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Constructions Quality Versus Bad Components In Jordanian Cement

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Abstract: - This paper presents a study of the bad components of the Jordanian cement and its effects on the quality of the constructions compared with standards or international cements. As the bad components increases the quality of the cement decreases. This study focuses on reveal such components and studying their effects on the cement quality and their future effects on the concrete construction. It is found that as the percent of bad components of cement (like gypsum) increases the quality of cement decrease and so the quality of constructions decreases.

Keywords: - *cement components, constructions, quality, and concrete.*

I. INTRODUCTION

Cement can be defined as a binder material, a substance that sets and hardens and can bind other materials together. The origin of the word "cement" derived from a Roman word which is used to describe masonry resembling modern concrete that was made from crushed rock with burnt lime as binder. The volcanic ash and pulverized brick supplements that were added to the burnt lime, to obtain a hydraulic binder were later referred to as cement. Nowadays Cements used in construction can be characterized as being either hydraulic or non-hydraulic, depending upon the ability of the cement to be used in the presence of water. Non-hydraulic cement will not set in wet conditions or underwater, rather it sets as it dries and reacts with CO2 in the air. It can be attacked by some aggressive chemicals after setting. Hydraulic cement is made by replacing some of the cement in a mix with activated aluminum silicates, pozzolanas, such as fly ash. The chemical reaction results in hydrates that are not very water-soluble and so are quite durable in water and safe from chemical attack. This allows setting in wet condition or underwater and further protects the hardened material from chemical attack like Portland cement. The chemical process for hydraulic cement found by ancient Romans used volcanic ash or activated aluminum silicates. Presently cheaper than volcanic ash, fly ashes from power stations recovered as a pollution control measure or other waste or by products are used as pozzolanas with plain cement to produce hydraulic cement. Pozzolanas can constitute up to 40% of Portland cement. The most important uses of cement are as a component in the production of mortar in masonry, and of concrete, a combination of cement and an aggregate to form a strong building material.

The silicates are responsible of the mechanical properties of the cement, the celite and the brown mille rite are essential to allow the formation of the liquid phase during the kiln sintering (firing). The chemistry of the above listed reactions is not completely clear and is still the object of research. Table 1 shows the chemical composition of cement.

Table 1 chemical composition of cement

Property	Portland Cement	Siliceous (ASTM C618 Class F) Fly Ash	Calcareous (ASTM C618 Class C) Fly Ash	Slag Cement	Silica Fume
SiO_2 content (%)	21	52	35	35	85–97
Al_2O_3 content (%)	5	23	18	12	—
Fe_2O_3 content (%)	3	11	6	1	—
CaO content (%)	62	5	21	40	< 1
Specific surface[b] (m^2/kg)	370	420	420	400	15,000–30,000
Specific gravity	3.15	2.38	2.65	2.94	2.22
General use in concrete	Primary binder	Cement replacement	Cement replacement	Cement replacement	Property enhancer

[a]Values shown are approximate: those of a specific material may vary.

[b]Specific surface measurements for silica fume by nitrogen adsorption (BET) method, others by air permeability method (Blaine).

II. LITERATURE REVIEW

RITU M. et al. (2009), proving that incorporation of Portland cement in increasing quantities in magnesium oxysulpahte cement improves the compressive strength of the cement remarkably. Water tightness of Sorel's cement increases with the increase in quantities of the additive (15%, 20%). Portland cement accelerates initial setting process and retards final setting process of oxysulpahte cement. An insignificant contraction in the length of the trial beams after mixing Portland cement in oxysulpahte cement was an encouraging finding of the study.

Christian J. (2008), found that the combination of certain alkanol amines (TEA and TIPA) with calcium nitrate gave considerable enhanced early strength of cement. Probably the same effect will be found combining nitrate with the highly efficient grinding aid DEA. If quality improvers are used for clinkers that are mineralized with for example Zn, Ti or Cr, significant improvement can be achieved. The total improvement as decrease in clinkering temperature, increased Blaine surface and increased early strength can be measured and expressed in terms of decreased energy used pr. cubic meter of produced concrete.

Rami H. et al.(2008), made some test on Jordanian cement and Test results indicated that masonry mortar mixtures proposed in this investigation met the European and American standard requirements for water retention and air content. The use of hydrated lime in these mixtures resulted in reducing the compressive and flexural strengths without enhancing the workability. The strength test results also indicated that masonry mortars, prepared at an aggregate to cement ratio equal to or less than 4 on loose volume basis, can be successfully used for different masonry applications in Jordan.

Hamadallah B. et al.(2013), Mortars have been prepared from six cement Jordanian brands and tested for their compressive strengths at 2, 7 and 28 days. The strength has been related to some physical parameters. It has been concluded that the compressive strength and its development with age has some variations between the different cement brands. There is an inverse linear relationship between compressive strength and water absorption, and a weaker positive relation with density. There is no clear relation between consistency and compressive strength. Inverse linear relations exist between less than 63 microns size fraction and strength. To account for the differences in compressive strength at different ages and using different cement brands, it is very important to identify the type and amount of cement mineral phases using concrete petrography and X-ray diffraction and fluorescence techniques.

This paper focuses on the effects of bad components on the quality of cement material and at the end on the construction quality.

III. RESULTS AND DISCUSSION

Many bad components affect concrete constructions quality which depends directly on cement quality. Depending on studies discussed the quality of cement and effects of such bad components on cement has a linear regression with the quality of the cement types.

The percent of quality of the constructions (Q) has a negative linear relation with the percent of the bad components of cement type used in such constructions (P) such that

$$Q= A-BP \quad (1)$$

Where A, and B are constants to be determined using the following data. Table 2 shows the quality percent versus the percent of bad components of the cement.

Table 2 quality versus bad components percent.

P (Bad components %)	5	10	15	20	25	30
Q(Quality)%	90	87	85	78	75	71

By experience and previous studies review this negative linear regression can be investigated and rewritten by determining A and B using linear regression formulas such that

$$Q=94.5-0.77*P \quad (2)$$

Fig. 1 shows the relation between the quality of construction (or cement) and the percent of bad components.

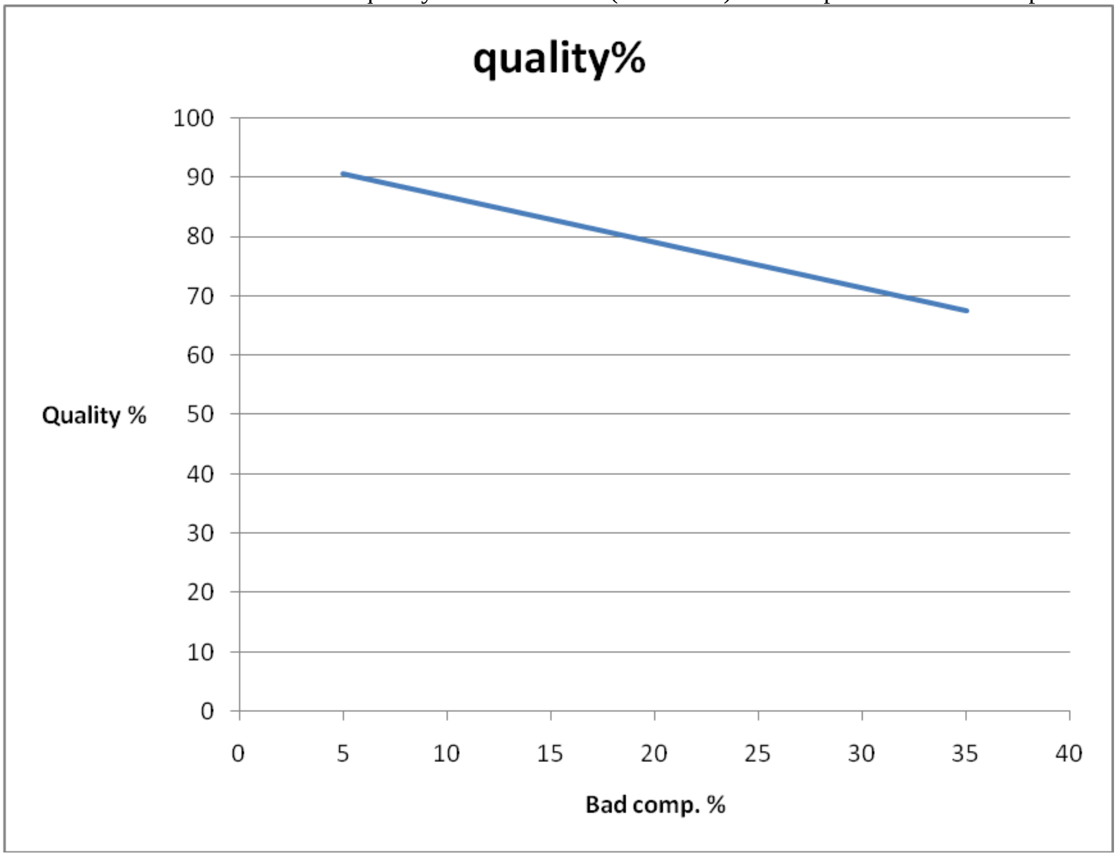

Fig.1 quality of constructions vs. bad components of cement.

It can be noticed that as the bad components percent in the cement increases the quality of the cement decreases and hence the quality of the final product i.e. the concrete constructions decreases too.

IV. CONCLUSIONS

The quality of concrete constructions depends on many factors including soil type, processes of constructions, materials, and the most important factor is cement type. It is found that as the percent of bad components of cement (like gypsum) increases the quality of cement decrease and so the quality of constructions decreases.

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