iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** V **Month of publication:** May 2021

DOI: https://doi.org/10.22214/ijraset.2021.34209

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue V May 2021- Available at www.ijraset.com

Feasibility Study of Concrete by using Polyethylene Terephthalate Fiber in Enhancing the Mechanical Properties of Concrete - A Review

Kartik D. Rathod[1], Dr. Isha Khedikar[2], Dr. Kuldeep Dabhekar[3]
[1]*PG Scholar,* [2, 3]*Assistant Professor, Civil Engineering Department, G. H. Raisoni College of Engineering Nagpur, Maharashtra, India*

Abstract: ***In these project Polyethylene terephthalate fiber(PET) fibers are use to improve the mechanical property of concrete and minimize the environmental pollution of earth. PET is use to prepare container for water, cold drinks, food etc. which is single used and it thrown in to the sea, dump on free land and burning. It cause many serious effect on animals, sea animals, destroy land fertility and other health releated issues. The PET material are used to improve mechanical property of concrete like tensile, compressive and flexural strength. Thus fibers are available in natural and artificial material. Now a days, artificial fibers are widely used in India. The types of fibers are plastic fibers, glass fibers, steel fibers etc. In India according to solid waste management data is 15,350 tons daily and 1,84,120 tons annually generate, but only 9,350 tons daily and 1,12,120 tons annually collected. So the uncollected data is that about 6000 tons daily and 72,000 tons annually uncollected, in such a way that it causes many problems to the atmosphere so that it becomes environmentally harmful. For developing country concrete is most important material. It is extensively used in construction industry. Concrete have many advantages like long service life, durability, chemical attack resistance etc. Thus concrete has some many disadvantage like low tensile strength, flexural strength and cracks. To overcome these disadvantage add some supplements in concrete to improve its strength. The fiber are one of them. It reduces environmental problem it becomes eco-friendly. In the case of workability test the results are obtain as, concrete become harsh when the percentage of PET fiber is increase. So that increase in PET fiber then workability is decrease. In case of compressive strength result are obtain as concrete carry higher applied load and give high compressive strength when adding 0.41% of PET fiber in concrete.***

Keywords: ***Polyethylene Terephthalate Fiber (PET), Environmental Pollution, Artificial Fiber, Mechanical Property, Eco-Friendly***

I. INTRODUCTION

PET fiber are use to improve minimize the environmental pollution of earth and concrete of property which is mechanical are studied by Mahdi Nematzadeh, M. E. Fernandez [1][2]. For developing country concrete is most important material. It is extensively use in concrete industry. It has many advantages like long service life, durability etc. Thus it has some many disadvantages like low tensile strength, flexural trength and cracks. To overcome these disadvantage add some supplements in concrete to improve its strength. The fiber are one of them are studied by Karim S. Rebeiz [4]. It reduces environmental problem and construction with higher results. PET fiber is use to prepare container water, cold drinks, food etc. PET material have many properties like impact strength, chemical resistance etc. PET material are use to improve mechanical property of concrete like compressive and flexural strength are studied by Annie C. Detomi [3]. Fibers are available in natural and artificial material. The use of PET fiber waste there advantage are to improve properties of materials which is in construction and the advantage of PET fiber waste is polluted the environment are studied by H. Ataei [7]. Now a days plastics are use in the world thus the replace the other material like glass, wood, steel etc. So this project is beneficial for our environment. Thus the plastic is one of tose material which take a ore time to decompose are studied by Jiehan [8]. In India plastic becomes more broadly use material but there groth is regularly and it causes many major issues in India. Thus the plastic is one of the material that take much time to decompose. So that the maximum 1000 year is required to decompose into the landfill. So that some plastic bottles are required minimum 450 year to decompose or more. Most of the time municipal solid waste corporation burnt plastic solid waste is 12%. So, in case of burning the plastic solid waste it release toxic gases like dioxin, furnace, mercury etc. Into the atmosphere. In India according to solid waste management data is 15,350 tons daily and 1,84,120 tons annually generate, but only 9,350 tons daily and 1,12,120 tons annually collected. So the uncollected data is that about 6000 tons daily and 72,000 tons annually uncollected, in such a way that it causes many problems to the atmosphere so that it becomes environmentally harmful.

©IJRASET: All Rights are Reserved

A. Objectives of PET Fiber Concrete

1) To study the mechanical and physical performance of recycled plastic use in concrete mixtures.
2) Study the effect on workability of concrete by addition of PET fiber.
3) To reuse polyethylene terephthalate (PET) bottles as a PET fibers in concrete.
4) To find effects on compressive strength and flexural strength of concrete after addition of PET fiber.
5) To compare results with conventional concrete.

B. Process of PET Fiber Concrete

1) Design shape of fiber.
2) Concrete mix design.
3) Check workability.
4) Casting of cubes.
5) Compression strength test of cubes.

C. Design Shape of Fiber

1) Specification of First Shape Fiber

Length = 40mm, Width = 10mm, Thickness = 0.25mm, No. of holes = 4, Distance of hole = 10mm c/c, Position of hole = full hole in centre line, Aspect ratio = L/B = 4

Fig-1 First shape fiber

2) Specification of Second Shape Fiber

Length = 40mm, Width = 10mm, Thickness = 0.25mm, No. of holes = 7, Distance of holes = 5mm c/c, Position of holes = Half holes back to back, Aspect ratio = 4

Fig-2 Second shape fiber

3) Specification of Third Shape Fiber

Length = 40mm, Width = 10mm, Thickness = 0.25mm, Rectangle = 3no.(10x8), Position of rectangle = Back to back, Aspect ratio = L/B = 4

Fig-3 Third shape fiber

D. Casting of Cubes

Fig-4 Casting of cubes

©IJRASET: All Rights are Reserved

II. LITERATURE REVIEW

Mahdi Nematzadeh et al. (2019) In this paper work are obtain as polymeric wastes are PET and crumb rubber are use in concrete mix. The application is determine that the relationship of stress strain of concrete material. Thus the PET crumb rubber of the concrete materials is the elevated temperature. The compressive strength, flexural strength, elastic modulus are the evaluated after the exposure to elevated temperature. The series of equation which is empirical are developed the fibers are immersed in two media. So fiber immersed in Portland cement are also observed. [1]

J. Paya et al. (2017) These paper studies are fibers from the postconsumer wastes and the fiber reinforced mortar are studies. The PET fiber bottles are immersed in alkaline medium of Portland cement paste. The surface of the fiber are analysed by the scanning electron microscope. This study are show that fibers are immersed into two media. The fiber immersed Portland cement paste are also observed. The results obtain are fiber are strong when they are immersed in cement paste. So that low economic and environmental costs. [2]

Tulio H. Panzera et al. (2015) Work are obtain in paper the quartz totally replace with PET particle the mechanical property of cement are obtained. Basis of water cement ratio full factorial design performed, The replacement of mechanical and physical parameter are use in the range of particle size. The result show that the reduction in obtain from mechanical property when quartz particle are put in place. The replace coarse quartz composite are obtain. [3]

Karim S. Rebeiz et al. (1994) In this paper studied that the steel of structural behaviour r/f concrete use with unsaturated polyester resin is based on plastic waste. In such a way that the response of the load deflection and beam which is PC beam of shear strength is evaluated. PET PC is helps in save energy. Resins use polyethylene terephthalate fiber offer the produce which is very good in quality at a low cost of application which is structural. [4]

Nirdesh Shah et al. (2019) This paper the work analyse impact on concrete which is in compressive strength. Analyse the load and deflection control is shown in PET strips. Thus study advantageous role of polyethylene terephthalate fiber strips in behaviour of concrete. These model describes the stress of polyethylene terephthalate fiber is use of load. This study give advantageous role of polyethylene terephthalate fiber. [5]

J. G. Teng et al. (2013) In paper FRP decomposes with strain which is in large quantity are promising a jacket seismic material of reinforced concrete columns. The results shows that they also cheaper than conventional FRP. The results show that the curve which is stress strain and loading effect of cycle. Result are obtained stress strain curve. [6]

K. Kalbasi A naraki et al. (2017) The PET is use in the large quantity around the world which is increase in every year. Thus result shows that the polyethylene terephthalate fiber of strength is decrease with increase PET fiber ratio. If PET fiber particles are decompose into concrete a large PET fiber are reuse. Results of mechanical properties of PET fiber concrete is obtained that decrease in strength of concrete with increase in PET fiber ratio. [7]

Zhanyong Yao et al. (2014) The proportion which ismix and property of mechanical PET fiber concrete are study by various tests. Thus the result shows that most important factor is PET aggregate ratio, PET mineral ratio. Thus the result obtains are mix proportion of concrete and PET fiber concrete. Thus the different kind of limestones, aggregate and minerals are use in ratio which is the sand. [8]

Dinis Gardete et al. (2019) In this work soil is characterized in laboratory the soil stabilization with waste tire fiber. This work the California bearing ratio and proctor test were performed. The results show that the maximum density which is dry with increase in content of waste which is fiber. Thus the results show increase in angle which is peak with increase in fiber content. [9]

Monire Marini et al. (2019) The stabilization of soil with cement which can be effective. The result indicate the UCS sample stabilize and cement were increase and cement were increase in zeolite replacement to an optimum value.To overcome the behaviour of cement loss of PET and mixture is very effective. [10]

Haya H. Mhanna et al. (2020) In this work the mechanical properties of PET laminate are investigate when it expose the temperature ranging from 25 degree celcius. Thus test results indicate that PET increase in rupture strain. The results show that the low confinement around the rupture strain which is laminate the nominal strain of PET which is the increase in temperature demonstrate the three phase of the nominal strain. [11]

Estarda H. Et al. (2006) In this work, FRP materials are investigate an alternative r/f to replace the steel. This research focus on investigate the effects of load on flexural strength. The results shows that the strength of concrete specimen studied of cyclic loading. This paper focus that the effects of the cyclic loading of the fiber r/f of a large number of the concrete beam. [12]

Maria Harja et al. (2014) The utilization of solid waste in the concrete of the polymer are report in this paper which includes the effect of the strength of compressive and the flexural strength of concrete thus the results shows that the fly ash and silica fume are obtain on the mechanical properties. [13]

©IJRASET: All Rights are Reserved

Theodoros C. Rousakis et al. (2013) In this work the hybrid suggest that the fiber rope on FRP they include that the one layer of the glass is the confinement thus the results show that the axial strain is also increase in the loading. Thus the study of the mechanical behaviour of the concrete by the glass polymer have hybrid technique are the suggests that the external r/f of the application of external mechanical properties of the strength of the compressive and tensile strength of the concrete quality. [14]

Lei Gu et al. (2017) In this paper the work is on the property of concrete is manufacture use in the recycle coarse aggregate is present . Results shows that the mechanical property of concrete is lower than the natural aggregate and the results show that the study is in environmentally with the use of waste. Thus the compressive strength is decrease when temperature is higher the results are suggest that the density of each manufactured efficiency coarse aggregate of the compressive strength. [15]

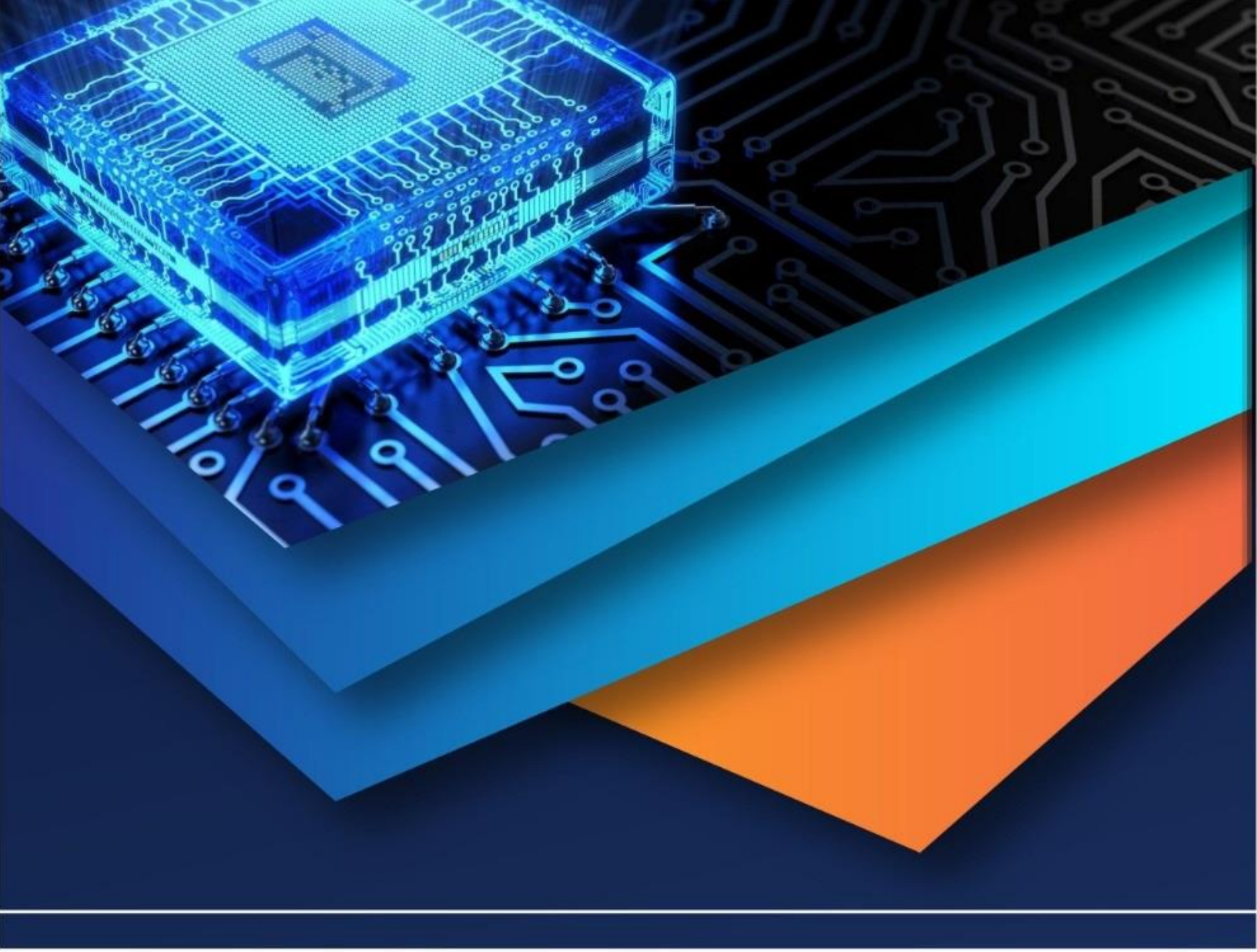
III. CONCLUSION

A. It reduces environmental problems with high results and it becomes eco-friendly.
B. PET bottles is a waste material and causes many serious effects in atmosphere.
C. But if we use these waste material as a construction material or as a fibers so can minimize environmental serious effect on world by PET bottles and also improve concrete prpperties.
D. In case of workability test the results are obtain as concrete become harsh when the percentage o PET fiber is increase.
E. In case of compressive strength results are obtain as concrete carry higher applied load and give high compressive strength when adding 0.45% of PET fiber in concrete.

REFERENCES

[1] Mahdi Nematzadeh & Mehdi Mousavimehr (2019), “Residual Compressive Stress–Strain Relationship for Hybrid Recycled PET–Crumb Rubber aggregate Concrete after Exposure to Elevated Temperatures”, American society of civil engineers, DOI. 10.1061/(ASCE)MT.1943-5533.0002749.
[2] M. E. Fernandez & J. Paya (2017), “Degradation Process of Postconsumer Waste Bottle Fibers Used in Portland Cement–Based Composites”, American society of civil engineers, DOI. 10.1061/(ASCE)MT.1943-5533.0002007.
[3] Anine C. Detomi & L. M. R. Filho (2015), “Replacement of Quartz in Cementitious Composites Using PET Particles: A Statistical Analysis of the Physical and Mechanical Properties”, American society of civil engineers, DOI. 10.1061/(ASCE)MT.1943-5533.0001358.
[4] Karim S. Rebeiz & Sleiman P. Serhal (1994),”Structural behavior of polymer concrete beams using recycled plastic”, Journal of material in civil engineering, DOI. ISSN 0899-1561/94/0001-0150.
[5] Nirdesh Shah & Vikram Kuar (2019),”Impact Assessment of Plastic Strips on Compressive Strength of Concrete”, American society of civil engineers, DOI. 10.1061/(ASCE)MT.1943-5533.0002784.
[6] Yu-Lei Bai & J. G. Teng (2013),”Cyclic Compressive Behavior of Concrete Confined with Large Rupture Strain FRP Composites », American society of civil engineers, DOI. 10.1061/(ASCE)CC.1943-5614.0000386.
[7] H. Ataei & P. Eng (2017),” Mechanical Properties of Polyethylene Terephthalate Particle-Based Concrete: A Review”, American society of civil engineers.
[8] Zhanyong Yao & Zhi Ge (2014), “Mix proportion design and mechanical property of recycled Polyethylene terephthalate concrete”, American society of civil engineers.
[9] Dinis Gardete & Rosa Luzia (2019), “Analysis of the Bearing Capacity of a Clayey Sand Stabilized with Waste Tire Fibers”, American society of civil engineers.
[10] Monire Mariri & Reza Ziaie (2019), “Stress–Strain Behavior of Loess Soil Stabilized with Cement, Zeolite, and Recycled Polyester Fiber”, American society of civil engineers, DOI. 10.1061/(ASCE)MT.1943-5533.0002952.
[11] Haya Mhanna & Rami Hawileh (2020), “Experimental Investigation and Modeling of the Thermal Effect on the Mechanical Properties of Polyethylene-Terephthalate FRP Laminates”, American society of civil engineers, DOI. 10.1061/(ASCE)MT.1943-5533.0003389.
[12] Aguiniga F & Estrada H (2006), “Effects of Cyclic Loading on Structural Performance of Glass Fiber Reinforced Polymer Reinforced Concrete Elements”, American society of civil engineers.
[13] Maria Harja & Irina baran (2014), “Comparison of Mechanical Properties for Polymer Concrete with Different Types of Filler”, American society of civil engineers, DOI. 10.1061/(ASCE)MT.1943-5533.0000069.
[14] Theodoros Rousakis (2013), “Hybrid Confinement of Concrete by FRP sheets and Fiber Ropes Under Cyclic Axial Compressive Loading”, American society of civil engineers.
[15] Lei Gu & Aliakar Gholampour (2017), “Short-Term Mechanical Properties of Concrete Containing Recycled Polypropylene Coarse Aggregates under Ambient and Elevated Temperature”, American society of civil engineers, DOI. 10.1061/(ASCE) MT.1943-5533.0002046.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)