

Properties of Plastic Bounded Agricultural Waste Composites II: Physical Properties of Some Composites.

[1*]*Akinyele S.A. and* [2]*Adeosun, B, O.*
[1] Federal Polytechnic, Ado-Ekiti, Nigeria
[2] Federal University of Technology Akure (FUTA) Nigeria.
[1*]Corresponding author : kinyelesa@yahoo.com.

ABSTRACT

Twenty six (26) plastic bounded composites, one unfilled and five each filled separately with varying contents of cement, limestone, silica-sand, drainage san granite have been formulated and compounded. Their percentage water absorption was determined. Composites % water absorption was determined. Composites % shrinkage range from (0.86-8.00) % and % water absorption from (1.03-15.00) %. These results suggest that the composites under study meet the allowable American Standard for Test Measurement (ASTM) for floor and wall tile tiles maximum 15% shrinkage and maximum 16% water absorption. If these composites are examined for mechanical strength, they may be found useful in the building industry for the manufacture of floor and wall tiles. Using spent pure water (thermoplastic) may result in the control of environmental pollution caused by the non-biodegradable spent plastic. Key word: plastic bonded composite, floor tile, wall tile, % shrinkage, % water absorption allowable ASTM.

1.0 INTRODUCTION

The ideal of incorporating agricultural wastes into a composite matrix is not novel; straw was used in a clay matrix to strength bricks in Egypt long time ago. The by-products of rice, groundnut, cowpea and maize have been used to produce particle boards which find utility in internal partitioning, celling covering and sound-proof Enclosure-building (sampathrajan et al). Today's composites have move through high technology and has emerged as engineering materials and as advanced structural composite (Premomony 1990). These recent composites consist of metal-metal, metal ceramics, plastic-metal-non metal and ceramics-agricultural wastes particle and fibre boards. They are heterogeneous solid consisting of two or more different materials that may be mechanically, metallurgically or chemically bonded together (Deganro et al 1980).

The properties of wood cement –bounded particle board have been studied extensively (Sanderinann et al, 1960; weather wax et al 1964; Bibls et al 1968; Mosleni et al 1983; Oyagade 1992; paramesmeran et al 1978; Dinwoodie, 1990; 1991. Problems associated with the production of wood cement particle board in tropical countries are (i) non-compatibility of tropical hardwoods with cement (ii) the large quantity of cement per unit weight of wood employed in the board manufacture not only makes the resultant board to be heavy, but also makes cement constitute an costly components of the board. The characteristically high density of the board is a possible limitation to its use particularly in area where weight saving is essential-like site handling and in application in situations such as ceiling panels (Bison-Werke, 1974).

The major consumption of synthetic polymers is as plastic materials in the form of molded objects. After the expiry of the economic use of most plastic materials they constitute environmental pollution consequent upon the non-biodegradability of plastics. As a means of controlling environmental pollution caused by spent plastics, spent plastics is now being recycled and filled with agricultural waste and some locally available material into composites. Some physical properties of the in the present work for possible manufacture of building materials which has been the exclusion reserve of cement bounded composites.

2.0 Experimental

Material-spent plastic (thermoplastics), spent pure water sachets, collected from the dungs, washed and sundried. Fillers-limestone was collected were separately collected, died, ground, and sieved to an appropriate size with the endecotte sieve. drainage sand was also collected, dried and sieved. Silica sand was likewise sieved (to the same particle size for limestone and drainage sand) after collection, washing and sun drying. For granite the commercial size was further reduced by a factor of about 1/8 while cement was used as bought. Twenty six (26) composites were formulated as shown in Table

1Curing –Spent plastics were melted and filled separately with the fillers according to Table 1. The resultant composite was introduced into cylindrical and rectangular moulds, allowed to cool, removed from the moulds and kept in cold water for 24 hours before the determination of properties.

3.0 Property determination

Methods for determination of percentage water absorption and percentage shrinkage have been reported (Samuel and Adeyemi 2004.)

4.0 Result and discussion

The physical properties determined for the twenty six composites as shown in table 1 and 2. It is observed that the control comrade (plastic only) shows % shrinkage of 1.12%. The composite of drainage sand, silica sand, limestone, cement and granite shows % shrinkage range of (1.80-2.86)%, (4.00-8.00)%, (2.30-4.00)% (1.00-4.00)% and (0.86-1.67)% respectively.

The control composite shows % water absorption, while the other composites show the following values; drainage sand (4.30-14.22)% silica sand (1.03-6.40)%, limestone (1.90-53)% cement (10.60-15.00)% and granite (2.74-6.65)%. Comparing the values of % water absorption and % shrinkage with the America standard for test and measurement (ASTM) for floor and wall tiles, all the five composites seem to meet the ASTM.

However, apart from these physical properties the ASTM contains standard for mechanical of these mechanical properties is the focus of an on-going research effort. It is after the conclusion of this part of the research that a categorical scientific statement could be made on the suitability of these composites for the production of floor and wall tiles.

5.0 Conclusion

The result of this work has shown conclusively that all composites examined meet the (ASTM) standard for the physical properties (% water absorption and % shrinkage) of floor and wall tiles. These are examined for mechanical strength they may be found useful in the manufacture of industry building materials like tiles and particle-boards and even compete favourably with wood cement composites. The use of spent thermoplastics this way would result in the control of environmental pollution caused by this non-biodegrable waste.

Table 1: Compounding formulation of composite

Composite code no	**Components**	
	Thermoplastic	**filler**
2	62.5	28 cement
3	62.5	56 cement
4	62.5	84 cement
5	62.5	112 cement
6	62.5	140 cement
7	62.5	35 limestone
8	62.5	52.5 limestone
9	62.5	70.0 limestone
10	62.5	105 limestone
11	62.5	125 limestone
12	62.5	25 silica sand
13	62.5	50 silica sand
14	62.5	62.5 silica sand
15	62.5	75 silica sand
16	62.5	87.5 silica sand
17	62.5	25 drainage sand
18	62.5	37.5 drainage sand
19	62.5	50 drainage sand
20	62.5	62.5 drainage sand
21	62.5	75 drainage sand
22	62.5	31 granite
23	62.5	46.5 granite
24	62.5	62 granite
25	62.5	77.5 granite
26	62.5	93 granite

Table 2: Properties examined for the composites

Composite	% shrinkage	% water absorption
1 unfilled	1.12	1.95
2 cement	4.00	12.7
3 cement	3.00	11.9
4 cement	2.90	15.0
5 cement	1.00	10.6
6 cement	1.15	11.2
Range	(1.00-4.00)	(10.6.15.00)
7 limestone	4.00	3.70
8 limestone	3.33	5.00
9 limestone	2.30	1.90
10 limestone	2.33	5.30
11 limestone	2.73	5.30
Range	(2.30-4.00)	(1.90-5.3)
12 silica-sand	8.00	6.40
13 silica-sand	6.00	5.10
14 silica-sand	5.00	1.03
15 silica-sand	5.50	3.80
16 silica-sand	4.00	3.31
Range	(4.00-8.00)	(1.03-6.40)
17 drawing sand	2.86	5.4
18 drawing sand	2.50	4.3
19 drawing sand	2.00	13.50
20 drawing sand	2.50	13.90
21 drawing sand	1.80	14.22
Range	(1.80-2.86)	(4.30-14.22)
22 Granite filled	1.62	2.79
23 Granite filled	1.40	6.65
24 Granite filled	1.10	5.98
25 Granite filled	1.00	2.33
26 Granite filled	0.86	2.74
Range	(0.86-1.67)	(2.74-6.65)

Table 3: American standard for testing and measurement (ASTM) allowable values for floor and wall tiles.

	Compressive strength Mpa	**% water absorption**	**% total shrinkage**
Floor tile	22.1 (minimum)	16.% (maximum	15% (maximum)
Wall tile	17.2 minimum	16% maximum	15% maximum

References

1. Sampathrajam A; Vijayraghavan, N. C and Swamniathen K.R (1991): Bio-resource Technology, 35, 67-71.
2. Premomony, G (1990): Polymer science and Technology of plastic rubber's Mc Graw- Hill N. 44 pp. 252
3. Degarmo, P.E, Temple B. J and Ronald K. O (1980); Materials and processing 9th Edn. Macmillan, N4 pp. 193-195.
4. Sanderman W. presusser, H.J and Schween, W (1960): studies on mineral bonded wood materials. The effect of wood extractives on the settings of cement-bouded wood materials, Holzforch ung 14 (3); 70-77
5. Weather max R. and Terknow, H. (1964) Effect of wood on the setting of Portland cement forest products journal 14 (12): 567-570.
6. Bibles, E.J and Lo, C.F (1968) Sugar and other wood extractives: effect on the setting of southern pure-cement mixtures. Forest products Journal 18 (8) 28-34.

7. Moslemi A.A. (1989): Wood –cement particle products; coming of age in fibre and particle boards bonded with inorganic binders, conference proceedings. Idaho pp 12-18
8. Oyagade, A.O. (1992): A preliminary investigation of the influence of some treatments on the compressive strength on Gmelina arborea wood cement composite, Nigerian Journal of Forestry 22 (1&2): 41-44.
9. Paramerwaran, N. and Broker, F. W. (1979): Micromorphological investigation on woo-cement composite after long term use, Holzforeschung 33:97-102.
10. Dinwoodie J.M (1978): Wood-cement particle board, BRE information building research establishment no. 1S2/98 2pp
11. Dinwoodie J.M and Paxton, B.H (1990): A technical assessment of cement-bounded wood particle boards in fibre and particle boards bonded with inorganic binders. Conference proceedings Idaho pp 115-112
12. Dinwoodie J.M (1991): Characterising the performance of chipboard in the United Kingdom. Proceedings 15th Washington State University International Symposium on particle board, T. M Maloney (Ed) Washingtone State University, pullmanto, Wa pp. 57-78.
13. Bison-werke (1977): Cement bonded particle board F.A.O portfolio of small-scale wood-based panel plants 22pp.
14. Deppe, H.J (1974): on the production and application of cement wood chipboards. Proceedings 8th Washington State University International Symposium on particle board T.M Maloney (Ed) Washington State University, Pullmanot, Wa. Pp. 267-287.
15. Samuel, J.O and M.B Adeyemi (2004): Effects of Silica/clay types and compositions on the properties of ceramic tiles, JORMAR (1) 42-53.
16. Oyagade, A.O (1997): Wood-cement composite sheet element for the building construction industries in Nigeria, The Journal of techno-Science vol.1, 4, 21-30