ABSTRACT

The water requirements are linked with the density of population and the growth of industrial activity. As the population and the industrial activity increases, it is susceptible to have more chances of water scarcity. Due to urbanization and industrialization, the construction industry is in the rapid pace of development. A large quantity of water is required for the entire construction activity which includes mixing of concrete ingredients, curing of concrete and washing of equipments etc. Both in developed and in developing countries water depletion issues are the major problems and hence an alternate has to be found out to replace the potable water used in construction industry with some other reused industrial effluent. The waste water let out from various industries such as rice mills, dairy farms, distilleries, sugar mills, paper mills, tanneries, textile processing units etc., is considered for reusing in the construction activity. Since there are more number of tanneries and textile processing units clustered in South India and huge amount of water is let out from these industries, the feasibility of using the tannery and textile processed effluents in the construction activity is studied in this research.

The characteristics of untreated and treated tannery effluents, untreated and treated textile effluents are analyzed. The properties of the materials used such as coarse aggregate, fine aggregate, cement etc are tested. A concrete mix has been designed to achieve the minimum grade of $M_{20}$ as required by IS 456 – 2000. The concrete specimens such as cubes, cylinders
and beams were prepared using the untreated and treated tannery effluent, untreated and treated textile effluent and potable water and cured in respective water or effluents for a period of 28 days. The effect on properties of the concrete such as compressive strength, tensile strength, flexural strength, bond strength, sulphate attack, chloride attack, corrosion using tannery and textile effluents are studied.

It is observed that there was no significant difference in the strength properties of the concrete such as compressive strength, tensile strength, flexural strength and bond strength whereas significant changes are observed in loss of weight and reduction in compressive strength of the concrete due to sulphate attack, chloride attack and corrosion of the reinforcement bar embedded in the concrete. The suitable admixtures were selected and optimized to counteract the adverse effects of using tannery and textile effluents (replacing potable water) on the properties of the concrete by conducting various experimental trials with various admixtures and in various combinations. Based on the experimental results, the concrete blended with 5% fly ash and 2.5% concare or 2.0% calcium nitrate are selected as the optimum dosage for minimizing the adverse effects on the concrete prepared using tannery effluents. The concrete blended with 5% fly ash and 2.0% concare or 2.0% calcium nitrate is selected as the optimum dosage for minimizing the adverse effects on the concrete specimen cast using textile effluents. To prevent the corrosion of reinforcement bar embedded in the concrete from the root level, a commercial inhibitor named cempatch-R is also coated on the steel reinforcement bar.
The properties of concrete (blended with admixtures) such as sulphate attack, chloride attack, corrosion, chemical attack, alkali aggregate reaction, leachability of chloride, leachability of sulphate, permeability, compressive strength, tensile strength, flexural strength (PCC), failure load (RCC beams) and bond strength prepared using potable water, tannery and textile effluents for longer duration are studied in various intervals of 28 days, 180 days, 1 year, 2 years and 2.5 years. It is observed that initially (up to a period of 1.0 year) there is more loss of weight of concrete and reduction in compressive strength of the concrete subjected to sulphate attack, chloride attack and loss of weight of the reinforcement bar embedded in the concrete. But after 1 year, the loss of weight of concrete and reduction in compressive strength of the concrete subjected to various attacks is less.

From the experimental studies it is observed that tannery effluent and textile effluents are suitable to be used for the preparation of the concrete blended with admixtures. The advantages of using such industrial effluents are that the water depletion from ground surface can be minimized and in turn the water scarcity in the country can be reduced. In addition the industrial effluents are reused safely without any disposal problems. The utilization of this industrial effluent in the concrete leads to an effective liquid waste management technique.