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ANALYSIS OF PROPERTIES OF CONCRETE USING POTASSIUM POWDER AS ADMIXTURE

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Abstract

Chemical admixtures are the ingredients in concrete other than Portland cement, water and aggregate those are added to mix immediately before or during mixing. These admixtures are primarily used to reduce the cost of concrete construction, to modify the properties of hardened concrete, to ensure the quality of concrete during mixing, transportation, placing curing and to overcome certain emergences during concrete operations. In this paper analysis of properties of concrete using potassium power as admixture is studied and verified the strength of concrete and temperature emitted due to chemical reaction to normal Portland cement. Using potassium powder the temperature emitted due to exothermal reaction of concrete has reduced. Thus gives better results hence we can use this potassium powder as an admixture where the temperature and the emitting temperatures place a crucial role in construction and maintenance.

Keywords: Potassium Powder; Temperature Retarder; Admixture; Concrete Exothermal Reaction.

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1. Introduction

Potassium is a chemical element with symbol 'K' and atomic number 19. Potassium is one of the alkali metals. All of the alkali metals have a single valence electron in the outer electron shell, a positive charge a cat-ion, which combines with anions to form salt. Potassium is chemically very similar to sodium, the previous element in group 1 of periodic table. They have a similar first ionization energy, which allows for each atom to give up its sole outer electron. Neutral potassium atom have 19 electrons one more than the extremely stable configuration of the noble

gas argon. Because of this low ionization energy of 418.8KJ/mol the potassium atom is much more likely to lose the last electron and acquire a positive charge than to gain and acquire a negative charge [1] [2] [3].

An alloy of sodium and potassium NaK is a liquid used as a heat-transfer medium and a desiccant for producing dry and air free solvents. It can also be used in reactive distillation [4]. The ternary alloy of 12%Na, 47%K and 41%CS has the lowest melting point of -78^0 of any metallic compound [5].

The transmitting and absorbing temperatures of concrete have reduced by using potassium powder as chemical admixture. Since, very less number of literature found related to the present study, the author just compared his work with general ordinary Portland cement.

2. Methodology

Potassium powder collected from manufactures. This powder must not be exposed to sun light and other chemical reaction. Instead packing powder in aluminum sheets or polythene cover helps in protecting powder from atmospheric moisture. While mixing the powder must be free from lumps. Target strength of concrete was determined by the equation

Target strength= f'ck= fck +1.65(s) …… [eq1] according to standard code IS10262-2009.

The amount of potassium admixture was calculated from the following equation,
Volume of powder used = (mass of chemical admixture/specific gravity of admixture *1000) …… [eq2].

The specific gravity of potassium powder was found 1.63 by Le-Chatelier principle [5] [6]. The cube casted for the size is said to be 15cm3. The compression and flexure strength were tested for 1, 7, 14, 21 and 28 days after casting.

An empty spaced cube with bottom, size of 10*10*10cm casted using concrete with potassium powder concrete and walls of thickness 1cm. Water of 1000c was filled in empty cube and the time consumed for reduction of temperature of water to 400c were noted down. This gives the time consumed by cube to reduce inner temperature of 1000c of water to 400c.

An empty cube casted by using potassium powder concrete size 10*10*10 was inserted into another larger empty cube casted using plane cement concrete size of 15*15*10cm. 3cm sufficient space was left between two cubes was filled with Water of 100c and top side of cube was closed by lid. Water temperature was noted down after 8mins for 1, 7, 14, 21 and 28 days of similar casted samples. The difference between the water temperature noted after 8min and the temperature at room temperature gives the amount of heat transmitted through the walls of inner cube.

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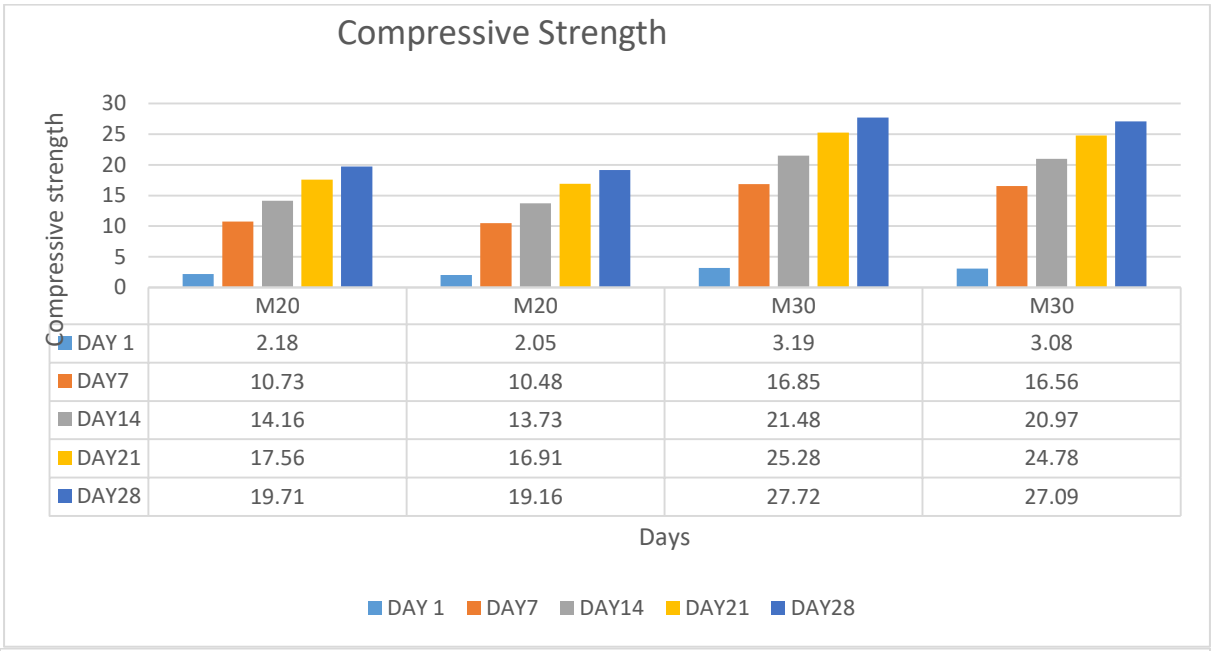
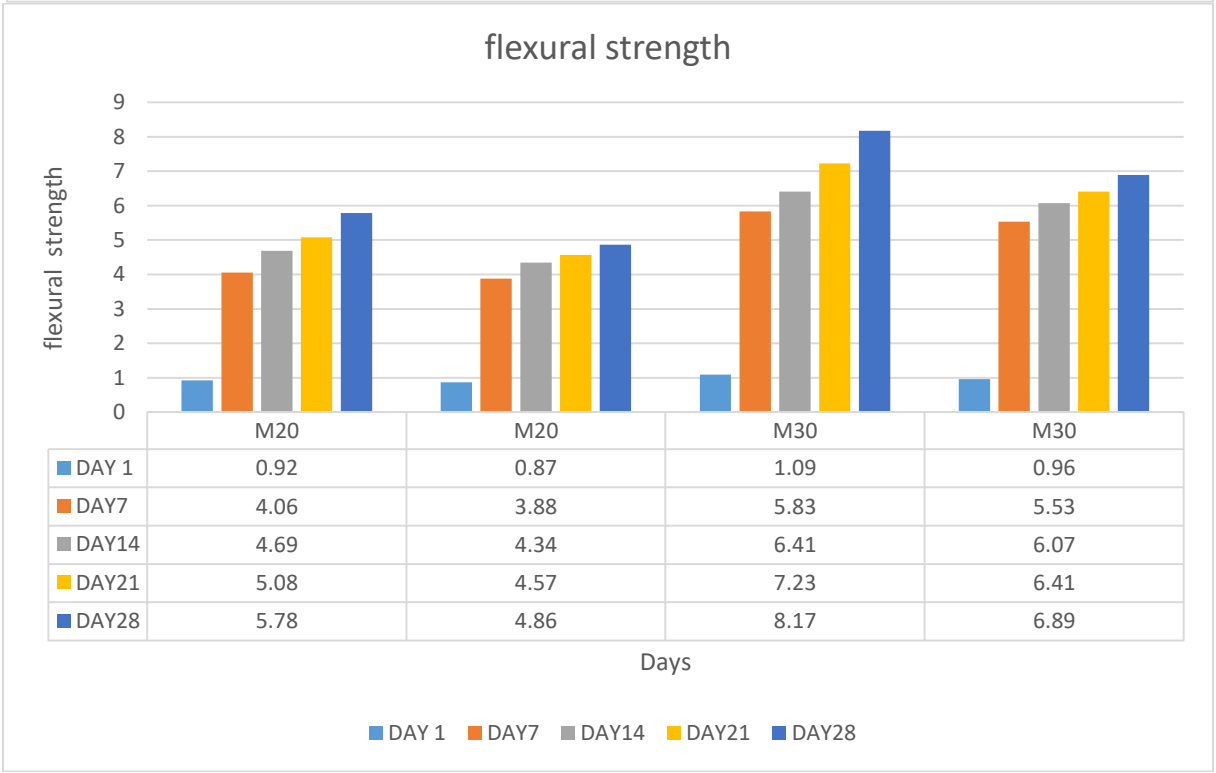
3. Results and Discussions



	M20	M20	M30	M30
DAY 1	2.18	2.05	3.19	3.08
DAY7	10.73	10.48	16.85	16.56
DAY14	14.16	13.73	21.48	20.97
DAY21	17.56	16.91	25.28	24.78
DAY28	19.71	19.16	27.72	27.09



	M20	M20	M30	M30
DAY 1	0.92	0.87	1.09	0.96
DAY7	4.06	3.88	5.83	5.53
DAY14	4.69	4.34	6.41	6.07
DAY21	5.08	4.57	7.23	6.41
DAY28	5.78	4.86	8.17	6.89

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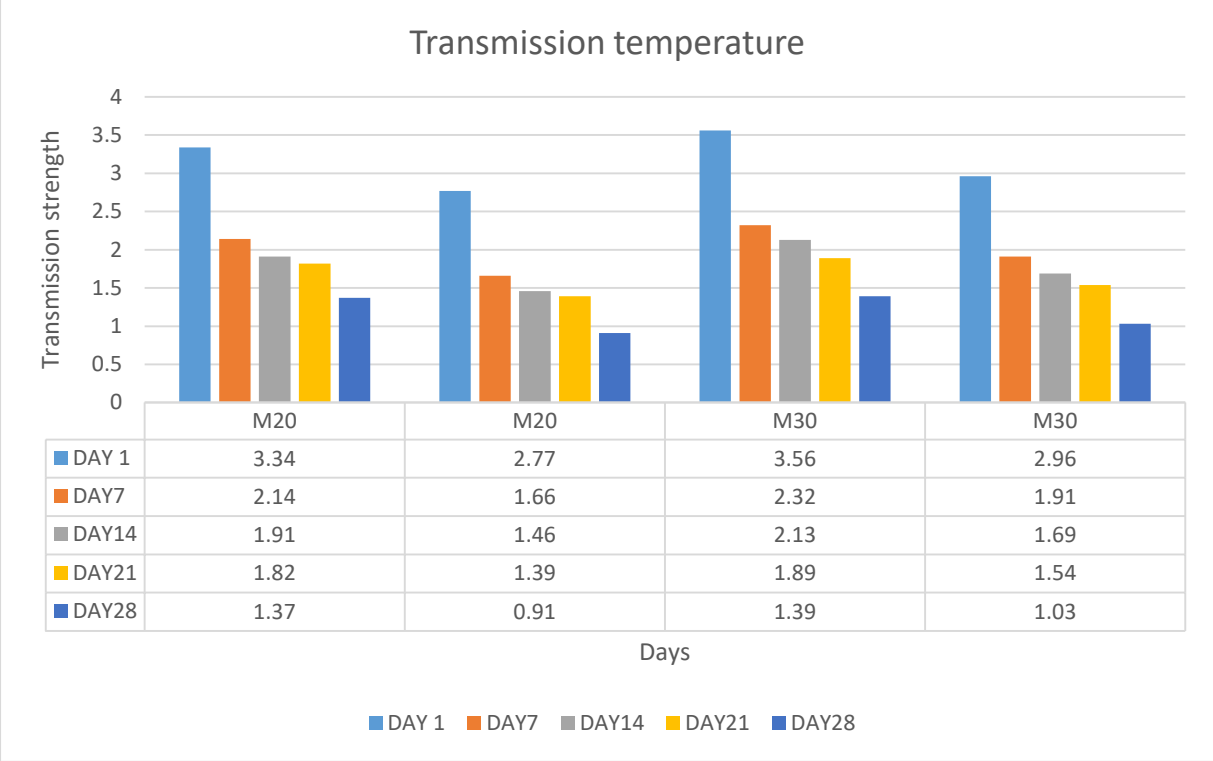
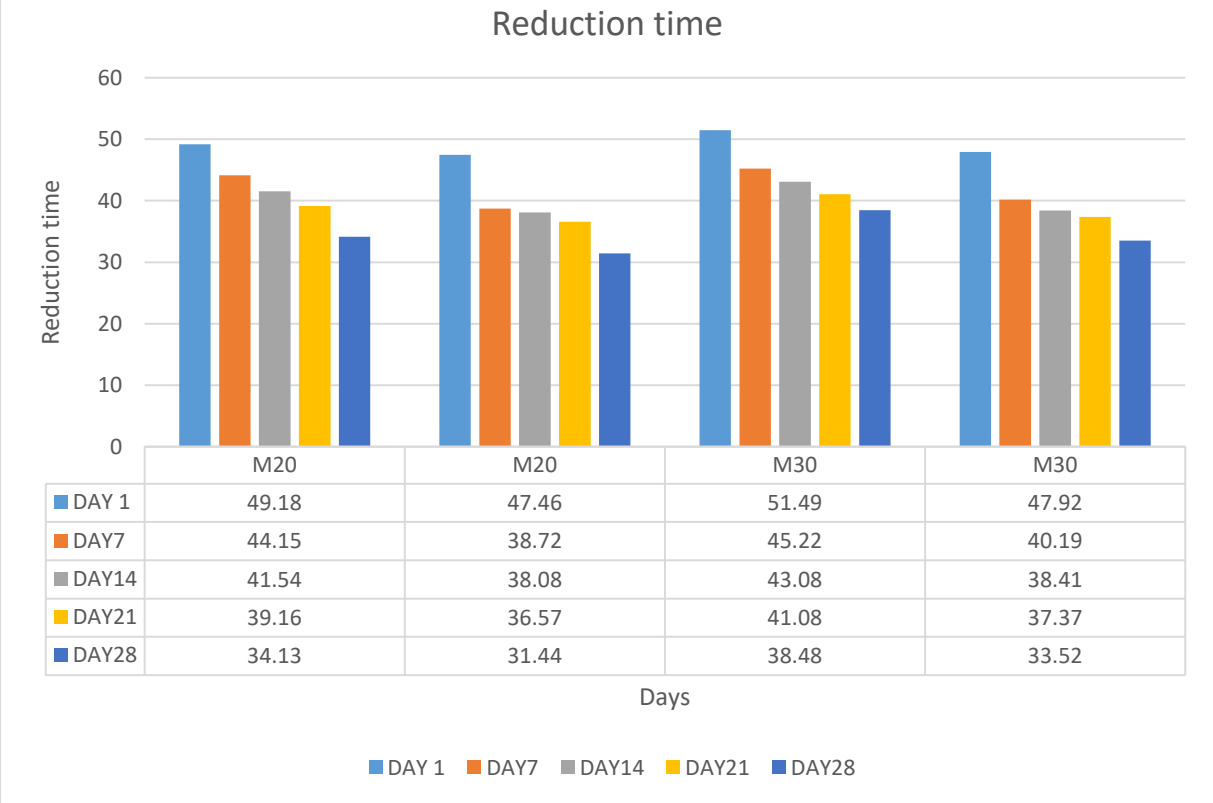


	M20	M20	M30	M30
DAY 1	3.34	2.77	3.56	2.96
DAY7	2.14	1.66	2.32	1.91
DAY14	1.91	1.46	2.13	1.69
DAY21	1.82	1.39	1.89	1.54
DAY28	1.37	0.91	1.39	1.03



	M20	M20	M30	M30
DAY 1	49.18	47.46	51.49	47.92
DAY7	44.15	38.72	45.22	40.19
DAY14	41.54	38.08	43.08	38.41
DAY21	39.16	36.57	41.08	37.37
DAY28	34.13	31.44	38.48	33.52

4. Conclusions & Recommendations

In fig (4) shows time taken by each sample to cool down from 100^0c to 40^0c. Present study reveals that using potassium as concrete admixture takes very less time that is 31 minutes 44 seconds for M20 and 33 minutes 52 seconds for M30 compared to normal concrete taking 34 minutes 13 seconds for M20 and 38 minutes 48 seconds for M30 grade concrete that is approximately 8% and 13% times faster in cooling by M20 and M30 grade of concrete respectively. Hence, it says that the time for reduction of temperature has reduced by using potassium powder as chemical admixture.

Although fig (1) and fig (2) showing compressive strength and flexural strength are lesser while using potassium as concrete admixture compared to normal concrete.

From the fig (3), It can be observed that M20 grade concrete with potassium as concrete admixture transmitted less temperature (0.91^0c) compared to normal concrete (1.37^0c). Temperature transmittance capacity M 30 found less that is (1.03^0c) compared to normal concrete that is (1.39^0c). That is approximately 34% and 25% of lesser temperature has been transmitted by M20 and M30 grade of concrete respectively.

Hence this is clear that by using potassium powder as admixture the properties relating to reduction and transmission of temperature in concrete has reduced.

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