The Effect of Water Quality on Workability of the Concrete

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***Abstract*: This research investigates the effect of water in terms of pH value on the workability property (slump) of the concrete. Five water samples were prepared as pH5, pH6, pH7, pH8 & pH9 to study the effects. The study was carried out by employing the same water for mixing water as for curing water. The workability was tested with two mix design ratios (1:2:4 and 1:1.5:3) via slump cone method. The research showed that the maximum workability had been achieved by the mix having water of pH7 while the workability achieved by water having pH value of 8 and 9 was greater than that of mix having water with pH value of 5 and 6.**

***Keywords*: Effect of water quality, pH value, Concrete, Workability.**

I. INTRODUCTION

Concrete is a very strong and versatile moldable construction material. It is made up of water, cement, aggregates (fine and coarse) and sometimes extra materials called admixture. The cement and water form a paste or gel which coats sand and aggregate. When cement has chemically reacted with water, it hardens and binds the whole mix together. The initial hardening reaction usually takes place within few hours. It takes some weeks for concrete to reach full hardness and strength. Concrete can continue to harden and gain strength over many years. Water is an important constituent in concrete. Several billion tons of water are annually consumed in mixing and curing of concrete around the world (Akshat Dimri, Jay Kr. Varshney, V. K. Verma, & Sandeep Gupta, 2015). It chemically reacts with cement (hydration) to produce desired properties of concrete (Adam M. Neville, 1995). Mixing water is the quantity of water that comes in contact with cement, impact slump of concrete and is used to determine water to cementitious materials ratio (w/c) of the concrete mixture. Strength and durability of concrete is controlled to a large extent by its w/c ratio. Mixing water in concrete includes batch water measured and added to the mixer at the batch plant. Water absorbed by the aggregates is excluded from mixing water. Besides, quality of mixing water used in concrete has important effects on fresh properties of concrete such as setting time and workability; it also has important effects on strength and durability of hardened concrete. Therefore, this research investigates the effect of water in terms of pH value on the fresh properties (slump) of concrete.

II. MATERIALS & METHODS

A. Cement

The cement used in this study was ordinary Portland cement purchased from Jamshoro, Sindh Pakistan. This type of cement was selected since most of construction industries in Pakistan use it.

B. Mixing Water

The mixing water used in this research work was taken from the Structural Lab,Civil Engineering Department, M.U.E.T Jamshoro.

C. Fine & Coarse Aggregates

Coarse aggregate (maximum size of 19 mm) and fine sand (maximum size of 4.75 mm) were purchased from a nearby crusher which are typically the same materials used in normal concrete mixtures.

D. Sulphuric Acid and Sodium Hydro Oxide

To make the water samples of pH 6 and pH7, Sulphuric Acid was used which is a commonly used acid to reduce the alkalinity of water in a safe and inexpensive way and for the samples of pH8 and pH9, Sodium Hydro Oxide was used to regulate the required pH level of water.

E. Digital pH meter and Laboratory pH meter

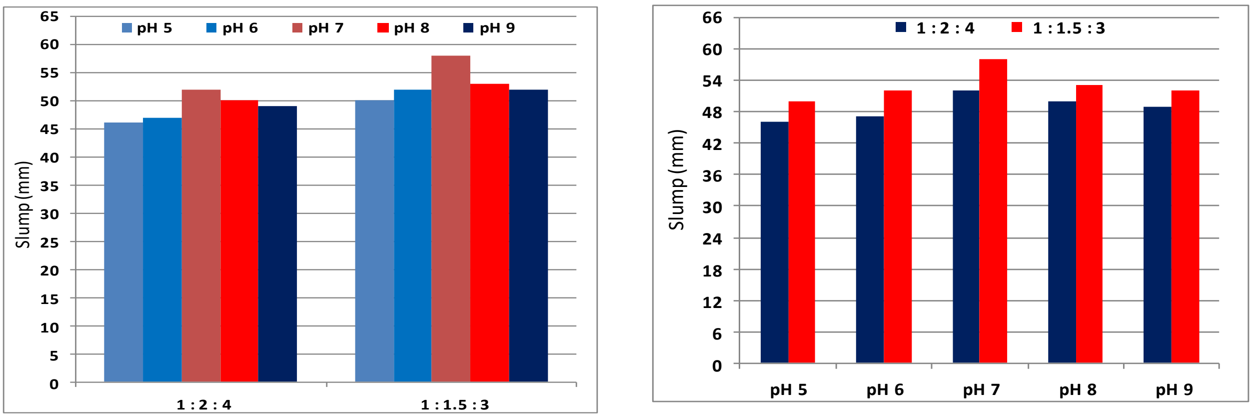
A portable digital pH meter was used to measure and regulate the pH level of water samples. The results were also cross checked with laboratory p H meter.

F. Methodology

The research work was carried out at Structural Lab, M.U.E.T Jamshoro to work out the effect of water quality on the workability of concrete in terms of pH level of water used in the manufacturing of the concrete. The five different pH levels (pH5, pH6, pH7, pH8 and pH9) were examined. By trial and error method, water samples were maintained by utilizing the Sulphuric Acid (to regulate the pH6 and pH5 levels) and Sodium hydro Oxide (to maintain pH8 and pH9 levels.). Two mix design ratios 1:2:4 and 1:1.5:3 were adopted to examine. The workability was measured by the slump test.

III. RESULTS

Workability test was conducted immediately after mixing, the outcomes of the workability test showed that measured slump values were within the target limits of 45-100 mm. Concrete prepared with water having pH value 7, achieved maximum slump value. However, the workability achieved by water having pH value of 8 and 9 is more than that of mix having pH value of 5 and 6. In both the mix ratios 1:2:4 and 1:1.5:3 same trend of workability has been observed.



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IV. CONCLUDING

On the basis of above conducted research work and results, it may be recommended that the concrete may be prepared with the water having pH level of 7 for the better results.

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