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Study of the Effect of Metallic NANO-Modifier on the Properties of Self-Compacting Concrete Using Portland cement, Rice Husk Ash and Quartz Flour

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Abstract: 7 cubes were collected as the study aims to study of the effect of metallic nano-modifier on the properties of self-compacting concrete using Portland cement, rice husk ashes it was based on Portland cement Spassky brand CEM I 42.5N. It has been concluded that crop waste can be used as an alternative to Portland cement in self-compacting concrete that keep as Mechanical and operational properties of concrete and ready-mix concrete. The specific surface area of the ash was increased by mechanochemical activation. The use of rice husk ash (RHA) - a by-product of the rice industry - when added in the production process of high-performance concrete helps enhance the properties of concrete, as well as providing a host of important advantages to the concrete industry.

Keywords: RHA, CS, TS, SCC, construction.

INTRODUCTION

Self-pressing concrete is characterized by its good workability, in addition to the quality of the final mix, and this leads to a reduction in working time, but the generation of self-pressing concrete will require several things, including the presence of a lot of cement in addition to some strength, in addition to that some additives to reduce the amount of water binding ratios.

Where the additives to concrete generate several results, including reducing the economic cost in addition to the texture that it provides to the concrete and obtaining the best agreed characteristics and reducing the cement.

At present, worldwide there is new trends in regarding the use of concrete, since the current requirements of the concrete characteristics are very: therefore, the use of varied types of additions, which modify and improve some concrete properties both in fresh and hardened state. In this context, an element to take into account is the use of waste rice husk, since it is estimated that this ash contains 80.33% of silicon oxide substance capable of modifying and improving the properties of compressive strength of concrete in the hardened state [Luo, Z. *et al*., 2012].

Chromatic copper arsenate obtained from rice husk under controlled combustion conditions has been used as a material to obtain amorphous silica and can be used as a source of mineral phases such as tricalcium and calcium silicate (C3S and C2S) from cement [Aggarwal, P. . *et al*., 2014]. CCA reacts with lime, leading to this reaction to form hydrated calcium silicate crystals (CHS), which contributes to the generation of mechanical resistance in concrete added [Du, H. *et al*., 2014][Zhang, M.H. *et al*., 2011][Rai, S. *et al*., 2018], it is for this reason that this material is considered a viable option for partial replacement Cement in building elements such as concrete blocks, from a mechanical and economic point of view, because these residues did not represent any commercial value until the last time of its use in the process of drying rice grains by taking advantage of the heat generated during the combustion process [Wang, L. *et al*., 2021] [Said, A.M. *et al*., 2012].

Today, cast concrete elements have an infinite number of uses, shapes, textures and colors, and are quite different from traditional building materials. Thanks to its high versatility, concrete is used to produce precast elements such as; Standard blocks, bricks, pavers, columns, tiles, partition retaining walls or any other specialty, all these products are currently achieved with very good quality and at significantly lower costs compared to other materials commonly used in the construction industry. It is of great importance that this building material, which has developed over time, is easy to the entire population in general, from the rural classes to the higher.

MATERIAL AND METHOD

The mineral NANO-modifier was developed using Portland cement in addition to rice husk ash, which were in equal proportions with quartz flour, as it was based on Portland cement Spassky brand CEM I 42.5N.

All chemical compounds used in this experiment will be clarified in the tables.

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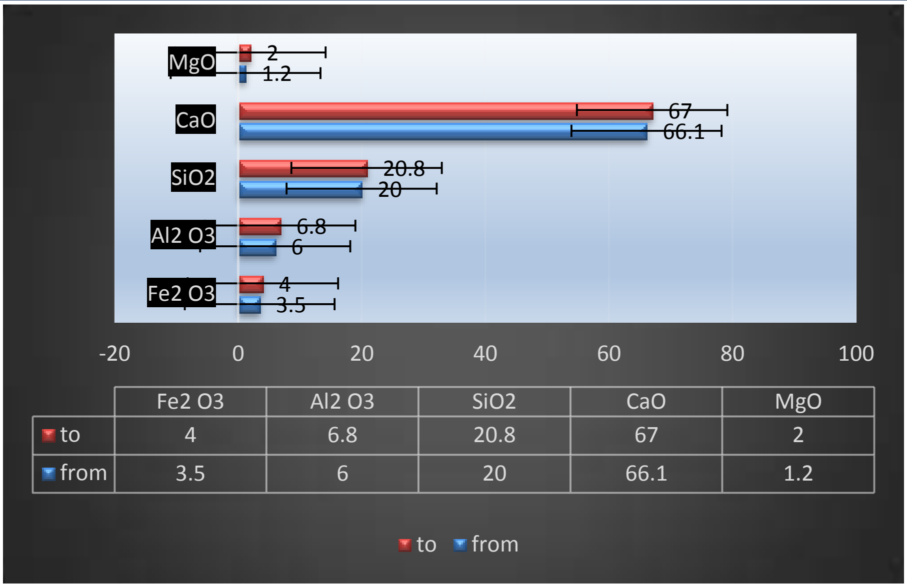

Figure 1: chemical composition of the spassky Portland cement

Table 1: Physical properties of rice husk ash

C	Type
color	ashen
Specific weight	2.53
Specific surface area	40-100 gm / m²
Bulk Density	200-300 Kgm/m^a

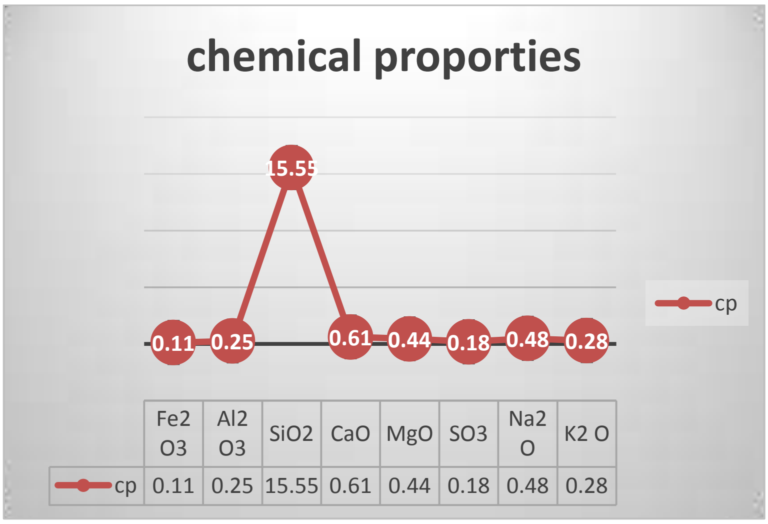

Figure 2: chemical composition of rice husk

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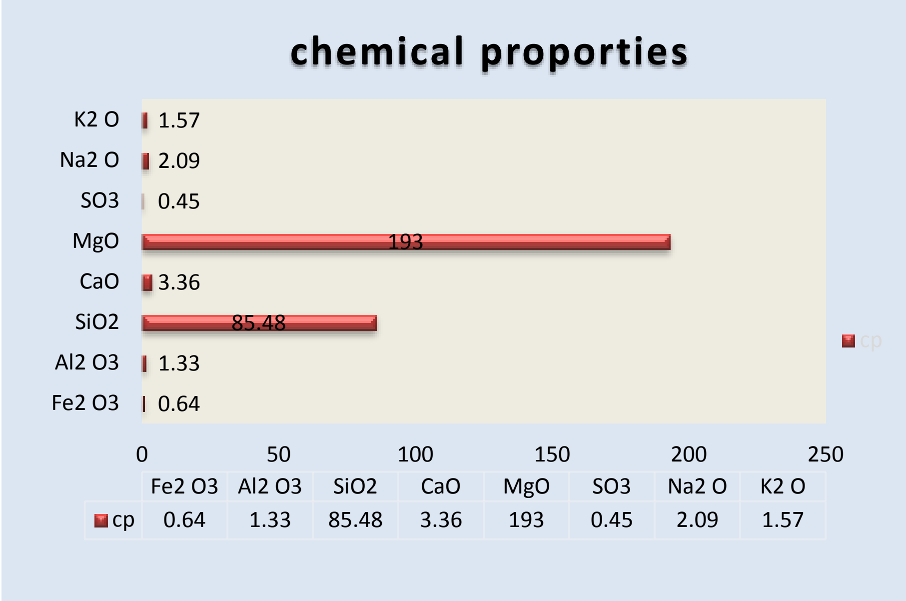

Figure 3: chemical composition of rice ashes

Metal nanoscale modifier has been prepared combined grinding of Portland cement and ash Rice husk and quartz microfilm

Figure 4: Determination of the slump

Sand size module - 1.84. Modulo fineness this sand is fine. The content of silty and clay particles - 2%. According to the content of dust and clay particles for fine sands, it can be concluded that this sand corresponds to GOST 8736-93.

Table 2: the particle size distribution of sand

Sizes of openings sit, mm	**Sizes of openings sit, mm**					**Passed through a 0.14 mm sieve**
	2,5	1,25	0,63	0,315	0,14	
Private balances,%	1,7	2,2	3,7	24,5	61,1	6,8
Total residues,%	1,7	3,9	7,6	32,1	93,2	100

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RESULTS

Table 3: Composition of Concrete Mixtures (Kg per 1 M3 Mixture)

No	Cement	sand	water	NANO modifier	Superplasticizer
	330	1650	175	1	3.5
	303	1650	175	3.5	3.7
	340	1650	175	7	3.8
	323	1650	175	10.5	4.1
	308	1650	175	14	3.7
	311	1650	175	17.5	3.8
	322	1650	175	21	4.00

Table 4: results of CS

Percentage of RHA addition, %	Normal CS MPa	Steam CS MPa
0	110	145
15	140	180
30	141	210
45	146	188
60	143	157

Table 5: Splitting tensile strength

Percentage of RHA addition, %	Normal TS MPa	Steam TS MPa
0	11	16
15	12	18
30	20	24
45	15	19
60	13	17

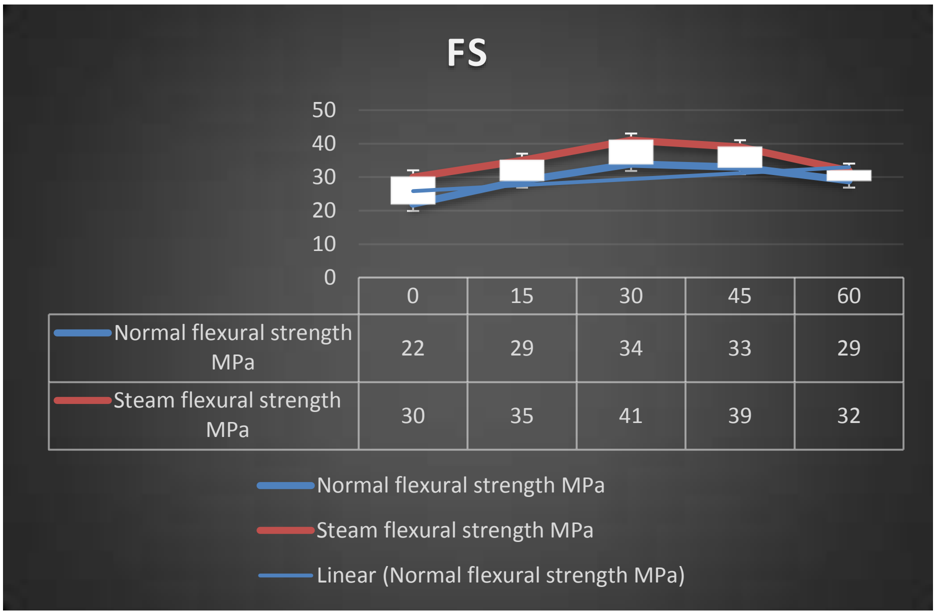

Figure 5: explain flexural strength

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Table 6: properties of concrete mixture

NM	Cone (mm)	Cone (T50cm)	V-funnel	L-box H2 /H1
0	720	3.5	6.3	9.96
1.5	690	4.15	8.4	0.91
3	699	4.10	6.9	9.92
4.5	705	3.5	8.9	0.89
6	715	4.11	8.1	0.92
7.5	710	4.05	8.5	0.91
9	711	3.12	8.3	0.99
11	730	3.45	6.3	0.94
12.5	698	4.10	7.8	0.90

DISCUSSION

We discussed in this study of the effect of rice husk ash on cement concrete and study the effect of compressive and tensile strength Through the use of rice husk ash, concrete gradually becomes unworkable (workability decreases). Hence water-reducing additives or additives should be used to obtain easily workable concrete during concrete pouring as it was found that the initial (initial) setting time of concrete RHA increases and that the final setting time decreases with the increase of RHA content. This behavior may be due to the low rate of hydration in the paste containing RHA. The higher the percentage of cement replaced with RHA by rice straw ash, the lower the workability of the fresh concrete mix. However, the workability of concrete can be improved by using water reducers or superplasticizers.

Rice husk ash concrete improves the compressive strength of concrete As concrete containing 30% rice husk ash replaced by cement showed maximum compressive strength It is due to amorphous silica and fine particle size of rice husk ash penetration resistance of chlorides and other chemicals is the most important factor which determines the durability of concrete. Adding rice husk ash into the concrete imparts a pozzolanic effect. It reduces a large amount of calcium hydroxide and makes an extra C-S-H gel. Hence it improves the concrete matrix, making it dense which results in low concrete permeability and high resistance to penetration of chlorides and other chemicals.

Thus, during the study of the physical and mechanical properties of self-compacting concrete with a partial replacement of Portland cement with a mineral Nano modifier the following was revealed. Usually, rice husk ash as secondary material has great potential for use as a replacement for Portland cement in self-compacting concrete, preserving the mechanical and operational characteristics of the concrete mixture and ready-mixed concrete in an acceptable range.

The compressive strength also increased with the increase of the addition, and its highest percentage reached by the addition percentage of 30% of the weight of the cement, where it increased in the case of 180 Steam CS MPa whenever in tensile strength we found increase of the addition was the heights percentage was when we added 30 of RHA However, these optimum values are highly dependent on the burning preparation of rice husk ash which negatively affects the amorphous silica components, and thus on the pozzolanic activities of the rice husk ash in concrete. A potential approach is provided to convert rice husk to improved, highly reactive rice husk ash by controlled burning and milling.

CONCLUSION

The use of by-products such as rice husk ash in concrete improves concrete quality and reduces pollution as well as construction cost. It is proven to be an environmentally friendly way to get rid of large amounts of waste that would pollute the land, air and water. It can be added with cement 5-30% by weight to increase the strength of concrete. Thus, it is an environmentally friendly product and also saves cost.

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