A Review on Behavior of Concrete using STP Sludge and Alum Sludge

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Abstract— The sludge is a by-product of water and wastewater treatment plant. Generation of such a large volume of sludge needs large land space. Due to scarcity of land area and adverse effects on soil, ground water quality and environmental restriction, use of large volume of sludge is a prime concern. Use of large volume of sludge as a construction material can solve disposal problems and makes an approach towards eco-friendly construction.

Key words: Alum Sludge, STP Sludge

I. INTRODUCTION

Waste is a prime and important environmental problem. The sludge is a by-product of treatment plant. Generation and type of sludge depends on type of treatment plant like Sewage treatment plant, Effluent treatment plant and Common effluent treatment plant. Population density plays vital role in generation of large volume of sludge, as the population increases day by day. Disposal of large volume of sludge needs large land area, due to scarcity of land area and adverse effects on land, ground water quality and causes odour nuisance [2].

To solve disposal problems and its adverse effects, sludge can be effectively used as a construction material [1] The paper shows review on use of alum sludge and STP (Sewage treatment plant sludge) as an ingredient in concrete mixes.

II. STP SLUDGE

Sewage treatment plant sludge (STP), which contains low organic sludge and high organic sludge. The low organic sludge contains sand particles and refers to grit and high organic sludge which is secondary pond sludge.

The low organic sludge can be used as fine aggregate replacement in concrete mixes and high organic sludge can use as an additive in concrete mixes.

III. ALUM SLUDGE

Alum sludge is water treatment sludge. The coagulant is added to water to remove colloidal particles. The alum sludge has similar chemical composition that of cement and can be replaced to cement.

IV. USE OF SEWAGE SLUDGE IN CONCRETE MIXES

A.Yagie, S.Yagie, E. Vazqeze. (2004) [1] had studied on the dry sewage sludge and determines its compatibility with cement. The dry sewage sludge was replaced to cement. The proportions of dry sewage sludge were taken as 0%, 2.5%, 5%, and 10% to the weight of the cement. The dry sludge concrete specimens were compared with the control specimen and also ones which were submerged in seawater and in fresh water. The strength of concrete with 2.5% and 5% of sludge addition were almost similar. The strength decrease by addition of 10% of dry sludge. As per his study the strength of concrete containing sludge was acceptable as compared to control concrete.

Jamshidi, Mehrdadi N, Jamsidi M. (2011) [3] had conducted study on dry sewage sludge on concrete performances. The dry sewage sludge was replaced by fine aggregate in concrete mixes. The concrete blocks were prepared with 0%, 5%, 10%, 20% and 30% proportions of dry sewage sludge to the weight of fine aggregate. The water cement ratios were taken as 0.45&0.55 and concrete blocks containing sludge were compared with both W/C ratios. The compressive strength was checked after 28 days, results conclude that with w/c ratio=0.45 shows optimum strength then the w/c ratio=0.55 because strength increase with decrease in w/c ratio. As sludge has low pozzolanic activity it can be used as fine aggregate in concrete mixes. The concrete mixture containing 10% of dry sludge can be used as non-structural elements.

Kartini K, Dahila Lema.et.al (2015) [4] had conducted study on domestic waste sludge powder (DWSP). The wet sludge was dried in natural sunlight and then it was dried in furnace for 72 hours to remove moisture, dried sludge was crushed into Los Angeles Abrasion test machine and sieved through 90µm.The dry sludge powder was used as a cement replacement and taken as 3%, 5%, 7%, 10% and 15% proportion to the weight of cement. Grade 30, 40 and 50 with w/c ratio=0.60. The compressive strength was checked for 7, 28&60 days. For grade 30, the strength of specimen at 28 day of specimen containing 3% and 15% sludge was below control concrete specimen. For grade 40, the strength of specimen containing 5% and 7% sludge was optimum and for grade 50, the strength of specimen containing 10% and 15% of sludge was low. As sludge may contain S03 which retard the setting of the concrete.

M.Alqedra, M.Arafa, M.Mattar (2011) [6] had studied on influence of low and high organic wastewater sludge on concrete. The low organic is the sun dried sludge, contains high sand contain and high organic sludge is the sludge taken from secondary pond, can be used as an additive in concrete mixes. Both sludge was taken as proportion 0%, 2.5% and 10%. The strength was checked at 28&90 days' age. The result shows that the strength of specimen containing sludge was higher at 90 days for the low organic sludge used as a sand replacement and that of compressive strength of high organic strength at 90-day age shows acceptable strength with2.5% and 5% sludge.

V. USE OF ALUM SLUDGE IN CONCRETE MIXES

Haider Mohammed Owaida, et.al (2013) [2] had carried out experimental work on use of alum sludge as partial cement replacement and compressive strength, splitting tensile strength and flexural strength of concrete block was checked. The Ordinary Portland Cement and admixture as added. The chemical characteristic of alum sludge was carried before using as cement replacement. The alum sludge powder was taken to weight of cement as 0%, 6%, 9%, 12% and 15% mix

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proportions with water cement ratio=0.33. The compressive strength and splitting tensile strength was checked at 3, 7 and 18 days and that of flexural strength at 28days.Results shows that higher strength was obtained at 6% addition of sludge because of presence of silica, alumina and ferric oxide in alum sludge and cement too.

Khalid Mohameed Breesem, (2014) [5] has carried out study on behaviour of self-compacting concrete using different sludge and waste material. The alum sludge from water treatment can use in production of cement and as ingredient in concrete mixes. The alum sludge was taken as 10%, 20%, 30%, 40% and 50% proportions to weight of cement. The concrete blocks was cured for 28 days and strength was checked, strength obtain was 805 higher than control concrete block. The reason behind it is due pozzolanic reaction of alum sludge with Ca (OH) 2 that produces C-S-H, so the strength increases.

Shayan Pirouz, Seyed Mostafa Khezri, (2015) [7] had conducted study on sludge from filtration plant. The dry sludge was taken as 0%, 10%, 20%, 30%, 40% and 50% mix proportions to the weight of cement with water to cement ratio=0.60. The concrete specimen was cured for 7,28 and 90 days. The compressive strength of concrete specimen were tested and result shows that strength at 90 day age higher than 28 day age and that of 28 and 90 days strength was higher than 7 day age strength.Therefore increasing curing period strength will increase.

Thaniya Kasol (2009) [8] had carried out experimental work on water treatment sludge as fine aggregate replacement in concrete mixes and evaluated the cost saving. The concrete mixes containing 10% and 20% of sludge can be used to make hollow non-load bearing concrete blocks and can reduce 0.64 baht (rupees) and 1.05 baht per block and that of 50% addition of sludge can reduce the maximum cost of 2.35 rupees per block.

VI. CONCLUSION

Since the fact that disposal of sludge has been important and prime problem due to scarcity of land,adverse effects on soil, ground water quality and odour nuisance. The use of STP sludge and alum sludge in concrete mixes can solve the disposal problem and also help to make eco-friendly construction material.

According to papers, alum sludge can effectively use as a cement replacement because alum sludge has similar composition as cement and importantly contains silica,alumina and ferric oxide which gives higher strength. Sewage sludge can be replaced to fine aggregate because of cohesiveness of sludge with fine aggregate.

Despite of it, use of both sludge depends upon the geographical condition of country and treatment processes given. The concrete containing alum sludge and sewage sludge can be used in makes tiles, road bases and sub-bases and in non-structural elements.

REFERENCES

[1] A. Yagüe, S.Valls, and E. Vázquez "Valorationaddition dry sludge sewage in concrete."Dept. of Construction Engineering, Universitay Politecnica de Catalunya, Nov(2004).

[2] Haider Mohammed Owaida, Roszilah Hamida, Siti Rozaimah Sheikh Abdullaha, Noorhisham Tan Koflia, Mohd Raihan Tahaa. "Physical and Mechanical Properties of High Performance Concrete with Alum Sludge as Partial Cement Replacement, pp.105-112,0ct (2013)"

[3] Jamshidi, Mehrdadi N, Jamshidi M. "Application of sewage dry sludge as fine aggregate n concrete."Journal of Enironmental studies, vol 37.dec (2011).

[4] Kartini, K., Dahlia Lema, A.M., Dyg. Siti Quraisyah, A.A., Anthony, A.D., Nuraini, T. and Siti Rahimah, R." Incinerated Domestic Waste Sludge Powder as Sustainable Replacement Material for Concrete." Pertanika J. Sci. & Technol. 23 (2): 193 - 205 (2015)

[5] Breesem, K. M., Faris, F. G., & Abdel-magid, I. M. (2014). Behavior of Self-Compacting Concrete Using Different Sludge and Waste Materials – A General Overview. *International Journal of Chemical, Environmental & Biological Sciences (IJCEBS)*, *2*(3), 151--156.

[6] Alqedra, M.Arafa& M.Mattar" Influence of low and high organic wastewater sludge on physical and mechanical properties of concrete mixes" Journal of Environmental sciences and Technology pp:354-365(2011).

[7] Shayan Pirouz& Seyed Mostafa Khezri"Using Urban Sewage Filtration Sludge for Producing Construction Material" Global Journal of Science Frontier Research: Vol 15 (2015).

[8] Thaniya Kaosol"Reuse Water Treatment Sludge for Hollow Concrete Block Manufacture." International Conference on Science, Technology and Innovation for Sustainable Well-Being pp.: 23-24 July (2009).

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