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EFFECT ON COMPRESSIVE STRENGTH OF CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY MUNICIPAL SOLID WASTE INCINERATION ASH

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ABSTRACT

The municipal solid waste incineration ash reduces are worldwide studied topic over the last decades, so that utilize the municipal solid waste is the one of the possibilities is to use MSWI in concrete production as it is done the bottom ash features the most convenient composition in concrete and it is a available in highest amounts among the MSWI ashes the bottom ash was used as partial replacement of cement of cement in concrete strength has to find ,if the prepared concrete will get sufficient durability or not. The behavior of concrete with the bottom as is differed from the control material due to presence of sulphats and chlorides in bottom ash.

KEYWORDS- municipal solid waste: incineration ash: concrete: compressive strength

INTRODUCTION

The generation of solid waste has been rapidly increasing due to the growth of production thousands of million tons of municipal solid waste produced every year .Usually the incineration technique for treating MSW reduce 70% by weight and 90% by volume in this process it produces ash. One of the paper presents the greatly improved strength obtained with ash which is has been exposed to a new additive these results show that up to 35% of the concrete can be made up of ash, while still obtaining compressive strength. A Construction block consists of 35-60% combined ash, 25-50% of sand and 15% of OPC is act like a hardest super plasticizer. The environmental friendliness of concrete cannot be fully appreciated without taking into consideration that cement and concrete industries are providing an ideal home for enormous quantities of waste products from other industries. The cement and concrete industries are uniquely positioned to eliminate many wastes from the environment while receiving significant economic and technical benefits at the same time. The use of industrial by-products in replacement of natural materials is widely encouraged in construction thus enabling residual materials to be recycled and valorized, while at the same time saving natural resources and energy. In cement production the residual materials can be used both as substitute fuels, raw materials and also as supplementary cementing materials replacing part of the clinker. This paper discusses the possibility of disposing the incinerator ash by adding it to concrete. Generally very small change we can observe by replacing 10% of municipal solid waste incineration ash mix with cement concrete. So we can increase the percentage of ash quantities into the concrete mixes and check the strength.

Cement and aggregate, which are the most important constituents used in concrete production, are the vital materials needed for the construction industry. This inevitably led to a continuous and increasing demand of natural materials used for their production. Parallel to the need for the utilization of the natural resources emerges a growing concern for protecting the environment and a need to preserve natural resources, such as aggregate, by using alternative materials that are either recycled or discarded as a waste.

Concrete has been a major construction material for centuries. Moreover, it would even be of high application with the increase in industrialization and the development of urbanization. Yet concrete construction so far is mainly based on the

use of virgin natural resources. Meanwhile the conservation concepts of natural resources are worth remembering and it is very essential to have a look at the different alternatives. Among them lies the recycling mechanism. This is a twofold advantage. One is that it can prevent the depletion of the scarce natural resources and the other will be the prevention of different used materials from their severe threats to the environment.

The use of Municipal Solid Waste incinerator bottom ash (MSWI) as a part of cement raw material was investigated. The purpose was not only to dispose of the wastes, but also to alleviate some environmental problems, by reducing resources usage, CO2 emissions and energy consumption in cement manufacturing. The replacement of MSWI in raw meal was 5 and 10 percent. Chemical composition and general characteristics, as well as setting times and compressive strength, of the MSWI cements were tested and compared with conventional cement. The chemical compositions of MSWI cements were similar to the control cement, except that the SiO2 component in MSWI cements was higher than that in control cement. Setting times of cement pastes were slightly different when MSWI were used as raw materials in cement. The longer setting times of these cement pastes than those of control cement is due to lower c_3s and higher c_2s levels than in CC. Compressive strength of mortar produced from MSWI cements was rather smaller than the control cement mortar, especially at higher MSWI percentage.

Municipal Solid Waste (MSW) generation in Thailand is of critical concern, especially in big cities. Bangkok, alone, produced approximately 8,000 tons per day in 2002. The incineration of municipal solid waste, an effective method of volume reduction, is presently receiving wide spread attention as a final disposal method of MSW in Bangkok. Likewise, MSW incineration process creates two general types of ash; fly ash and bottom ash. MSW ash can be used in concrete; it will not only be able to reduce the consumption of cement raw materials, but also to solve the MSW ash disposal problems simultaneously. found that MSW ash has an irregular grain surface and very high specific surface area. Other properties such as high loss on ignition, highly variable in characteristics and low reactivity were also contributing problems in the reuse of MSW ash as a pozzolan. Studied the properties of concrete containing MSW incineration ash and reported that different burning conditions affected the reactivity of MSW fly ash. In addition, samples from different compositions resulted in different chemical and physical properties of the final MSW ash cement studied the use of MSW as cement replacing material. The results show that the setting time of paste was delayed significantly. Compressive strength of the concrete replaced with MSW was also greatly reduced when compared with the control concrete. Classified the combustible MSWs into three major types; paper, leaves, and food. After preparation, leaves, paper and food were separately burned in a ferrocement incinerator. Finally, all types of combustible MSW ashes were ground in a grinding machine fixed at 45 minutes. The weight ratio of each combustible MSW ash to total raw material was fixed at 0.05 for all of the experiments. They found that chemical composition and setting property of these cement, as well as the compressive strength of concrete, were rather close to the control cement. From the previous research, the use of MSW ash as a pozzolan or cement replacing material gave undesirable properties of the cementanous materials. Another research used MSW ash as a part of raw materials by classifying the combustible MSW in to paper, leaves and food. The results showed that the general properties were similar to Ordinary Portland Cement (OPC). However, in practice it is difficult to classify MSW. Accordingly, this study presents the possibility of using MSWI as a part of raw materials in cement manufacturing without adjusting the proportion of raw meal. For real applications, if MSWI is replaced in raw materials, it may be necessary to adjust the proportion of raw meal. This new type of cement is expected to improve energy efficiency, to conserve raw materials and to reduce air pollution of the cement manufacturing, while the cement quality is expected to be the same as that of OPC.

MATERIALS

a. Cement
b. Fine aggregate
c. Coarse aggregate
d. Water

Mineral admixture used in this experiment is:
Municipal solid waste incineration ash

METHODS OF NEXT INVESTIGATION

i) Collection of municipal solid waste incineration ash
ii) Physical tests conducted on incineration ash
iii) Preparation of mix design M20
iv) Adding of incineration as 0, 10, 20, 30 40 % in cement
v) Making number of samples of concrete cubes
vi) Testing of cubes to 3, 7, 28 days

Specific gravity of MSWI ash is: 2.34

Tests to be conducted on materials:

Cement: i) initial and final setting time ii) specific gravity

Fine aggregate:

i) Sieve analysis, ii) specific gravity

Coarse aggregate:

i) Flakiness and elongation, ii)specific gravity,

COMPRESSIVE STRENGTH

Compression test according to carried out on these cubes. The specimens were loaded at a constant strain rate until failure. The compressive strength is decreased with an increase in the percentage of the ash. The results of compressive strength cubes for 3 days, 7 days and 28 days.

PROPORTIONS OF NOMINAL MIX DESIGN FOR M20 (1:1.5:3)

Table 1: Proportions of nominal mix design for M20

S. No	Designation Of Mix	Mix Proportion					W/C Ratio
		C (kg)	F.A (kg)	C.A (kg)		MSWIA (kg)	
				20mm	10mm		
1	MSWIA 0%	16.38	24.57	32.67	16.83	0	0.5
2	MSWIA10%	14.742	24.57	32.67	16.83	1.638	0.5
3	MSWIA20%	13.104	24.57	32.67	16.83	3.278	0.5
4	MSWIA30%	11.466	24.57	32.67	16.83	4.194	0.5
5	MSWIA40%	9.828	24.57	32.67	16.83	6.552	0.5

RESULTS AND DISCUSSIONS

COMPRESSIVE CUBE STRENGTH AT 3 DAYS:

Table 2: compressive cube strength at 3 days

S.NO	MIX IDENTITY	MEAN WEIGHT (kg)	MEAN LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (Mpa)
1.	Mix 0 %	7.980	430.67	19.14

2.	Mix 10 %	7.850	550	24.4
3.	Mix 20 %	7.545	530	23.55
4.	Mix 30 %	7.378	400	17.7
5.	Mix 40 %	7.198	310	13.77

COMPRESSIVE CUBE STRENGTH AT 7 DAYS:

Table 3: compressive cube strength at 7 days

S.NO	MIX IDENTITY	MEAN WEIGHT (kg)	MEAN LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (Mpa)
1.	Mix 0 %	8.140	520	23.11
2.	Mix 10 %	7.880	620	27.55
3.	Mix 20 %	7.690	570	25.3
4.	Mix 30 %	7.574	500	22.22
5.	Mix 40 %	7.390	420	18.66

COMPRESSIVE CUBE STRENGTH AT 28 DAYS

Table 4: compressive cube strength at 28 d

S.NO	MIX IDENTITY	MEAN WEIGHT (kg)	MEAN LOAD AT FAILURE (KN)	COMPRESSIVE STRENGTH (Mpa)
1.	Mix 0 %	8.303	756.5	33.62
2.	Mix 10 %	7.966	780	34.66
3.	Mix 20 %	7.885	620	27.55
4.	Mix 30 %	7.789	540	24
5.	Mix 40 %	7.554	360	16

Figure:1

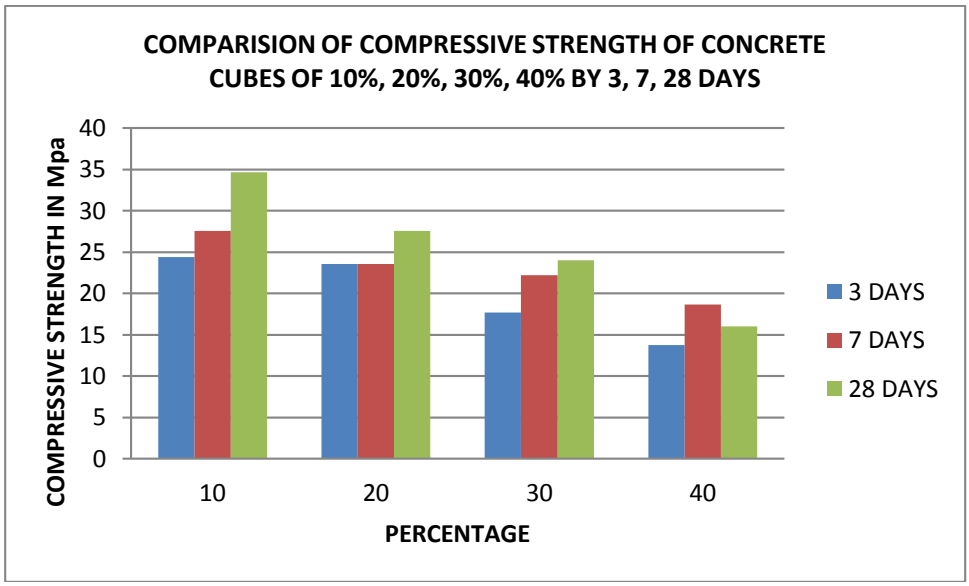
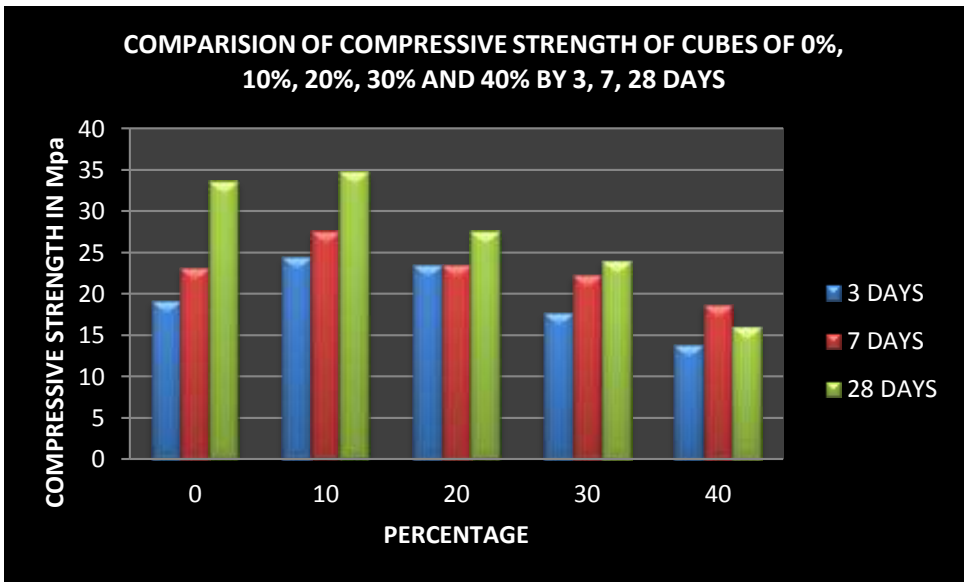


Figure:2



CONCLUSIONS

1. The compressive test results on the cement replaced ash cubes did show improvement while adding 10% and 20% in the 28 days strength in comparison to the control cube, but it fall increasing the percentage above 30% 3 days, 7days. 28days cube strength of M20 grade concrete.
2. Replacement of municipal solid waste ash up to 20% is good for using construction purpose at sea shore buildings and normal buildings. And also solid waste incineration powder replacing mixes are also used as base coarse.
3. While increasing the percentage of MSWI ash in cement then caco3 will reduces in it. As we maintain the more percentage of MSWI ash then add suitable amount of $caco_3$.

4. The untreated MSWI ash was used as partial cement replacement in concrete. This ash, by its chemical composition, does not fulfill the standard requirements on concrete admixtures but the prepared concrete had acceptable properties. The 3-days compressive strength of material with 10 % cement replacement was comparable with the control specimen; the 28-days strength was lower which can be explained by different hydration process. The frost resistance of MSWI ash containing concrete was very good. The prepared concrete contained relatively low content of MSWI ash; this approach represents a compromise between the ecological request on a practical utilization of MSWI ashes and properties of the acquired product.
5. Higher ash dosage – without any accompanied loss of concrete properties – would be possible only when the ash would be treated in some way (e.g. by verification) but in such case there would arise additional costs suppressing the MSWI ashes utilization attractiveness for building industry.

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