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Use of Textile Industrial Waste as Environment–Friendly Construction Materials

S. V. Elangovan[1]*, V. Chandramohan[2], N. Sivakumar[3] and M. Palanivel[4]

[1]Department of Chemistry, Velalar College of Engineering and Technology, Erode, India; kanjielango@gmail.com

[2]Department of Chemistry, P.S.G. College of Arts & Science, Coimbatore, India

[3]Department of Chemistry, Chikkanna Govt. Arts College, Tiruppur, India

[4]Department of Environmental Science, P.S.G. College of Arts & Science, Coimbatore, India

Abstract

The chemical treatment method adopted in common effluent treatment plants to treat Textile industrial waste water produces large quantity of chemical coagulant sludge. The magnitude of problem of dumping solid waste creates another kind of pollution. Hence a way is to be found to reduce the extent of pollution through the chemical coagulant sludge and make use of the sludge profitably. In this context, a laboratory scale study was conducted for using the chemical coagulant sludge for manufacturing of concrete building blocks and analyzing the leachates by immersing the blocks at different pH water.

Keywords: Chemical Coagulant Sludge, Concrete Building Blocks, Leachate, pH

1. Introduction

The demand for textile fabrics has been rapidly increasing for the last two decades in our country. Water is the main raw material and dyeing units consume large quantity of water and generate waste water and solid waste. The normal dyeing operations of textile plants are such that the dyes used vary from day to day [1]. Frequent changes in dye stuff employed in the dyeing process cause considerable effluent characteristics [2]. Synthetic polyelectrolytes, as a coagulant aid for a removal of pollutants and turbidity [3]–[5] from water and wastewater is extensively used in the developed countries [6], [7]. The disposal of solid wastes generated by textile industry consists of landfill and lagooning of sludge and incineration. Landfill creates back rate problem and incineration leads to air pollution. Application of modern engineering and technological methods are necessary now more than ever to cope with the sludge disposal problems [8].

1.1 Characteristics of Chemical Coagulant Sludge

Thickened sludge (Moisture Content) – 98%

Centrifuged sludge (Moisture Content) – 60%

pH – 9.13 to 9.94

TDS – 9.1 to 18 g/Kg

Sulphate Concentration – 463 – 475 mg/Kg

Chloride Concentration – 2.95 – 2.83 g/Kg

Heavy metals present – Copper, Nickel, Chromium, Iron, Lead and Cadmium.

2. Materials and Methods

In this present study, the different proportions of chemical coagulant sludge is mixed with sand, cement (53 Grade), flyash, crushed stones (2 cm) and concrete blocks (Triplet) were made using wooden hand mould. The samples were dried in shade and immersed in water for about 21 days. The maximum compressive load bearing capacity of samples were checked using UPM 110. In the separate study the blocks were immersed in altered pH for 21 days then leachate samples were analysed for different parameters like Calcium, Magnesium, Iron, Sodium, Potassium, TDS and Electrical Conductivity by adopting the standard methods.

Author for correspondence

3. Results and Discussion

The proportion of cement (53 Grade) and the ratio of crushed stones (2 cm) were constant, but there is a change in the sand for different ratio of powdered sludge and flyash. Control also was prepared using 2 parts of sand and one part of sludge and flyash. The compressive load of the control block was 32±10.93 tons. The compressive load for sludge and flyash are 26±5.03 to 48.53±14.0 tonns (Figure 1). The leachates showed alkalinity ranging from 11 to 12 pH, TDS ranges from 652 to 896 mg/L for sludge (Sample IA) and 804 to 1036 mg/L for sludge and flyash combination (Sample IV). The electrical conductivity ranges from 1180 to 3380 micromhos/cm for sludge (Sample IA) and 1970 to 3740 micromhos/cm for sludge and flyash combination (Sample IV).

The metal content for sludge varies: Sodium 139 to 800 mg/L, Potassium 165 to 320 mg/L, Calcium 150 to 1900 mg/L, Magnesium 300 to 1150 mg/L, (Sample IA) and for sludge and flyash combination, Sodium 123 to 165 mg/L, Potassium 108 to 158 mg/L, Calcium 100 to 1300 mg/L, Magnesium 700 to 1400 mg/L, (Sample IV). For all samples and control the Iron content is below detectable limit. The high concentration of Sodium and Potassium in Sample IA leachate indicates enrichment of Sodium and Potassium in Chemical coagulant sludge. The finishing operations are wet processes and significant quantities of various chemicals like caustic soda, soda ash, sodium hydrosulphate etc., are used to bring out finished products to acceptable level, the chemicals used in industry ultimately find their way into the effluents and sludge generated through the chemical treatment process. Even though sludge contains higher concentration

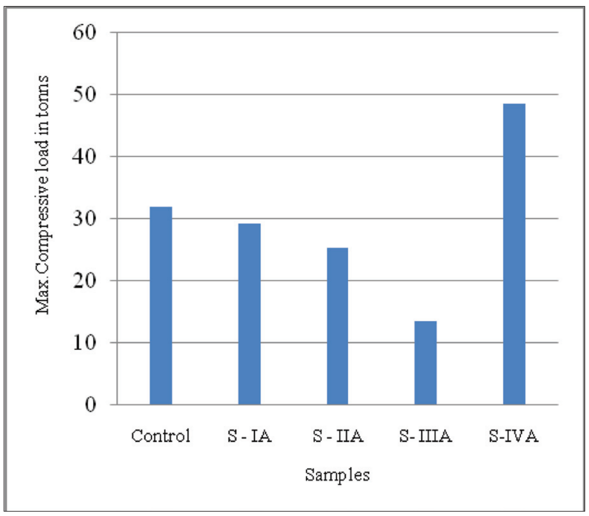

Figure 1. Maximum compressive load of concrete blocks made using sludge.

of calcium and magnesium when it becomes concrete blocks it is not generated as leachate, which is similar to that of control. Calcium and Magnesium show variability but variations range in fair agreement with that of control.

Total Dissolved Solids (TDS) were used as an indicator of the total amount of dissolved materials in solution. The variations in TDS concentrations for control and samples showed the same tendencies.

4. Conclusion

Viewed from a total perspective of the study, the option of mixing small quantities of chemical coagulant sludge and flyash for construction of concrete building material is also a promising techno-economic alternative. However more studies are required to evolve guidelines for the use of such blocks by the construction industry and to confirm that toxic leachates are not generated from such blocks, in this paper, an effort has been made on the use of textile industrial wastes as environment friendly construction materials.

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