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A Short Note on- Resistance of Concrete Containing Fly Ash and Silica Fume

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Introduction

The goal of this research is to see how resistant concrete is to organic acid and abrasive corrosion, both of which are common in pig farms. Cement was substituted with fly ash and silica fume at various weight percentages up to 30% in the concrete compositions. The compressive strength and mass loss owing to organic acid corrosion of cubic mortar and concrete specimens were constructed and tested. The test findings showed that combining fly ash and silica fume greatly increased the concrete's compressive strength, especially over lengthy curing durations. The addition of fly ash and silica fume considerably increased the resistance of the concrete and mortar against organic acid corrosion.

Description

Furthermore, two testing machines (one for organic acid corrosion tests in wet-dried circumstances and the other for an abrasion testing machine with steel brushes) were designed to imitate the abrasion-corrosive assault on concrete floors in pig farms. The concrete slab was cast and tested in an organic acid solution with an abrasion test using a wet-dry switching system. The test findings showed that using a considerable amount of fly ash and silica fume to increase the concrete's resistance to organic acid corrosion and abrasive corrosion is ineffective. When compared to the reference, the concrete mixture containing 5% silica fume has the best resistance to organic acid corrosion and abrasive corrosion, with a mass loss reduction of 7.14 percent mixture.

Concrete corrosion is defined as the chemical and physical destruction and deterioration of concrete structures. Concrete degradation is caused by a variety of circumstances. Environmental conditions, materials, preparation techniques, and degradation from their uses are among the most typical factors. Various concrete building components in agricultural structures are exposed to acid assault, with lactic acid, acetic acid, and sulfuric acid serving as the primary aggressive agents. The natural decomposition of organic materials, particularly agricultural goods, can yield various organic acids such as lactic and acetic acids [1].

The generation of lactic and acetic acids from the breakdown of animal feed or agricultural products in the presence of water results in an acidic environment in animal homes and farms. Under low pH, less than 4, organic acid reacted with cement hydrated compounds, resulting in the breakdown of hydration products (calcium hydroxide calcium silicate hydrate or C-S-H) to form mostly calcium salts that are water soluble. As a result of the poorly soluble calcium salts, permeability and porosity rise, resulting in a loss in concrete compressive strength [2].

According to Wang a drop in the Ca/Si ratio of cement paste during NH4NO3 dissolution owing to the decalcification of hydration products might result in a weakening of the cement paste's micro hardness, which has a long-term effect on the mechanical characteristics of concrete. Furthermore, organic acid corrosion damages concrete flooring in animal buildings, and mechanical abrasion from cleaning methods speeds up the corrosion process. Depicts typical damage to concrete flooring at a pig farm, including damage surrounding the feeding machine as a result of lactic acid attack from spilled and soured meal-water mixes. The use of several forms of industrial waste as pozzolanic materials in concrete has been thoroughly studied from a variety of viewpoints, including strength, permeability, durability, and corrosion resistance. Fly ash, silicon smelting fume, and powdered granulated blast-furnace slag are the most typical industrial wastes utilised as pozzolanic ingredients in the concrete industry. The use of fly ash and/or silica fume in concrete has been shown to improve mechanical qualities in previous research. The simultaneous use of fly ash and silica fume as cement replacement materials for blended cement mortars under autoclaved curing was investigated [3].

The compressive strength of the fly ash blended cement mortar decreased as the fly ash fraction increased, indicating that it had a lower compressive strength than the OPC mortar. However, adding silica fume to cement mortars enhanced compressive strength, and the compressive strength of the binary blend of fly ash and silica fume was higher than the OPC mortar. Looked at the impact of fly ash and silica fume on concrete mechanical parameters such modulus of elasticity, compressive strength, and toughness. They used silica fume to replace 15 wt% of total cement, as well as fly ash to replace up to 15 wt% of total cement (at replacement levels of 0 percent, 5 percent, 10 percent, and 15 percent). The compressive strength of the OPC concrete rose by 15–28 percent, according to the results [4,5].

The modulus of elasticity improved by 7–13 percent as the proportion of fly ash grew, and the sample that substitutes cement with 10% silica fume and 10% fly ash had the greatest attributes overall. Previous research has looked on the abrasion resistance of concrete.

Conclusion

In addition to enhanced mechanical qualities, several studies show that using fly ash and silica fume in concrete increased acid resistance by lowering calcium content and decreasing porosity. When compared to reference OPC concrete, found that substituting 60% of the cement content with low-calcium fly ash resulted in superior resistance when exposed to a 5% H_2SO_4 acid solution. Ravindrarajah found that replacing up to 15% of the cement with silica fume resulted in decreased HCl acid attack in high-strength concrete. The mass loss and compressive strength loss of concrete subjected to a hydrochloric acid solution were investigated by Goyal. The results of the tests revealed that the ternary reacts with a mixture of silica fume and fly ash.

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Conflict of Interest

None

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