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THE FLY-ASH ADMIXTURE INFLUENCE CONCERNING THE PERMEABILITY OF THE BELITIC CEMENT CONCRETE

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Abstract: *The actual research involving fly-ashes resulted as a residue from the thermo power station processes point out the fact that the admixture of a certain quantity in the fresh concrete has as an effect the considerable increasing of the permeability. Also, the admixture of the fly-ashes could considerable decrease the cement quantity in the concrete mixture, so that the price of the concrete will be more decreased. In this case it is important to analyse the influence of the fly-ashes addition over the impermeability rate of the belitic cement concrete.*
Keywords: *fly-ash, belitic concrete*

1. INTRODUCTION

The concrete works assume the realization of some performant features from all points of view. In this way, a concrete with high permeability requirements can be accomplish using active additions, in case where we do not neglect the strength characteristic. The permeability characteristic it is performed through the structural characteristics - compactness, porosity. If on the compactness it can interfer in the way of enlargement, by using active additives, experimentally was observed that the ensemble of technical characteristics obtained on these concrete were close to those of concrete without addition. So it is impose that for every mixture of concrete made with belitic cement to analyze the permeability characteristic comparative with others technical characteristics important for favorable behavior of concrete and to choose the variants with the best overall behavior.

2. GENERAL ASPECTS CONCERNING OF THE OF FLY-ASH ADMIXTURE' INFLUENCE ON SOME CONCRETE CHARACTERISTICS

Cement concrete use cement as binder, and this influences the formation of concrete structure through its nature and through the dosage used for realization of the mixture. In case of hydrotechnical cements used as a binder for concrete, in the category of wich it fits the one that is the subject of the present study, it has in the composition 6-20 % basic slag of furnace that improves the structural characteristics.
From the point of view of the acting mechanism of the addition, this type of addition produces some changes in the structure of the cement stone and on the formed structural characteristics and so on the behavior of the binder used in the concrete mixtures. So, the slag is hydrated in the presence of calcium hydroxide solution which rises from the reaction with water of the cement clinker. The hardening takes place in time, the cement paste gets rigid, the viscosity around the particles of slag increases, leading to a slowing in the process of difusion. In this period there are formed the saturated solutions of gypsum, calcium hydroxide and small quantities of SiO_2 and Al_2O_3. The speed that dissolve and it hydrates Al_2O_3 is smaller than the speed that it separate later to hidroaluminat. SiO_2 that exist in the solution implies the hydration of tricalcium silicate. Later there will be the reactions between water, calcium hydroxide and calcium sulphate with the active compounds of the slag. In a first phase, the slag undergoes a superficial coloidation (coloidare) and afterwards it will take place the formation of hydrosilicates, hydroaluminates and complex hydrocompounds.The formed hydrosilicates will encourage the increase of volume of new gelic formations, which after a process of hardening lead to an intens process of microcracks. In this situation is recomended to maintain till the concrete hardens in a wet environment or

underwater, to prevent the contractions and in the same time helping increase its compactness. The previous studies revealed the fact that the mechanical strenght although are growing slowly, in the end the values are close to those of the cement without addition, and at longer periods of hardening may exceed the strength of cement without addition.
From the research to date and those who used as addition thermo plant ash and belitic cement with addition of bazic furnace slag (the same type of addition), did not exceed the total proportion of addition 30-40%. In these conditions there is the possibility to occure some consequences regarding:
1. a greater content of water mixing imposed by addition, that is the smooth part with a big surface area, determins the dendency of movement of the pores dimension having the dimension 0,5-1 mm, to greater dimensions;
2. growth volume of capillary pores through increasing the volume of addition, from the concrete mixture.
These changes are theoretic unfavorable in forming the concrete and they can have negative influences on the structural characteristics of the concrete, that why it is imposed a very strict corelation on the content of smooth part from the mixture. This presume that the ash dosage must be corelated so that the smooth part do not exceed some boundaries and in the same time it must be considered the fact that the water dosage in the mixt and the ratio that is between water and the smooth part must be in lower limits or reduced using tensioactiv addition.

3. EXPERIMENTAL TESTS

The experiment was prepared taken into account the standards NE 012-1/2007 in conjunction with NE 012/2010 that reffers to the realization of concrete in different working conditions and who specify the limits for composition factors (minimum cement dosage, ratio A/C maxim etc.) and in the same time recommended in regard to the exposure class of the concrete, even the type of cement that is recommended to be used.
Given the experience in the domain and the restrictions imposed by the standards, we create 3 recipes of concrete using aggregate from rivers with maxim dimension of 16mm, composite cement type H II/A-S 32.5 and as addition fly-ash collected by dry way, all those for different values of component dosage and we realise the following compositional characteristics, presented in table 1:

Table 1: Compositional characteristics of the fresh concrete

Index recipe	Component dosage			A/C+Ce	Consistency class – cm
	Cement-C kg/m^3	Ash-Ce kg/m^3	Water-A l/m^3		
B1	100	200	223	0,74	C3(8,5)
B2	200	200	215	0,55	C3(8,5)
B3	300	150	216	0,49	C3(8,5)

Were made cubic specimens with the side of 14,1 cm, three from every recipe were retained in standard conditions to be tested for permeability, and other three specimens were also retained in standard conditions and tested for compression after 28 days.

4. EXPERIMENTAL RESULTS

Corresponding to the compositional characteristics of the 4 recipes, after subjecting the samples to test, was recorded the following results presented in table 2:

Table 2: Experimental results

Simbol samples	Content of cimentation material C+Ce	Strengh at 28 days N/mm^2	Specific growth at 28 days N/mm^2/kg x 1000	Degree of impermeability
B1	100+200	6.0	20	P4
B2	200+200	18.0	45	P8
B3	300+150	25.2	50	P12

A graphical transposition of the experimental results, would allow a clearer appreciacion of the permeability characteristics, as follows:

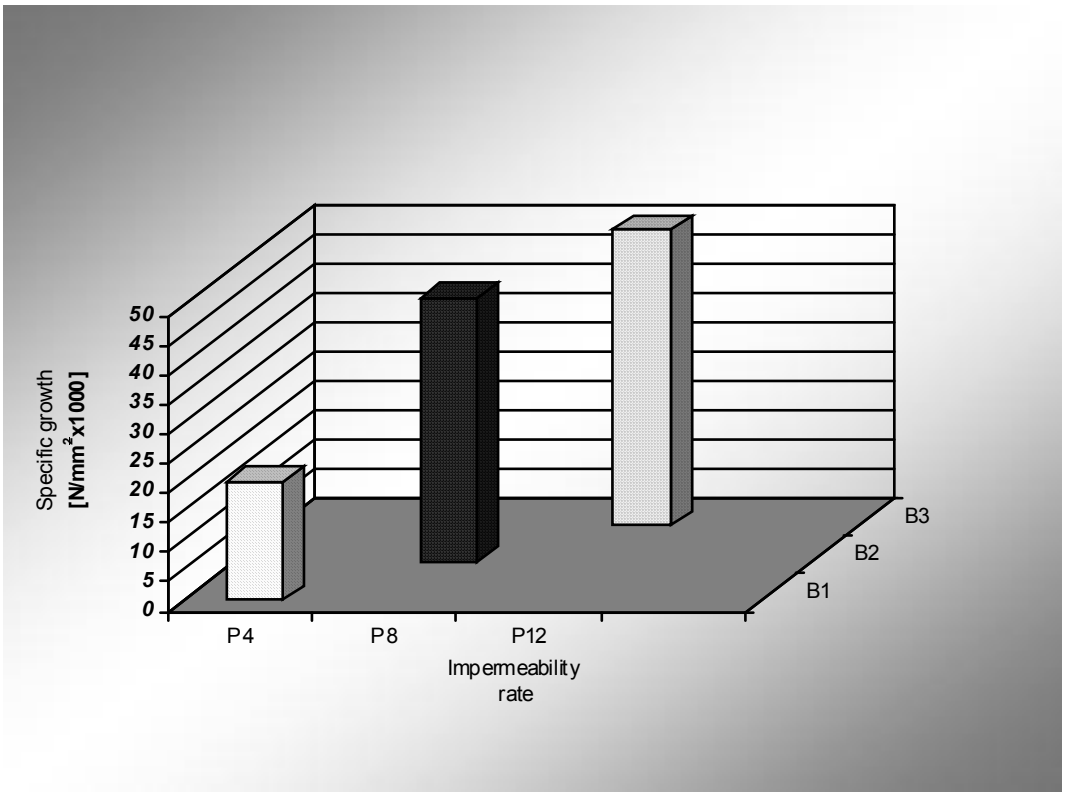

Figure 1: Permeability variation depending on the specific growth

5. CONCLUSIONS

Analysis of the experimental values supplemented with the interpretation of the chart allows the following conclusions:

1. The recipes 1, 2 and 3 have the cement dosage of 100, 200 and 300 kg/m^3, were the dosage of ash is 200, 200 respectively 150kg/m^3, present a degree of impermeability rising in accordance with specific growth, in conditions were in general were kept practically the same consistency;
2. Recipe 1 present a reduced impermeability characteristic, in conditions were the dosage of cement is just 100kg/m^3, and the dosage of ash is 200% in regard the dosage of cement. In these conditions the strenth of concrete is reduced in relation with the dosage of cement used, except that the duration of hardening over 90 days its value will be in concordancy with the dosage of cement used. It is worth to mention the fact the degree of impermeability in this case is reduce, only P4, but it stands the reserve that at 90 days will present specific improvements to this type of cement;
3. It is considered that recipe B3, presents very good characteristics in cured state at 28 days from casting, witch recommends from point of view of the strength and also from the degree of impermeability;
4. From economical efficency point of view, in terms of impermeability characteristic, I would notice recipe B2. Even though in this case, for a dosage of cement, of 200 kg/m^3 and ash 200 kg/m^3, it is obtained a specific growth of 10% smaller than in case of recipe B3 in conditions of a dosage of cement increased with 33% and in a dosage of ash smaller with 25%, consider that this recipe (B2) reflects the improvementof the behavior from impermeability point of view, in conditions of introduction of some increased dosage of fly-ash, if it makes the comparaison with recipe B1.

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