Utilization Of Farming Bi-Products In Construction Industries

Archana katroliya , Vinod Gautam, Archana Tiwari

Department of Civil Engineering, M.I.T.S, Gwalior

E-mail:- archi.katroliya@gmail.com

Abstract: - Utilization of industrial and Farming bi-products in the industry has been the focus of research for economical, environmental, and technical reasons. Farming bi-products are waste-product of the farming industry, This waste-product is already causing serious environmental pollution which calls for urgent ways of handling the waste. For industrial use ash can be chemically and physically characterized. Economic, lightweight clay resources in the shape of bricks and blocks are extensively used in recent structure. They may be obtained by adding of rice shell, rye straw, etc, as absorbent forming resources. Rice shell is a main by-product of the rice mill industry. Its consumption as a important product has forever been a problem. Various technologies for consumption of rice shell through genetic and thermo chemical conversion are being developed.

The purpose of this work is to develop lightweight clay materials with clay matrix and filler of rice shell and examine their main physic mechanical properties. The results obtained allow to suppose that the resources synthesized on the basis of ravage resources can be used as lightweight resources for structure purpose.

Key words:- Lightweight clay resources, agro-waste**,** concentration; density, compressibility, Microstructure, etc.

Introduction:- Researches all over the universe today are concentrate on ways of utilizing either industrial or farming wastes as a source of raw materials for the industry. For controlling environmental pollution ,earning foreign exchange and economic groth can be get by utilization of wastes. the light weight clay materials in the form of clay bricks and blocks are more widely used in modern construction. The way of its obtaining is to add in clay different porous forming agents - including rice shell, straw of rye and barley, etc. [1-3]. The utilization of these combustible resources as porous forming agents for production of lightweight insulating bricks has two main merits - the need of small amount of energy due to the large amount of energy that is released during combustion by-product. In the same time this is an alternative method for the efficient consumption of large amounts of waste materials [4-6]. The rice shell is a major co-product of rice manufacturing. Investigations showed that the interest towards rice shell is growing universal. It is connected with the leading role of rice as a grain culture from which waste products cannot be used as cooking, compost or firewood. In this aspect, the problem with the utilization of the large amounts of this material elimination of certain ecological threat remains to be solved [7-11]. A number of review have been dedicated to rice shell and the products obtained from its thermal degradation at different conditions [12-16].

The aim of this work is to develop lightweight ceramic materials from clay and rice husk, and to investigate the effect of varying rice husk and clay contents on the insulating properties of kaolin clay firebrick.

2. Experimental method And Material used:-

1. ***Methods***

The materials obtained were characterized by X-ray analysis, differential thermal analysis (DTA) and scanning electron microscopy (SEM).

The X-ray analyses were carried out by the method of powder diffraction using X-ray apparatus equipped with goniometer URD-6 (India) with cobalt anode and K_α mission.

Density(g/cm3)=Mass/Volume

One experiments were performed on an apparatus for complex thermal analysis (STA 449 F3 Jupiter), NETZSCH – India.

IJERT

The micrographs were taken using scanning electron microscope Tesla BS 340 (Birla cement). The SiO_2 content in the solid residue was determined after treatment with hydrofluoric acid.**Materials**

As the main raw materials were used**:**

i. Kaolin mud with impurity of iron and organic compounds, whose composition is given in Table II

ii. rice shell - the present study was carried out with rice husk obtained during processing of rice variety. Krasnoyarsk 425 grown in Bulgaria. Before use, the rice husk were thoroughly washed – three times with tap wate r followed by three times with deionised water to remove adhering soil, clay and dust, boiled for an hour to desorbs any impurities and finally, dried at 101 ^{0}**C** overnight. The dried husk were ground in rotary cutting mill and sieved manually with 0.64–0.13 mm sieves.

This starting material was used for all further studies [3].

TABLE Ist
OXIDE COMPOSITION OF CLAY

Oxide	Percentage Weight
SiO_2	54.08
Al_2O_3	28.12
LOI	9.03
Fe_2O_3	2.15
K_2O	2.04
TiO_2	1.17
MgO	1.59
CaO	1.05
Na_2O	0.92

3.RESULTS AND DISCUSSION

A. Studies on the rice shell

1. Derivatographic studies

The improvement of many technological methods for utilization of rice shell by thermal decomposition cannot be accomplished without profound studies on the processes of their thermal destruction by DTA-analysis (fig.1). The present derivatographic studied were carried out under the following conditions:

i. in static air, under heating, first the physically adsorbed water was released (6%), followed by the burning of the organic components to obtain solid residue (25% residue containing mainly SiO_2 - 92%).

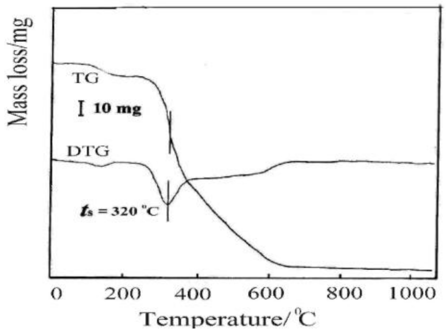


Fig.1DTA and TG curves of RH samples burning in air

It is known [12-14] that the thermal destruction of rice shell has three stages: ventilation (41-151degreeC), removal of unstable organic components (216 – 351) and blazing of carbon compounds between 340-680degree centigrade . From thermo gravimetric calculations based on the data obtained from DTA, the kinetic characteristics of the destruction processes can be determined, as it has been already reported earlier [15,16]. The DTA analysis of rice shell put in oxidative medium shown in (Fig.1)and water released up to 4.6percent at temperature range80 to 182 degree centigrade. Thermal devastation process are stated at 220degree Centigrade and completed at 630 degree Centigrade and in this process mass reduces up to 74.5 percent. The mass reduction at 270C was 11 % and at 450C – 52 %.In the presence of air and nitrogen thermal devastation process proceed with temp of 320 degree Centigrade and 360 degree Centigrade respectively.

2. *X- ray analysis*

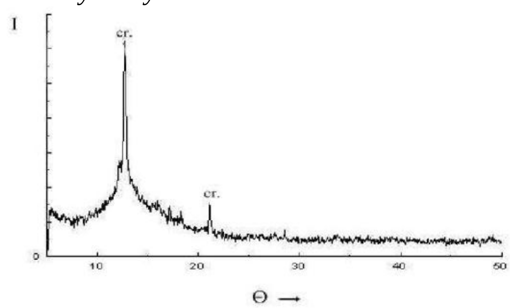


Fig. 2 Thermal process with air at 905degree centigrade for x –ray analysis of rice shell.

For composite material uncooked and thermally treated rice shell can be used. it is necessary to know

IJERT

what changes happened in structure during this process. The determination of the temperature up to which the powder is amorphous is significant because the crystalline product has lower reactivity than the amorphous one. The diffractogram of sample oxidized at 905degree Centigrade presented in fig. 2 shows a strong peak (d = 4.07 Å) equivalent to the high - crystalline phase of silica - **α**-cristobalite, and distinguishable peak at d = 2.48 Å (point also for **α**-cristobalite). Quartz was not detected. The rice shell used in our work, were heated in oxygen medium in the temperature range 400 - 1000 °. For the purposes of these experiments have been chosen RH burned at 600 °. According to X-ray analysis carrie d out at temperatures around 600 ° C, silicon oxide in rice husk is still in active the amorphous form, which combined with the porous structure of the ash makes it very reactive in the process of sintering the samples.

B. Analysis on the clay

The DTA and TG curve of clay with phase of feldspar, magnetite quartz and kaolinite are shown in Fig 3. The one percent weight losses also present. At 340 ^{0}C exo-effect appears due to the presence of minerals magnetite, which is
accompanied by about 1, 15% loss in weight, it is followed by a wide endo-effect at about 540 ^{0}C, due to the collapse of the clay materials and chemical separation related water in the clay, which is associated with about 6% weight loss. For formation new phase exo-effect appear at about 955 ^{0}C. This process is reducing the mass 1-22 percent.

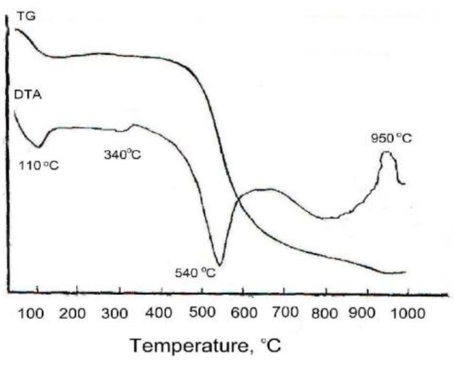


Fig. 3 curves of clay with TG and DTA

Technological properties of clay materials mainly depends on their degree of dispersion [17].Granumatic composition of clay affects the number of properties density, compressibility, porosity, etc.

The result show that the largest amount is a fraction with particle size less than 62.5 micro meter.

Distribution of table given below in table 2nd

Table 2nd

GRANULO METRIC COMPOSITION OF CLAY

Particle size Micro Meter	Division. %
≥500	1
500-125	8
125-62.5	10
≤62.5	81

It is known that the grain composition of the clay plays an important role on the frost resistance [17]. Data from the definitions of grading of clay used are a prerequisite for high frost resistance of bricks made from it.

Studies on the clay materials with addition of rice shell
Based on a clay matrix and thermally treated or raw rice shell 11 kinds of samples were synthesized which composition is given in Table 3rd .

The specimens were formed by semi-dry pressing on hydraulic press “Carl Zeiss Yena” (Germ any). Brick were dried to approximately 5-7 % moisture content. The dried brick were finally fired in a furnace at temperature of 1000 ^{o}C.

This firing process caused the burning out of the rice husk in the finished bricks.

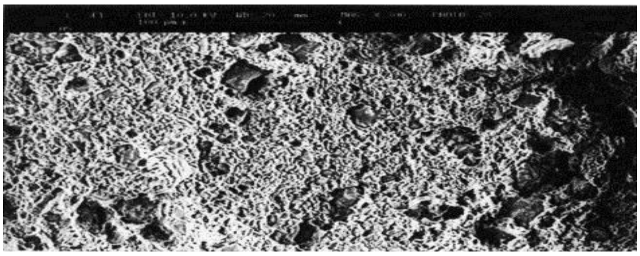
Table 3rd
Composition of Sample

Ne	**Clay**	**Raw rice husk**	**WRHA**
1	**100**	**…….**	**………**
2	**99**	**2**	**……..**

IJERT

3	**98**	**3**	**………..**
4	**97**	**4**	**………**
5	**96**	**5**	**…………**
6	**95**	**6**	**…….**
7	**99**	**…….**	**3**
8	**98**	**……**	**4**
9	**97**	**……….**	**5**
10	**96**	**……..**	**6**
11	**95**	**………..**	**7**

Fig. 4 presents electron-scanning microphotograph of the sample № 9 with clay matrix reinforced with WRHA



.

Fig.4 Electron-scanning microphotograph of sample.

TABLE 4th

PROPERTIES OF SAMPLE BASED ON CLAY AND WRHA

Composition	Apparent density, ρ x 10^{-3} kg/m^3	Water uptake, %	Porosity, %
1	1.72	21.60	37.13
2	1.63	22.25	37.60
3	1.61	24.90	40.44
4	1.56	26.92	41.93
5	1.53	27.81	43.85
6	1.47	29.71	45.11
7	1.69	22.10	37.21
8	1.63	24.60	39.75
9	1.60	26.10	41.22
10	1.56	27.29	42.59
11	1.53	27.81	42.85

The results show that the density of the synthesized material ranges from 1.70 to 1.53 g/cm^3, and their water absorption is within 22 to 28%. The density decreases with increasing the addition of rice straw and rice husk ash in the brick, while the apparent density and water absorption increase. This fact may be connected with large losses in ignition, which was in rice straw about 80%, and in ash from rice husk - 16%.

In general, the parents synthesized from clay and white ash have better physico-mechanical properties compared to those synthesized from clay and rice straw. The results of the analysis showed that the selected clay can be used for making of hollow insulating bricks.

IJERT

4. CONCLUSIONS

Based on rice shell and clay matrix a number of lightweight clay materials were developed. Rice shell - raw and thermally treated contribute to the formation of porous structure in the samples. Synthesized materials are with porosity ranging from 37 to 43%. Using the rice husk, burned at 600 ° C in air, silicon oxide in rice husk is s till in the active amorphous form, so combined with the porous structure of the ash makes it very reactive in the process of sintering the samples. The main phases contained in fired bricks are: quartz, kaolinite, feldspar and magnetite. The samples obtained from clay and ash have higher physical - mechanical properties compared to those synthesized from rice straw and clay.

REFERENCES.

[1] Emmanuel Ogo Onche, Benjamin Iyenagbe Ugheoke, Sunday Albert Lawal, and Utibe Martin Dickson, "Effect of Rice Husk and Diatomite on the Insulating Properties of Kaolin – Clay Firebricks", Leonardo Electronic Journal of Practices and Technologies, vol. 11, pp. 81-90,2007.

[2] M. A.Rahman, "Properties of clay sand-rice husk as h Mixed bricks" ,Int. J. Cement Comp. Lightweight Concrete, vol. 9, pp.105-108,1987.

[3]G. Marahleh, "Production of Light Weight Ceramics Teils from Local Materials", Am. J. Applied Sci., vol. 2 pp. 778 –83, 2005.

[4] J.D. Jegatheeswaran, and R. Malathy, "Utilization of papermill sludge in manufacturing of bricks - An environmental friendly approach",Pollution Research, vol. 30, pp. 299- 3 03, 2011.

[5] Lyubcho A. L.yubchev and Irena G. Markovska, "Waste materials for preparation of porous corundum – matrix
composi tes", International symposium "Ecology '93", Bourgas, September 9-11 , 1993, p.32 –37.

[6] V. Loryuenyong, T. Panyachai, K. Kaewsimork, and C. Siritai, "Fabrication of lightweight clay bricks from recyc led glass wastes",Ceramic Transactions, vol. 210, pp. 213-2 19, 2010.

[7] C. Sujivorakul, C. Jaturapitakkul, and A.Taotip, Utilization of fly ash, rice husk ash and Palm Oil Fuel Ash in Glass Fiber-Reinforced Concrete", J. Mater. Civil Eng., vol. 23, pp. 1281-1288,2011.

[8]

Conservation, vol. 17, pp.353-357, 2011.

[9]A. Sharma and T.Rajeswara Rao, "Kinetics of pyrolysis of Rice husk",Bioresource Technol. vol. 67 pp.53-59, 1999.

[10]D. M. Ibrahim and M. Helmy, "Crystallite growth of rice husk ash silica", Thermochim. Acta vol. 45,pp. 79-85, 1981.

[11]M. Devan, Proc. Nat. Workshop on rice husk for Energy, Vigian, Bhawan, New Delhi, p. 35,1982.

[12]A. Chakraverty, P. Mishra, and H.D.Banerjee, "In vestigation of thermal decomposition of rice husk", Thermochim. Acta, vol. 94, pp.267 – 275, 1985.

[13]H. D. Banerjee, S. Sen, and H. N. Acharya," Investigation on the production of silicon from rice husks by the magnesium method", Mater. Sci. Eng., vol. 5, pp.173-179, 1982.

[14]M. A. Hamad, "Thermal characteristics of rice hull s", J. Chem.Tech Biotechnol., vol.31, pp. 624 -626, 1981.

[15]L. T.Vlaev, I. G. Markovska and L.A. Lyubchev, "Non–isothermal kinetics of pyrolysis of rice
husk", Thermochim ica Acta, vol.406, **p**p.1 – 7, 2003.

[16]L.T.Vlaev, I.G. Markovska, and L.A. Lyubchev, "Kin etics compensation effect at thermal degradation of rice husk", Oxid. commun., vol. 27, pp.444 – 452, 2004. E. A. Gerasimov, Technology of ceramics products, Technics, Sofia,2003.

IJERT