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PREPARATION AND CHARACTERIZATION OF BAGASSE ASH

Yin Maung Maung[1], Than Than Win[2], Aye Thida Oo[4]
[1, 2, 4,] Department of Physics, University of Yangon, Yangon, Myanmar
[1]dryinmgmg@gmail.com, [2]thannthannwinn@gmail.com, [4]drayethidaoo@gmail.com
San San Htwe[3], Ko Ko Kyaw Soe[5]
[3]Department of Physics, Dagon University, Yangon, Myanmar
[5]Department of Physics, Meiktila University, Meiktila, Myanmar
[3]sansanhtwe296@mail.ur, [5]dr.kokokyawsoe@gmail.com

***Abstract*— The bagasse was packed in the air tight and placed inside electric control furnace and burnt at a temperature of 1200˚C for 3h and 6h to obtain bagasse ash. After firing, it was characterized by X-ray diffraction (XRD). Bio-char disk (pellet) was formed by following appropriate amount of silica gel, PVA and DIW. They were annealed at 110˚C for 3h to be binder burnt-out. They were annealed at 600˚C for 1h to be more rigid. The bagasse ash ceramics were annealed at 1200˚C for 1h, 2h and 3h. Microstructural properties of bagasse ash ceramics were characterized by scanning electron microscope (SEM). Physical properties such as firing shrinkage and density of all Bio-char ceramics were determined.**

***Index Terms*—Bagasse, XRD, SEM**.

I. INTRODUCTION

Sugarcane is a member of the grass family. Sugarcane is a tree-free renewable resource and one of the most important agricultural plants that grown in hot regions. Sugarcane is "carbon neutral" (i.e. emissions are equal to energy generated) and is the product of choice in the manufacture of bio-fuels due to its high energy conversion rate. Bagasse is lateral production of sugarcane that after treatment of sugarcane in the form of light yellow particles is produced. The chemical composition of this product are cellulousfibers, water and some soil soluble material such as cube sugar, by passing time cube *sugaris converted alchol also the evaporation of* bagasse fibre produce the metane gas which can cause fire in some circumstance[1].Bagasse is composed of fiber and pith, the fiber is thick walled and relatively long (1.4mm)[2]. Bagasse is a major by-product of sugar industry which finds a very useful utilization in the same industry as an energy source. Sugarcane consists of 25-30% bagasse whereas sugar recovered by the industry is about 10%. Bagasse is also used as a raw material for paper making due to its fibrous content and about 0.3 tons of paper can be made from one ton of bagasse[3]. Bagasse is a byproduct during the manufacture of sugar and it has high calorific value. It is utilized as a fuel in boilers in the sugar mills to generate steam and electricity[4].The bagasse is used in the energy production (steam/electricity), fuel, hydrolysis, paper pulp, cellulose and wood veneer. The sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemicellulose and 25% of lignin. Each ton of sugarcane generates approximately 26% of bagasse (at a moisture content of 50%) and 0.62% of residual ash[5,6].The bagasse ash is the remains of fibrous waste after the extraction of the sugar juice from cane.In many tropical countries there are substantial quantities of bagasse and husks from rice both are rich in amorphous silica, which react with lime[7,8].The bagasse ash is a pozzolanic material that would otherwise require disposal[9].

II. EXPERIMENTAL PROCEDURE

A. Sample Preparation

The sugarcane was collected from Yangon region, Myanmar pictured in Fig. 1. The sugarcane waste, bagasse (300 g) was dried under sunlight to reduce the moisture content in bagasse shown in Fig. 2. The dry bagasse was ground with a grinding machine and placed inside electric furnace. After firing at 1200°C for 3h and 6h, bagasse ash was shown in Fig. 3 was obtained. This bagasse ash was characterized by XRD (X-ray Diffraction).By observing the XRD spectrum, the XRD structure of bagasse ash at 1200°C for 3h was formed to be better than that of bagasse ash 1200°C for 6h. So, the bagasse ash for 1200°C for 3h was chosen for further investigation. This bagasse ash was mixed thoroughly with silica gel, polyvinyl alcohol and distilled water. It was mould-pressed and bio-char pellet was formed and the figure was shown in Fig.4. The samples were dried in an open air at 110°C for 3h to expel any moisture. Bio-char disk (pellet) was then fired in a digital electric furnace at 600°C for 1h.The bagasse ash ceramics were annealed at 1200˚C for 1h, 2h and 3h. Scanning Electron Microscope (SEM) characterization was performed to analyze their microstructural properties. The physical properties of bagasse bio-char ceramics will be investigated. The summarized of sample preparation was shown in Fig. 5(a&b).

Fig. 1. The Photograph of Sugarcane

Fig. 2 .The photograph of the dry Bagasse

Fig .3. The photograph of the dry Bagasse Ash

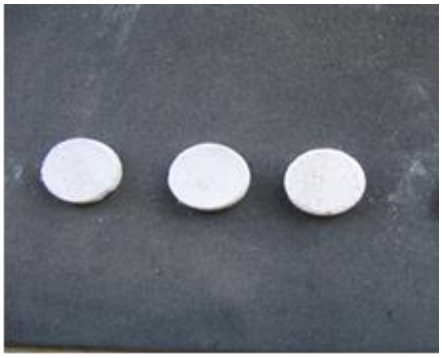


Fig. 4 .The photograph of Bagasse Ash specimens

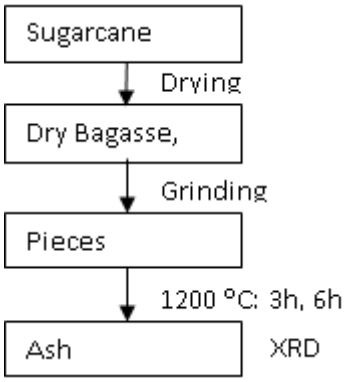


Fig. 5(a) Schematic representation of bagasse ash

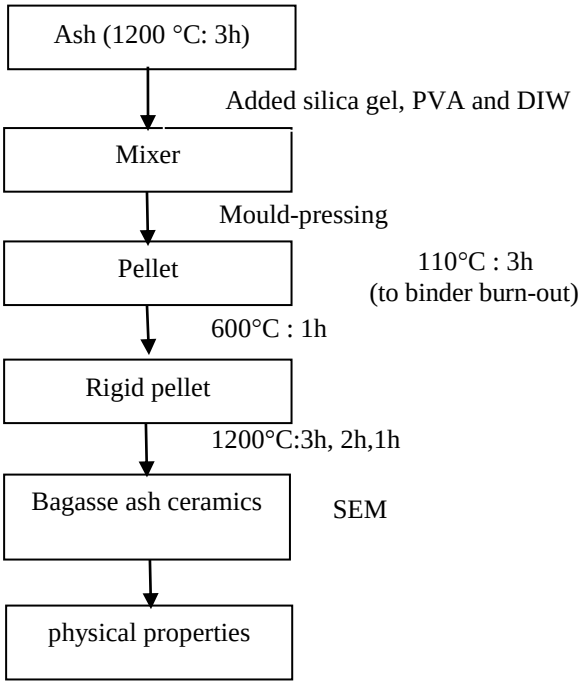


Fig. 5(b). Schematic representation of bagasse ash ceramic

III. Results and Discussion

A. XRD Analysis

The XRD spectrum of bagasse ash at 1200˚C for 3h was given as Fig.6(a). From the fig it was formed that the bagasse ash contained four different compounds such as SiO_2, TiO_2, SiC and Ti_5Si_4. As a SiO_2 phase, (111) and (311) peaks were observed at 22.352 deg and 36.050 deg. As a TiO_2 phase, (1-21), (123) and (101) peaks were observed at 29.176 deg, 30.254 deg and 31.744 deg. As a SiC peaks were observed at 50.821 deg. As a Ti_5Si_4 phase (120), (211), (310),(121) and (004) peaks were observed at 30.824 deg, 31.046 deg, 42.498 deg, 32.143 deg and 27.447 deg.

The XRD spectrum of bagasse ash at 1200˚C for 6h was given as Fig.6 (b). From the fig it was formed that the bagasse ash contained two different compounds such as SiO_2 and TiO_2. As a SiO_2 phase, (011) peak was observed at 26.636 deg. As a TiO_2 phase, (-122), (1-22), (-108),(0-26),(022),(-206) and (-204) peaks were observed at 27.542 deg, 28.644 deg ,30.001 deg, 31.476deg, 33.100deg, 34.310deg and 34.805deg. Structural properties of Bagasse ash at 1200°C for 3h and 6h was shown in Table 1 and2.

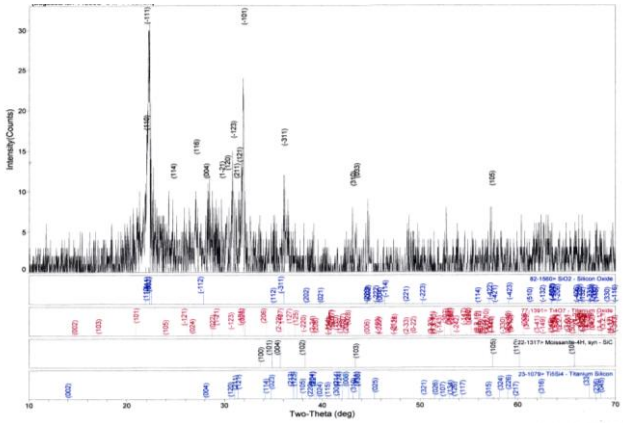


Fig.6 (a) XRD pattern of Bagasse ash at 1200°C for 3h

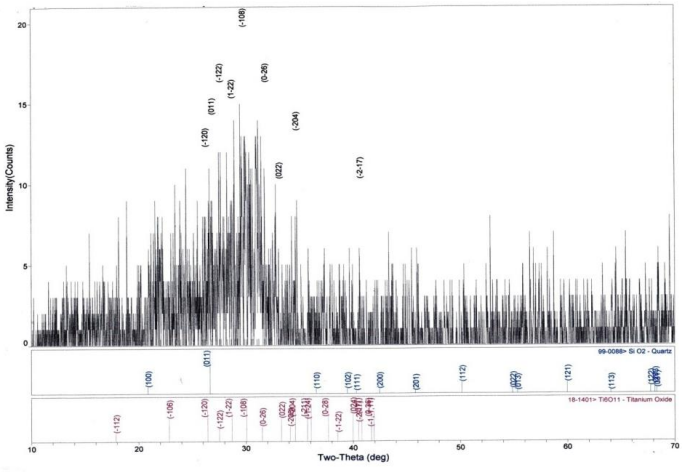


Fig.6 (b) XRD pattern of Bagasse ash at 1200°C for 6h

TABLE I. STRUCTURAL PROPERTIES OF BAGASSE ASH AT 1200˚C FOR 3H

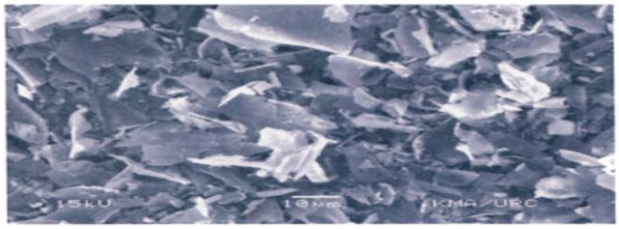
	Compound	*Peaks*	*2θ (deg)*	*d(A˚)*
Bagasse Ash (1200˚C : 3h)	SiO_2	(111)	22.352	3.9741
		(311)	36.050	2.4893
	TiO_2	(1-21)	29.176	3.0582
		(123)	30.254	2.9517
		(101)	31.744	2.8165
	SiC	(105)	50.821	1.6057
	Ti_5Si_4	(120)	30.824	2.8985
		(211)	31.046	2.8782
		(310)	42.498	2.0670
		(121)	32.143	2.8872
		(004)	27.447	3.2188

TABLE II. STRUCTURAL PROPERTIES OF BAGASSE ASH AT 1200˚C FOR 6H

	Compound	*Peaks*	*2θ (deg)*	*d(A˚)*
Bagasse Ash (1200°C : 6h)	SiO_2	(011)	26.636	3.3439
	TiO_2	(-122)	27.542	3.2359
		(1-22)	28.644	3.1138
		(-108)	30.001	2.9760
		(0-26)	31.476	2.8399
		(022)	33.100	2.7041
		(-206)	34.310	2.6115
		(-204)	34.805	2.5755

B. SEM Analysis

The microstructure of bagasse ash was shown in Fig. 7(a-c). Distribution and orientation of filter in the bagasse ash was morphologically investigated using JSM-5610 Scanning Electron Microscope (SEM) in order to determine the microstructure of bagasse ash. The microstructure of bagasse was examined at accelerating voltage of 15 kV. In Table 3 was showed the fiber length of bagasse ash in the different carried out. From this table, the maximum fiber length 11.54 µm was found for 1200°C for 3h, 18.97µm for 1200°C for 2h and 26.30 µm for 1200°C for 1h respectively. The fiber length is critical factor that need to be considered due to necessity for effective drying condition of composite material.



(a)

(b) **(c)**

Fig. 7 SEM image of Bagasse Ash at 1200°C for(a) 3h (b) 2h (c) 1h

TABLE III. FIBER LENGTH OF BAGASSE ASH IN THE DIFFERENT ANNEALING TIME AT 1200°C

Fiber length (µm)		
1200°C (1h)	*1200°C (2h)*	*1200°C (3h)*
5.19	1.72	4.62
18.15	17.59	6.54
8.15	10.69	3.46
26.30	18.97	11.54

IV. PHYSICAL ANALYSIS

A. Firing Shrinkage

The firing shrinkage value of bagasse ash is a parameter for the process classification on raw material and on the conditions employed in the annealing treatment. In this work, due mainly to the small mass used in the reactions, it was determined the weight of natural dried bagasse and bagasse ash. In Table 4 was showed the weight loss for each reaction of bagasse in the different times carried out.

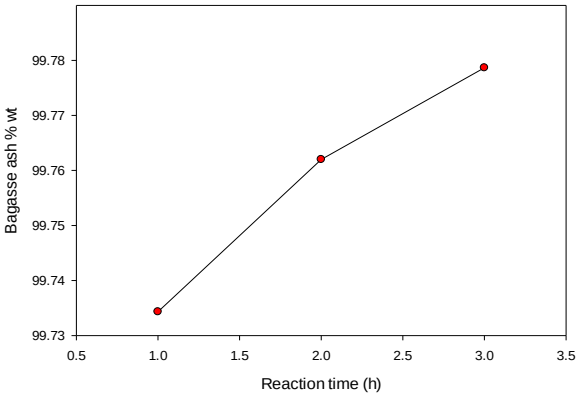


Fig. 8 Variation of Bagasse Ash with reaction time

The first assessment after any stage of bagasse treatment was the yield measurement, which is the crucially dependent on raw material and on the conditions employed in the heat treatment. In Table 4 was showed the weight loss for each reaction of bagasse in the different time carried out. Analyzing Table 4, it was verified that there was a decline in yields, and hence, an increased loss of weight in function of reaction time.

TABLE IV. LOSS OF WEIGHT IN THE DIFFERENT TIME OF SUGARCANE BAGASSE

Time reaction (h)	*Initial Weight(g)*	*Final Weight(g)*	*Shrinkage*
1	300	0.797	99.73
2	300	0.714	99.76
3	300	0.664	99.77

B. Density

The density at any point of a homogeneous object equals its total mass divided by its total volume. The mass density of a material varies with temperature and pressure. The weight of Bagasse ash dependence of the density was represented in Fig. 9. From the graph, it was obtained the maximum density at 0.914 g of bagasse ash, mainly on account of access to these components by the silica gel and PVA. Table 5 presented the calculated parameters of density.

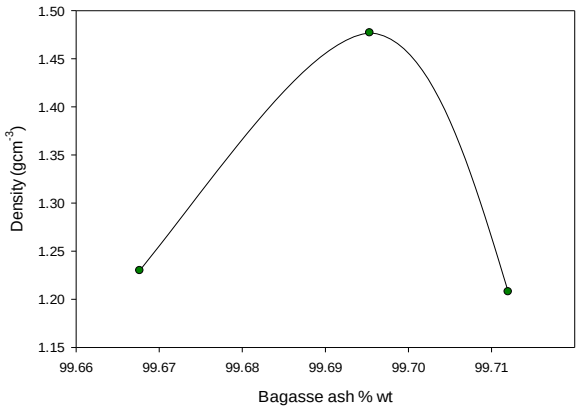


Fig. 9 Density versus the weight of Bagasse Ash

TABLE V. DENSITY AND VOLUME IN THE DIFFERENT WEIGHT OF BAGASSE ASH

Time reaction (h)	***Weight(g)***	***Bagasse ash % wt***	***Volume (cm^3)***	***Density(g/cm^3)***
1	0.997	99.668	0,810	1.230
2	0.914	99.695	0.619	1.477
3	0.864	99.712	0.715	1.208

V. CONCLUSION

Preparation and characterization of Bagasse ash have been studied. At first, it was found that SiO_2, TiO_2, SiC and Ti_5Si_4 compounds were found at 1200˚C for 3h and 6h. SEM investigation indicated the fiber length of bagasse ash. In the physical properties measurements, the bagasse ash % wt increased with increasing the reaction time. It was observed that the maximum density was determined to be 1.477 gcm^{-3}. In our future study we will investigate replacing cement by sugarcane bagasse ash as pozzolan.

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REFERENCES

[1] Abdolkarim Abbasi and Amin Zargar, "Using bagasse ash in concrete as pozzolan," Middle-East Journal of Scientific Research,vol.13(6),pp.716-719,2013

[2] J.O. Agunsoye and V.S.Aigbodion, "Bagasse filled recycled polyethylene bio-composites: Morphological and mechanical properties study," Results in Physics, vol(3),pp.187-194,2013

[3] NOOR-UL-AMIN, "Chemical Activation of Bagasse Ash in Cementitious System and its Impact on Strength Development," J.Chem.soc.Pak,vol.32(4),2010

[4] D.Govindarajan and G.Jayalakshmi, "XRD,FTIR and SEM studies on calcined sugarcane bagasse ash blended cement, "Archives of Physics Research,vol.2(4),pp.38-44,2011

[5] Mrs.U.R.kawade, Mr.V.R.Rathi and Miss Vaishali D.Girge, "Effect of use of Bagasse Ash on Strength of Concrete," International Journal of Innovative Research in Science, Engineering and Technology, vol.2(7),pp.2997-3000,2013

[6] R. Srinivasan and K.Sathiya, "Experimental Study on Bagasse Ash on Concrete," International Journal for Service Learning in Engineering,vol.5(2),pp.60-66,2010

[7] Mohammed Abdullahi MU'AZU, "Influence of Compactive Effort on Bagasse Ash with Cement Treated Lateritic Soil,".

[8] Mohammed Abdullahi MU'AZU, "Evaluation of Plasticity and partical Size Distribution Characteristics of Bagasse Ash on Cement Treated Lateritic Soil" Leonardo Journal of Sciences,(10),pp.137-152,2007

[9] Nuntachai Chusilp, Napongsatorn Likhitsripaiboon and Chai Jaturapitakkul, "Development of bagasse ash as a pozzolanic material in concrete"Asian Journal on Energy and Environment,vol.10(03),pp.149-159,2009