Effect Of Plantain Peels Ash As Admixture On The Bleeding Of Fresh Concrete

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Abstract
Concrete bleeding is a major challenge in the construction industry because; it leads to the production of very porous concrete with weak structure.It is in a bid to overcome the challenge of using imported and expensive admixtures that this research was carried out, to determine the possibility of using locally available and cheap materials as admixtures to reduce the amount of bleeding water in fresh concrete. A sample of ripe plantain peels was collected from Zuba fruit market Abuja. The peels were carefully air dried after which they were burnt in open air into ashes and sieved through sieve 45µm. The chemical analysis was carried out at the department of Chemistry, Ahmadu Bello University, Zaria to determine its chemical composition. The aggregates characterization was done, the specific gravity of the Plantain Peels Ash (PPA) was determined as 2.16 which indicated that PPA is a light weight material. A concretemix ratio of $1:1\frac{1}{2}:3$ was used. PPA as admixture was added to the concrete mix in 0.4, 0.8, 1.2, 1.6 and 2.0% of the mass of cement. After which the amount of bleeding water was determined. The result obtained showed that the mass of the bleeding water was reduced as the percentage of PPA used was increased; this was as a result of increase in surface area of the admixture. PPA isrecommended as a water retaining admixture since it was able to reduce the amount of bleeding water of the fresh concrete.

Key words: Admixture**,** Bleeding, Cement,Concrete, Plantain Peels Ash and Water Retaining

Introduction:
Bleeding is the tendency of water to rise to the surface of freshly placed concrete. It is caused by the inability of solid constituents of the mix to hold all of the mixing water as they settle down.Segregation is the cause of bleeding in the fresh concrete mix. Segregation is the phenomenon in which heavy aggregate particles settle down at the bottom of the slab and light particle moves to the surface top. Bleeding is more prominent on the surface of concrete, when water to cement ratio is higher and it occurs when ingredients of concrete are not in good proportions, bad mix proportion (Jahren, 2013)

Due to settling of heavy particles, water travels to the surface of concrete and form a water layer on the top surface of concrete. That upward movement of water also carries fine particles of cement too and that creates a deficiency of cement within the concrete, producing a porous concrete with a very weak structure (Lerch , 2015).

Concrete bleeding could be controlled by encouraging the use of air en-training admixtures in the concrete mix. Unfortunately most of the admixtures available in Nigeria have been imported and are very expensive.

It is in a bid to overcome the challenge of using imported and expensive admixtures that this research was carried out, to determine the possibility of using locally available and cheap materials as admixtures to reduce the amount of bleeding water in fresh concrete.

According to Marthog (2012), natural fiber ash is sustainable and effective material in order to minimize the used of cement and reduce the construction cost.
Grutzeck et al. (1982) reported that the concrete containing silica fume shows significantly reduced bleeding. This effect is caused primarily by the high surface area of the silica fume to be wetted; there is very little free water left in the mixture for bleeding. Additionally, the silica fume reduces bleeding by physically blocking the pores in the fresh concrete.

Jahren (2013) reported that fresh concrete containing silica fume is more cohesive and less prone to segregation than concrete without silica fume.

Plastic shrinkage cracking is basically caused by rapid drying of concrete surface when the rate of evaporation exceeds the rate of bleeding (Lerch , 2015). Therefore, bleeding may be viewed as a necessary evil or a benefit depending upon specific circumstances of the job site.

Schiessl and Schmidt (1990) reported that the total bleeding capacity, Q (ml) is closely related to the initial bleeding rate q (ml/h) this was obtained from a bleeding test of 25 samples of concrete mixes.

METHODOLOGY

Materials

Cement: The Cement for that was used for this research work is Ordinary Portland Cement. It was sourced locally from Dangote Cement product, Nigeria. It conformed to the requirements of (BS EN 197-1: 2000) 35kg of cement were brought to the Federal University of Technology, Minna Civil Engineering laboratory where the research was carried out.

Fine Aggregate: The sand intended for this research work was also locally sourced from FerinDoky, Minna, Nigeria. The impurities were completely removed in accordance to the requirements of BS 882 (1992). 10 Tones of the aggregates were brought to the Federal University of Technology, Minna Civil Engineering laboratory where the research was carried out.

Coarse Aggregate: The granite used for this research work is within the range of 5-20mm in diameter; It was sourced locally from Tricta quarry in Minna, Nigeria and it conforms to requirements of BS 882 (1992).

Plantain Peel Ash (PPA): The plantain peels used for this research were sourced locally from Zuba fruit market, Abuja. The ripe plantains were peeled and air-dried. The dried sample was burnt in open air to ash, the ash sample was sieved through a 150µm sieve, in accordance to the American Society for Testing Methods (ASTM-C618 Class N).
Potable water was used for this research**,** the water was obtained from Federal University of Technology, Minna municipal water supply, It conformed to BS EN 1008 (2002) requirements.

Methods

The following methods were used in this research, all the tests were carried out at the Civil Engineering laboratory of Federal University of Technology, Minna, Nigeria except otherwise stated.

i. Chemical composition of PPA: The chemical analysis of the PPA was carried in the department of Chemistry at Ahmadu Bello University, Zaria.
ii. Particle size distribution test, this was carried out in conformity to BS 1377-2:1990.
iii. Bulk density
iv. Specific gravity.

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v. Concrete Mix Design: The British (Department of Environment, DOE) method of concrete mix design was used for this research to obtain the mix proportion of $1:1\frac{1}{2}:3$.
vi. Concrete bleeding test, this test was carried out as specified by (ASTM C232-99)

RESULTS AND DISCUSSION

Chemical Analysis of PPA

The chemical analysis of the PPA was carried out at the Department of Chemistry, Ahmadu Bello University, Zaria. The result of the chemical composition is presented in Table 1. The chemical compound of Silicon dioxide (SiO = 79.38%), Iron oxide (Fe_2O_3= 6.53%) and Aluminum oxide (Al_2O_3= 19.84%) which constitute a total sum of 105.37% of pozzolanic materials. The value obtained exceeds the minimum value of 70% requirement for a material which possesses pozzolanic properties according to (ASTM C 618 part 78, 1978). The value (79.38%) obtained is greater than the value obtained by Ijuta (2009) for Rice Husk Ash (48.36%), which is a clear indication that PPA is of high pozzolanicity and can be used as admixture in concrete production as compared to natural pozzolanas. Kayam (1995) who also carried out thesame chemical analysis on PPA obtained a close value of 88.56% to the value obtained in this research.

From Table 1. It can be clearly seen that the percentage composition of SiO_2 in PPA is 79.31% which is three times greater than that of (OPC) 28.57%. According to Godwin *et al* (2014), Ash is said to have cementitious and reactive properties if the summation of CaO, SiO_2, Al_2O_3 and Fe_2O_3 is above the required minimum value of 70% as specified by (ASTM C 618 part 78). .

Table 1: Chemical Composition of OPC and PPA

Elemental Oxide	Percentage composition of OPC	Percentage Composition of PPA
SiO_2	28.57	79.38
CaO	79.12	1.08
Al_2O_3	2.80	19.84
MgO	-	5.13
Fe_2O_3	4. 28	6.53
Mn_2O_3	0.01	0.34
K_2O	0.24	2.62
P_2O_5	-	9.08
SO_3	1.6	0.00
TiO_2	0.16	0.61
ZnO	-	0.00
Cr_2O_3	0.038	0.00
Na_2O	-	3.20

Concrete Bleeding Test

It was observed that mass of the bleeding water significantly decreased as the percentage of the admixture (PPA) was increased. The least mass of the bled water was obtained at an optimum PPA value of 1.2%. The result is shown in Figure 1. The decrease in the mass of water is as a result of increase in surface area of the admixture. Furthermore, the admixture has the effect of increasing the air content from naturally occurring amount of air this forms pockets of air in concretes which accumulate some amounts of water (Utim, 2009).

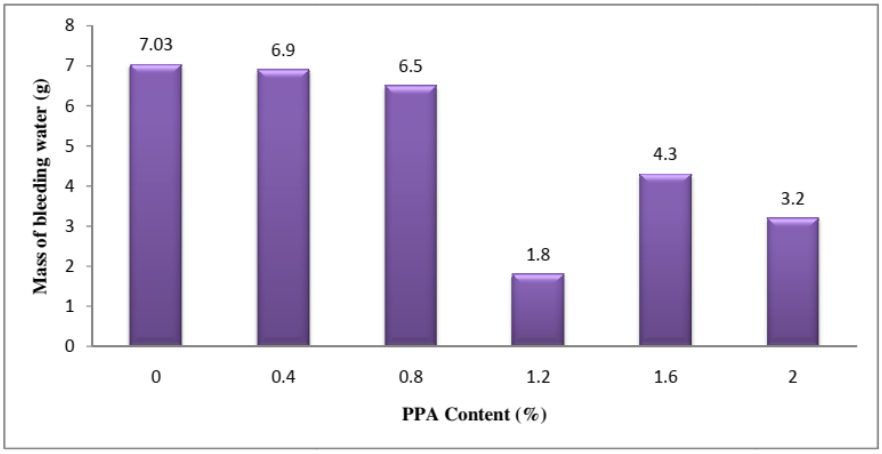

Figure 1: Relationship between mass of bleeding water and PPA content

CONCLUSION

The following provides the summary of results obtained from this research.
i. The chemical analysis of PPA was carried out and the result indicated that PPA met the requirements for admixture materials as specified by ASTM-C618

ii. PPA reduces the bleeding water of fresh concrete.

RECOMMENDATION

i. PPA is recommended as a water retaining admixture since it was able to reduce the amount of bleeding water of the concrete.

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