose of sugarcane leaves after sieve analysis process

Static coefficient of friction

Determination of static coefficient of friction for the design of components of biomass pelletizer. Coefficient of friction between the material and sugarcane leaves after Sieve analysis process is expected to be depending on material type. The angle of friction (α) is the angle between a tilted plane and the horizontal plane at which sugarcane leaves after Sieve analysis process overcomes the static friction and begins to slide down the surface of the tilted plane as it is tilted slowly and gradually. The coefficient of friction was determined according to the following equation. (A. K. Zaalouk and F. I. Zabady, 2009) As shown in figure 4 and Eq. (4)

$$\mu = \tan\alpha \qquad (4)$$

Where μ is static coefficient of friction

Figure 4 Determination of static coefficient of friction

Bulk density

The bulk density of sugarcane leaves after sieve analysis process was determined by measuring the weight of sugarcane leaves after sieve analysis process and measured in a standard container of a given size and shape. The volume was used in mass/volume. (Nazlı Savlak et al, 2016) as shown in Eq. (5) The bulk density was calculated by dividing the mass of the sugarcane leaves after sieve analysis process were leveled to the top surface of the container and were weighed using a digital balance. (Zhijia Liu et al, 2013).

$$\rho_b = \frac{m_b}{V_b} \qquad (5)$$

3 Results and Discussion

A study some physical properties of sugarcane leaves residues from chopping and shredding unit. The hammer mill of 3 mm. screen and Khon Kaen 3 sugarcane variety were used present study. Sieve with an aperture size of A 2.1 mm. and B 2.5 mm. were used. The average moisture content of sugarcane leaves was 12.54% w.b.

Average fineness modulus and Average particle size of sugarcane leaves with an aperture size were 3.6340 and 1.15 mm. for A 2.1 mm, Average fineness modulus and Average particle size of sugarcane leaves with an aperture size were 4.8394 and 2.65 mm. for B 2.5 mm, respectively. As shown in table (1)

Table 1 Average fineness modulus and Average particle with an aperture size A and B

an aperture size	A	B
Average fineness modulus	3.6340	4.8394
Average particle size (mm.)	1.15	2.65

Average angle of repose of sugarcane leaves A and B are similar. As shown in table (2)

Table 2 Average angle of repose of sugarcane leaves A and B

an aperture size	A	B
Average	54.64±1.39	60.21±0.52

static coefficient of friction after Sieve analysis process with plywood plate, iron plate, plastic sheet and zinc sheets were 0.53-0.73. As shown in table (3)

Table 3 static coefficient of friction after Sieve analysis process

an aperture size (avg)	static coefficient of friction			
	plywood plate	iron plate	plastic sheet	zinc sheets
A	0.64	0.73	0.55	0.68
B	0.55	0.71	0.53	0.65

Bulk density of sugarcane leaves after sieve analysis process with an aperture size A and B were 110.46 kg.m^{-3} and 67.36 kg.m^{-3}. As shown in table (4)

Table 4 Bulk density of sugarcane leaves after sieve analysis process with an aperture size A and B

an aperture size	A	B
avg	110.46±1.31	67.36±1.06

Table 1-4 shows the results of the study on some physical properties of sugarcane leaves After Reduction Process for Pelleting Biomass and Khon Kaen 3 sugarcane variety were used present study. The physical properties were fineness modulus, particle size, angle of repose, static coefficient of friction and bulk density. The physical properties can be summarized as shown in table (5)

Table 5 Summary of physical properties after reduction process for pelleting biomass

Parameter	an aperture size	
	A	B
moisture content (% w.b.)	12.54% w.b.	
angle of repose (°)	54.64	60.21
static coefficient of friction		
- plywood plate	0.64	0.55
- iron plate	0.73	0.71
- plastic sheet	0.55	0.53
- zinc sheets	0.68	0.65
bulk density (kg.m^{-3})	110.46	67.36
Fineness modulus, F.M.	3.6340	4.8394
average particle sizes mm.	1.15	2.65

4 Conclusions

The results of the study on the physical properties of cane leaves after after reduction process and sieve with an aperture size for Pelleting Biomass was to know the characteristics of sugarcane leaves; fineness modulus, particle size, angle of repose, static coefficient of friction and bulk density. The characteristics can be basic information in the design considerations and use the device that is used properly; conveyor design, mixing tank design and pelletizer design

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