

REVIEW ON GEOPOLYMER CONCRETE

(Use of fly ash in geopolymer concrete)

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Abstract: In manufacturing process of cement involves emission of majority of carbon associated with other chemicals. To reduced use of amount of cement in concert we can substitute some percentage of cement by fly ash. On the other hand fly ash is difficult to dispose which is create threat to the environment. We can utilize this fly ash in cement concrete as a partial replacement of cement as well as additive so as to provide an environmentally consistent way of it's disposal and reuse from observations it found that fly ash initially imparts high strength to concrete and also reduce the permeability of concrete. Fly ash benefits fresh concrete by reducing the mixing water requirements and improving the past behaviour.

IndexTerms – Fly ash, Sodium Silicate, Sodium Hydroxide

I. INTRODUCTION

Today's developing and growing world a construction sector grows, these necessities increases as well. Also requirements of row material increases gradually. Cement one of the basic material of construction engineering has an important place in view of strength of structure. Cement is an extremely important construction material used for Infrastructure development. Cement demand is directly associated to economic growth and many growing economies are striving for rapid infrastructure development which underlines the tremendous growth in cement production.

On the other hand cement production is the third ranking producer of anthropogenic CO₂ in the world. 4%-5% of the worldwide total of CO₂ emissions is caused by cement production. After water, concrete is the most widely used substance on earth. Every one ton of carbon dioxide of cement manufacturer release half ton of carbon dioxide so there is an instant need to control the usage of cement.

A pozzolana is a siliceous or siliceous/aluminous material which when mixed with lime and water forms a cementitious compounds. Fly ash is the best known, and one of the most commonly used, pozzolanas in the world. Fly ash is the waste product of coal based electricity generating thermal power plant, known for it's ill effects on agricultural land, sub-surface water pollution and diseases to mankind. Utilization of by products as the partial replacement of cement has important economical, environmental and technical benefits such as reduced amount of fly ash as waste materials, Improve durability of concrete and resistance to chloride and sulphate penetration.

II. FLY ASH

Fly ash has many benefits and improves concrete performance in both fresh and harden state. Fly ash use in concrete improving the workability of plastic concrete and strength and durability of harden concrete.

- **Benefits of fresh concrete:**

Fly ash benefits fresh concrete by reducing the mixing water requirement and improving the paste flow behaviour.

- **Improved workability:**

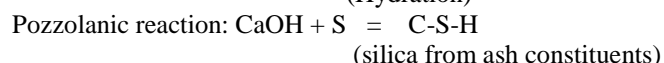
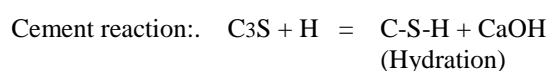
The spherical shaped particles of fly ash as miniature ball bearings within the concrete mix, thus providing a lubricant effect.

- **Decreased water demand:**

Replacement of cement by fly ash reduces the water demand. When fly ash is used at about 20% it reduce water demand by approximately 10%. The decrease water demand has little or no effect on drying shrinkage or cracking. Replacing cement with the same amount of fly ash reduce the heat of hydration of concrete. This reduction in the heat of hydration does not sacrifice long term strength gain or durability.

- **Reaction of fly ash in concrete:**

One of the primary benefits of fly ash is its reaction with available lime and alkali in concrete providing additional cementitious compounds. Reaction of fly ash with lime form's additional calcium silicate hydrate binder (C-S-H). C-H-S is a main product of hydration of cement and it primarily respond for strength in cement base material.



- **Increased ultimate strength:**

The additional binder produced by the fly ash with available lime allows fly ash concrete to continue to gain strength over time.

- **Reduced permeability:**

The decrease in water content combined with the production of additional cementitious compounds reduces the pore interconnectivity of concrete thus decreasing permeability.

- **Fly ash increases resistance to sulphate attack:**

Sulphate attack on concrete has the potential to cause serious damage or structural failures. Attack occurs when the sulphates are able to react with the free lime released during hydration of the Portland cement and with calcium aluminates present in the cement this reaction results in formation of sulphate compound including sulphoaluminates. This compound occupy a great volume then the original concrete components they cause expansion and eventual failure of the concrete.

Bituminous coal fly ashes greatly improve the resistance to concrete to sulphate attack. Reaction silica, alumina and ferric oxide found in fly ash with calcium hydroxide liberated during the hydration of Portland cement to form relatively stable cementitious compounds. Fly ash reacts with available alkali which make them less available to react with certain silica minerals contained in aggregates. Fly ash consumes the free lime making it unavailable to react with sulphate. Reduced permeability prevents sulphate penetration in to the concrete.

III. SODIUM SILICATE AND SODIUM HYDROXIDE (ALKALINE ACTIVATORS)

Sodium silicate is used as alkali activator in alkali activated cement. In concrete it is used as a setting accelerator and also applied in the form of silicate. Sodium silicate react with the calcium hydroxide in hydrated cement paste to form calcium silicate hydrate gel that fills cracks.

Sodium hydroxide helps to improve compressive strength of geopolymer concrete increases with increase in test period up to three days.

IV. CONCLUSION

Fly ash is a waste generating from thermal power plant. If fly ash can be reuse in cement concrete work than it will be good for both environment and economy. by using fly ash as a alternative to cement in concrete. It reduced environmental damage fly ash also improve workability. Permeability of concrete can decrease by using fly ash. Replace 20% - 40% of cement by fly ash makes concrete economical.

