International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-5, January 2020

Assesment to Increase the Mechanical Properties of used Ballast by Edta Solution as a Construction Material

N. Prabhanjan, G. Swamy Yadav, G. Sahithi, B. Sravanthi, B. Tipraj

Abstract: ***Ballast is playing a vital role in taking the huge loads of railways which is strong, durable and also providing maximum stability to track/permanent way. Usually having a 40mm size ballast. The Shape of the ballast is important as its irregular shape and sharp edges help in the interlocking of themselves which gives more stability and passage of drainage. Within its lifetime the ballast used to get rounded edges, unable to stabilize or interlock and losses its strength for this reduction it should be replaced with new ballast. So the waste ballast is considered as our material to be tested in our project by adding the solution called EDTA (ETHYLENEDIAMINETETRAACETIC ACID) to develop the maximum properties of ballast by crushing them to 10mm, 12.5mm and 20mm size used for road construction. This work was conducted to determine the hardness, toughness, strength of aggregate using EDTA solution. The effectiveness of aggregate using of EDTA was studied in this project by adding required concentrations of 5%, 10% to the aggregates.***

Keywords: ***Ballast, Permanent way, Interlocking, EDTA solution.***

I. INTRODUCTION

Ballast is one of the important aggregate material, which uses to transfer the loads o soil from the top of rails an sleepers. These are granular aggregates of having the size of 20mm to 60mm for the permanent way[2]. These can be placed directly on sub grade for taking entire loads from the top. The main function of the ballast is to provide a firm and level bed for the sleepers to rest on. This allows for maintaining track at a correct level without disturb to the rail roadbed. The water will drain off quickly and can keep the sleepers in dry conditions and To discourage the growth of vegetation. Transfers and distributes the load from the sleepers to a large area of the formation. It provides elasticity and resilience to the track for proper comfort riding and also it can provide the necessary resistance to the track for longitudinal and lateral stability. Effective track means to maintain the level and alignment of the track. In the life of ballast change of integrity and humiliation are the type of failures occurs due to continuous repetition of loads like the movement of rail trains and weathering action of the environment. Humiliation is the process of losing edges and cleaves into pieces like fines. These fines particles may fill the voids between aggregate maybe it leads to loss of bonding between aggregates and maybe a reduction in shear strength of ballast. This failure results in plastic deformation in the track[2]. Track geometry conditions (such as track profile) the ballast and Mechanical behaviors are mainly based on continuous maintenance.. Maintenance is one of the major parameters in civil engineering life. In the process of maintenance of ballast, we have to find the present condition of ballast[3]. Usually, degradable ballast may not continue for the future. For this purpose only we have to conduct the number of appropriate tests for this ballast to know the mechanical properties of the ballast for the life span. Usually, we are conducting an impact test, compression test, Los angles abrasion test; specific gravity and water absorption tests for the aggregates. By these tests, we are finding the basic parameters like strength, toughness, the hardness of aggregates[1]. Due to the continuous movement of railways leads to deterioration of ballast. So continuous maintenance is required for ballast. Generally, 250mm thick of ballast we are providing to the track. While applying ballast only some tamping actions are taking. By this effect, the ballast can settle up to certain limit but maybe it leads to breakage of edges. EDTA is commonly using as an agent in a number of industries. In commonly this is using in wastewater treatment plants and also as stable element. Not only used in treatment plants, as well as using in household and agricultural applications also [4]

II. MATERIAL AND METHODS

i) USED BALLAST:

Waste ballast is the major material for this project. We collected used and waste ballast from the railway station. Commonly the size of ballasts about 40mm. by the continuous attack of cycling loads from train movements, this ballast may be turned as deteriorated material. The collected ballast break into small pieces into the required size by a hammer.

Manuscript published on January 30, 2020.
* Correspondence Author
Neduri Prabhanjan*, Department of Civil Engineering, SR Engineering College, Warangal, India. E-mail: prabhanjan_n@srecwarangal.ac.in
Golla Swamy Yadav, Department of Civil Engineering, SR Engineering College, Warangal,India. E-mail: swamy_yaav-g@srecwarangal.ac.in
Gorre Sahithi, Department of Civil Engineering, SR Engineering College, Warangal,India. E-mail: sahithi_g@srecwarangal.ac.in
Bojjam Sravanthi, Department of Civil Engineering, Kakatiya Institute of Technology and science, Warangal, India.
E-mail: sravsiri2008@gmail.com
B. Tipraj, Department of Civil Engineering, SR Engineering College, Warangal, India. E-mail: tipraj_b@srecwarangal.ac.in

we conducted a number of tests on these ballast material which conducting for aggregate and comparing results for normal and used ballast.

ii)EDTA SOLUTION:

We are using different reusing agents in construction. One of the recycling agents in these days is the EDTA solution. This liquid type of solution taken into consideration for adding to the used ballast in required concentrations based on standard weights of samples taken for the tests.

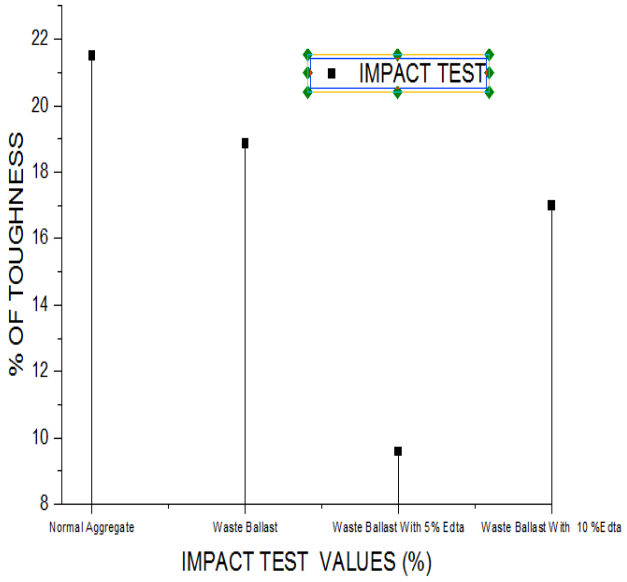
III. METHODOLOGY

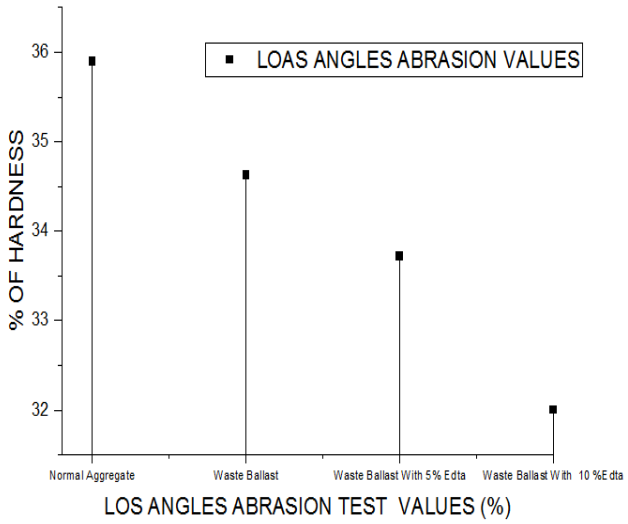
Collected ballast material and broken into small pieces accordingly size of common aggtegate nearly 10-12 mm. we conducted standard aggregate tests like Impact, Abrasion, Crushing Specific gravity and Water absorption Test. normally we tested on normal aggregates as well as used ballast and compared results. After this EDTA solution has been added to the used ballast and compared results with normal aggregates. We got the best results as we expected.

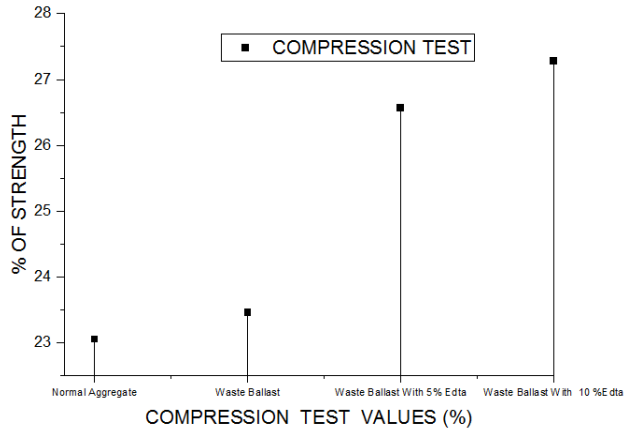
IV. RESULTS

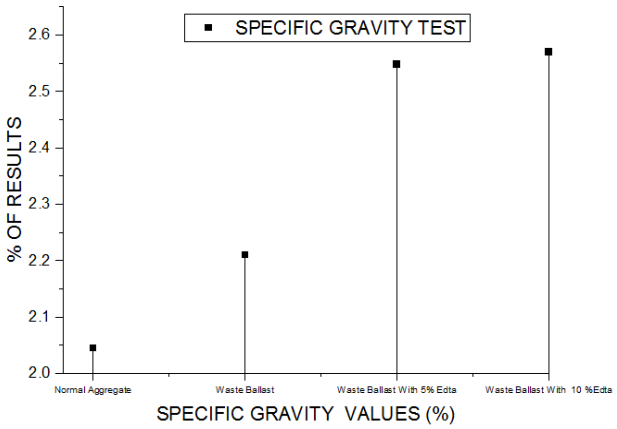
Tests	Normal Aggregate	Waste Ballast	Waste Ballast With 5% EDTA	Waste Ballast With 10 % EDTA
Impact	21.49%	18.85%	9.58%	17%
Crushing	23.05%	23.46%	26.565%	27.28%
Abrasion	35.9%	34.63%	33.72%	32%
Specific Gravity	2.045%	2.21%	2.548%	2.57%
Water Absorption	0.25%	0.2%	0.759%	0.51%

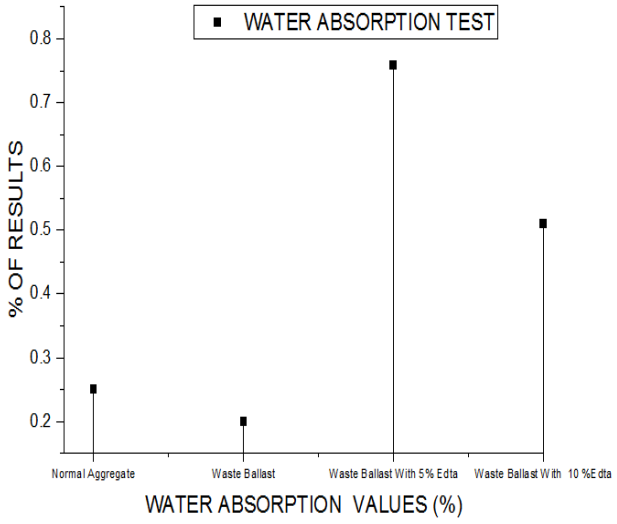
Table1: Percentage of Results of normal aggregate and Waste ballast adding with EDTA Solution in a different proportion











V. CONCLUSION

Comparing with the normal aggregates and used ballast the impact value, abrasion value and specific gravity of used ballast with 5% EDTA is good up requirements of road constructions and having more strength than normal aggregates. While comparing with the normal aggregates these are economical and reusable with no cost. Water absorption values of used ballast are in required conditions as per road constructions. So from this study waste ballast can be reuse as aggregates for road constructions.

REFERENCES

1. C. Jayasuriya, B. Indraratna, and T. Ngoc Ngo, "Experimental study to examine the role of under sleeper pads for improved performance of ballast under cyclic loading," Transp. Geotech., vol. 19, pp. 61–73, 2019.
2. Y. Guo, V. Markine, X. Zhang, W. Qiang, and G. Jing, "Image analysis for morphology, rheology and degradation study of railway ballast: A review," Transp. Geotech., vol. 18, pp. 173–211, 2019.
3. J. Sadeghi, M. E. Motieyan-Najar, J. A. Zakeri, B. Yousefi, and M. Mollazadeh, "Improvement of railway ballast maintenance approach, incorporating ballast geometry and fouling conditions," J. Appl. Geophys., vol. 151, pp. 263–273, 2018.
4. M. Sillanpää and J. Rämö, "Adsorption of metal-ethylenediaminetetraacetic acid chelates onto lake sediment," Chemosphere, vol. 45, no. 6–7, pp. 881–885, 2001.
5. S. Çalt and A. Serper, "Time-dependent effects of EDTA on dentin structures," J. Endod., vol. 28, no. 1, pp. 17–19, 2002.
6. Peter Anderson,coilnJ.cunningham, and D.A.Barry:Railway ballast provides both the foumdation and drainage for railway track.
7. LL-Wha Lee,481-487,2009:On the paved track,the railway ballast is used as aggregate for the foiling layer using the pre packed concrete method
8. Mohamad Miami,Nottingham:Describesthe results of environmental life cycle of ballast and generic concrete track beds,including cost in sleeper and embedded track systems.
9. H.K. Lam, W.M.B. Ip, J.P.G. McKay, Use of incineration MSW ash: a review, Sustainability 2 (2010) 1943–1968.
10. A.M. Joseph, R. Snellings, P. Van den Heede, S. Matthys, N. De Belie, The use of municipal solid waste incineration ash in various building materials: a Belgian point of view, Materials 11 (2018).
11. H. Akhter, L.G. Butler, S. Branz, F.K. Cartledge, M.E. Tittlebaum, Immobilization of As, Cd, Cr and Pb-containing soils by using cement or pozzolanic fixing agents, J. Hazard. Mater. 24 (1990) 145–155.
12. US EPA, Solidification/Stabilization Resource Guide, U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response Technology Innovation Office, Washington, D.C, 1999, p. 20460.
13. B. Batchelor, Overview of waste stabilization with cement, Waste Manag. 26 (2006) 689–698.
14. K. Anastasiadou, K. Christopoulos, E. Mousios, E. Gidarakos, Solidification/stabilization of fly and bottom ash from medical waste incineration facility, J. Hazard. Mater. 207 (2012) 165–170.
15. S. Naganathan, H.A. Razak, S.N.A. Hamid, Corrosivity and leaching behavior of controlled low-strength material (CLSM) made using bottom ash and quarry dust, J. Environ. Manage. 128 (2013) 637–641.
16. D.Y.S. Yan, I.Y. Tang, I.M.C. Lo, Development of controlled low-strength material derived from beneficial reuse of bottom ash and sediment for green construction, Constr. Build. Mater. 64 (2014) 201–207.
17. J.E. Renew, C.H. Huang, S.E. Burns, M. Carrasquillo, W.L. Sun, K.M. Ellison, Immobilization of heavy metals by Solidification/Stabilization of Co-disposed flue gas desulfurization brine and coal fly ash, Energy Fuels 30 (2016) 5042–5051.
18. American Concrete Institute, Controlled low-strength materials, ACI 229 (1999) R-99. [11] C.E. Halim, R. Amal, D. Beydoun, J.A. Scott, G. Low, Evaluating the applicability of a modified toxicity characteristic leaching procedure (TCLP) for the classification of cementitious wastes containing lead and cadmium, J. Hazard. Mater. 103 (2003) 125–140.

AUTHORS PROFILE

Neduri Prabhanjan, Assistant Professor, Civil Engineering, SR Engineering College, Warangal.

Golla Swamy Yadav, Assistant Professor, Civil Engineering, SR Engineering College, Warangal.

Gottam Sahithi, Assistant Professor, Civil Engineering, SR Engineering College, Warangal.

Bojjam Sravanthi, Assistant Professor, Civil Engineering, Kakatiya Institute of Technology an science, Warangal.

B.Tipraj, Assistant Professor, Civil Engineering, SR Engineering College, Warangal.