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RESEARCH OF THE POSSIBILITY TO PRODUCING CEMENT TYPE I 52,5 IN CEMENT PLANT KAKANJ

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ABSTRACT
This study is about possibility of the production of CEM I 52,5 in cementplant Kakanj satisfying some requirements for cement quality issued by EN 197-1. By EN 197-1, CEM I 52,5 consists of 95-100 % clinker and minor additional constituents of 0 - 5 %. Limestone and fly ash is used as minor constituents in this study. Specific surface, chemical analyses, tensile and compressive strength is done in this work.
Keywords: limestone, fly ash, cement, chemical analyses, compressive strength

1. EN 197-1 REQUIREMENTS FOR CEMENT TYPE CEM I 52,5

This type of cement belongs to CEM I issued by EN 197-1. According to this standard, clinker quantity needed for this cement class is 95-100 %. The minor additional components allowed by EN 197-1 is 0 - 5 %. The minor additional components promotes phisical properties of cement after appropriate preparing these materials. They can be inert materials, slightly hydraulic, hydraulic or pozzolan properties. These additional components must not promote corrosion of the reinforcement or impair the properties of the cement or of the concrete or mortar made from the cement.
Table 1 shows requirements for cement type CEM I 52,5 issued by EN 197-1.

Table 1. Physical-mechanical requirements for CEM I 52,5

Type	Compressive strength (MPa)		Initial setting time (min)	Ekspansion (mm)
	Early strength	Standard strength		
	2 days	28 days		
52,5 N	≥ 20,0	≥52,5	≥ 45	≤ 10
52,5 R	≥ 30,0			

2. CHEMICAL ANALYSES OF CONSTITUENTS

Chemical analyses of constituents are given in table below (table 2).

Table 2. Chemical analyses of constituents

	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Na_2O	K_2O	Free lime
Clinker	21,53	6,14	3,27	65,26	1,43	0,86	0,41	0,68	0,23
Limestone (L)	0,45	0,39	0,20	52,07	0,41	0,73	0,08	0,14	-
Fly ash (F)	42,72	20,11	7,61	21,11	2,25	1,51	0,12	0,98	-
Gypsum	4,00	1,62	0,61	30,52	3,28	38,94	-	-	-

Clinker used in this testing has been taken from daily production in cement plant Kakanj, limestone from the quarry Ribnica, fly ash from powerplant Kakanj and gypsum from Donji Vakuf.

3. SAMPLE PREPARATION

Three samples were prepared for this testing:

- Sample with clinker and gypsum
- Sample with clinker, limestone and gypsum
- Sample with clinker, fly ash and gypsum

All samples were prepared in the laboratory balls mill with two different specific surfaces (Blaine) and water/cement ratio (w/c) of 0,5. These data are given in table 3.

Table 3. Prepared samples

Sample		Clinker	Gypsum	Limestone	Fly ash	Blaine
		%	%	%	%	cm^2/g
Sample I (clinker)	a	96	4	0	0	3690
	b	96	4	0	0	4270
Sample II (clinker + limestone)	a	92	4	4	0	3470
	b	92	4	4	0	4240
Sample III (clinker + fly ash)	a	92	4	0	4	3750
	b	92	4	0	4	4300

4. RESULTS

According to table 1, compressive strength for CEM I 52,5 at 2 days and 28 days are the most important in this testing. Table 4 shows results of this testing. Ordinary PC sample was determined only to compare with another samples.

Table 4. Testing results

Sample		Tensile strength (MPa)		Compressive strength (MPa)	
		2 days	28 days	2 days	28 days
Sample I (clinker)	a	4,7	7,8	25,8	62,1
	b	5,4	9,0	29,1	64,2
Sample II (clinker + limestone)	a	4,8	8,3	25,0	62,5
	b	5,1	8,8	29,9	65,3
Sample III (clinker + fly ash)	a	5,4	8,5	29,0	66,0
	b	5,2	8,3	29,9	65,6

Figure 1 shows comparation between PC sample and samples with limestone and fly ash, which have lower specific surface. Fly ash cement has the highest compressive strength at 2 and 28 days regarding to another samples.

Figure 2 shows comparation between PC sample with regard to samples with limestone and fly ash which have higher specific surface. Each of three samples has similar compressive strength at 2 and 28 days.

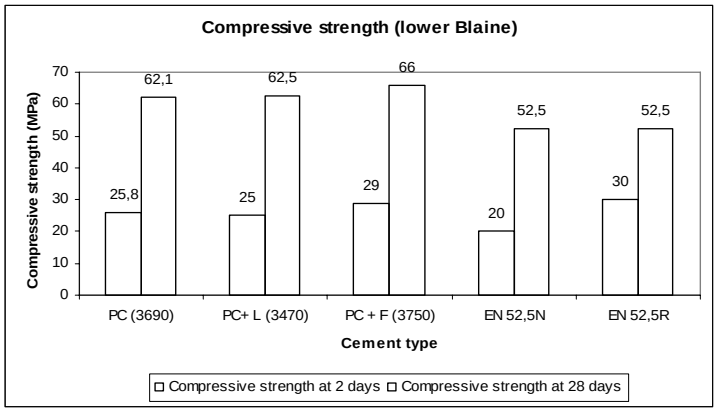

Figure 1. Comparison samples cement with lower specific surface (Blaine)

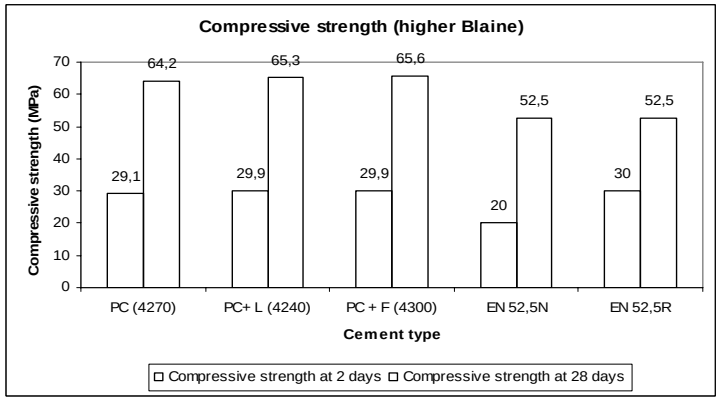

Figure 2. Comparison samples cement with higher specific surface (Blaine)

4. CONCLUSION

Limestone cement with higher specific surface has better properties than samples with lower specific surface because of its relatively softer character compared to portland cement clinker, limestone grinds more readily in a cement finish mill. When a given quantity of energy is introduced into the finish mill, limestone will tend to grind to smaller particle fractions than will portland cement clinker. Therefore, when introduced into the finishing process, a greater percentage of the particles in the small end of the particle size distribution will consist of limestone. Two important material properties are enhanced as a result. First, the particle size distribution of cements containing limestone will be more uniformly graded than finished cement not containing limestone. Second, in order to achieve equal workability, for a given particle size, the water demand for limestone will be lower than the water demand for portland cement particles. The combined result of both of these occurrences is that portland cement containing interground limestone will tend to have lower water demand and denser particle packing, both positive contributors to increasing paste strength. According to EN 197-1 standard, cement plant Kakanj can produce CEM I 52,2 N.

5. REFERENCES

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