Research Article

Development of smart sustainable recyclable system termed for waste composite material under SBAI scheme

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ABSTRACT

Globally future cities are urbanizing due to which construction industry is showing rapid change by application of advanced construction techniques and resources. In the past few decades, various research states that formworks involve 15-22% of the project cost, hence this study emphasizes in manufacturing a smart material for sustainable formwork from undegradable materials available in the form of scrap waste by recycling under Swachh a Bharat Abhiyan initiative. The objective of this research is to develop smart material termed as Waste Composite Material (WCM) substitute to timber. Standard Engineering tests on WCM were conducted in laboratory under prescribed IS specification which showed good results in its load taking capacity in tension, compression and shear as compared to timber. As this research helps in reducing solid waste pollution by recycling them, it can be concluded that for future infrastructural projectsWCMcanbeconsideredaseconomicalandeco-friendlyalternativesolution.

Keywords: Recyclable Material, Sustainable Material, WCM, Cost.

DOI: https://doi.org/10.31838/ejmcm.07.02.03

Introduction

The formwork is supporting structure which is used in construction. There are several types of formwork systems used in construction industry. The selection of the formwork mainly depends on needs of a particular project. In conventional formwork system steel, aluminum, fiber materials are used for as formwork materials [1] Nowadays with rapidly growth of construction industry the requirement of industry is also change. As all these needs cannot be completed by traditional formwork system. So, the WCM formwork is alternative system and best option for the construction industry [3]. The environmental effects of construction of formwork are also revealed through this system. The WCM formwork system is the best alternative solution of traditional formwork system. this form work system is famous for quality, durability, economy Andre quired optimum time. Nowadays with rapidly growth of construction in dustry the requirement of industry is also change [5]. As all these needs cannot be completed by traditional formwork system. So, the WCM formwork is alternative system and best option for the construction industry. The environmental effects of construction of formwork are also revealed through this system [7-10].

Literature Review

Arbaz Kazi (2015) [8] suggested address building and transportation requirement of an increasing population. The accurate and speedy construction is the need of increasing the Indian economy. Traditional construction methods unable to fulfill the demand of infrastructural facilities. Hence new construction technologies by providing speedy construction. Imtiyaz Mohit et al. (2015) [6] in this study they studied an attempt is made to have a comparative study of traditional form work method with Plastic form work. This system is not

currently used in construction. The selection of formwork system is very important for productivity. Rahul Shinde et al. (2016) [4] in this study the alternative solution of conventional formwork is done with the help of abs plastic formwork. This is the new invention to increasing the strength, quality, and safety in formwork system. Dongm in lee et al. (2017) [2] they studied the increased productivity in form work system by using modern form work system. The advance form work layout is by increasing the productivity of formwork in high rise building.

Methodology

In this chapter shows the methodology have been adopted. Discussing about the materials and procedure of making Waste Composite Sheets. Figure 1 shows the flowchart of WCM process.

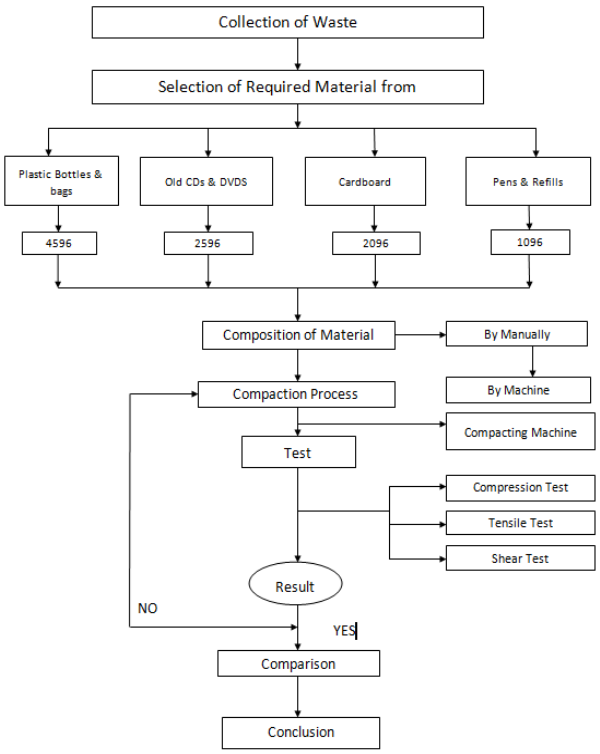


Figure .1. Flow chart of methodology

Selection and collection of Material: The by-products of all the industries and household uses produce a huge quantity of waste which if separate properly can be reconsidered as recycle and reuse. It is a mixture of solid waste like plastic bottles, disposable glass, and broken Furniture old CDs& DVDs etc. Collected Material is un useful for daily use. The quantity of was tematerial is Very large so it is easily available in Dumping ground. Select the required waste and Recyclable materials in sufficient quantity and separate out the material like plastic bottles, disposable glass, and broken furniture, old CDs& DVDs etc. selection process done manually.[11]

Composition of Waste Material: Selected materials are well composed. The composition of the material is done by either manually or mechanically. After the composition of materials are cut in small pieces as per requirement of making Waste composite moulded sheet.

Process and Test on Material**:** All the cutting particles are the mix in properly then Mixed particles are compressed in compacting machines and making a sheet as per requirement cut down that sheets, that goes to easily move to working or place because is very light weight. After the making of plastic composite sheets there is some test to be conducted like tensile test, Compression test, and Shear test with the help of these test finding the strength of the Waste Composite sheet. The compression test is finding with thehelpofReboundHammerApparatusandTensileandSheartestaredoneonUniversal Testing Machine. Figure 2 shows the Waste composite sheet.

Figure .2. Waste Composite Sheet

Objectives

Many studies have been carried out on project management in recent times. The objectives of the present research study are

To reclaim formwork efficiently from the waste or used materials by Recycling hence balancing A ecofriendly environment considering Swachh a Bharat Abhiyan.

Toscrutinizethestrengthofwastecompositematerialsalongwithtimber.

To distinguish the results between waste composite materials and timber by conducting tensile, compression and shear strength test.

Implementation

This form work system is more durable, environment a friendly. The various tests will be conducted on this form work system, Such as Tensile test, compression and shear test.

Compression Test

Compression test is conducted by applying Rebound hammer this is a Non- Destructive testing. This

system is to determine the Internal and surface defect without destructing the material. It is a fast and effective method for assessing the quality of material. A Higher rebound value indicates the higher compressive strength of material. Following Figure 3 Shows the compression testing with using rebound hammer.

Figure .3. Rebound Hammer

Tensile test

Thetensiletestiscarriedoutbyapplyinglongitudinalloadat aspecificExtension to a standard tensile specimen with known dimensions. The tensile test on Universal testing machine.

Shear Test

In this test taking a suitable length of rectangular specimen. And find the readings in testing machine under compressive load. Figure 4 shows the Shear test Conduct on Waste Composite Sheet.

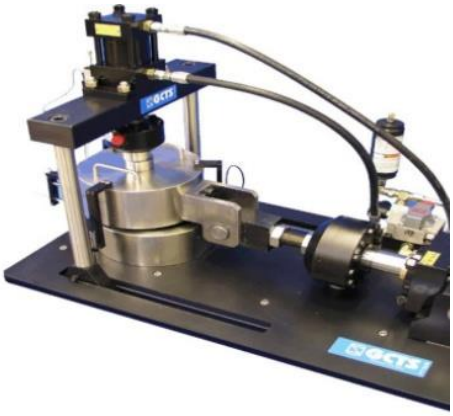
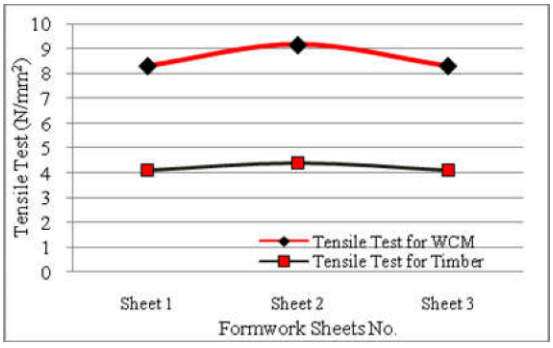


Figure .4. Shear Test

Result and Discussion

Compressive strength of composite sheets and timber sheet should be finding with the help of rebound hammer apparatus. The following the graph of Rebound Hammer Test.

Tensile Test comparison between WCM and Timber



shown in Figure 5 This test is conducted on Universal Testing Machine.

Figure .5. Tensile Test Graph

Following Figure 6 shows the shear Test comparison between WCM and Timber. In this test taking a suitable length of rectangular specimen. And find the readings in testing machine under compressive load.

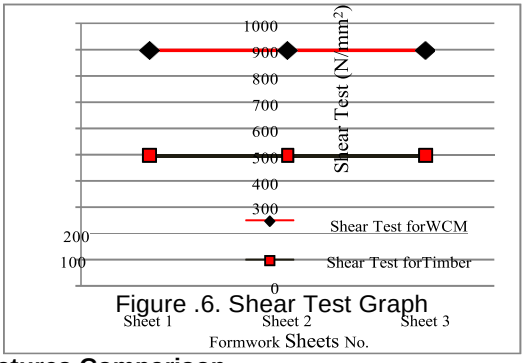


Figure .6. Shear Test Graph

Features Comparison

The WCM sheets are superior to Timber sheet and the strength is very good as compared to timber. The Features comparison between WCM and Timber shown in Table 1.

Table .1. Features Comparison between Timber and WCM

Properties	Timber	WCM
Modularity	Non-Modular	Modular
Weight	Fairly Light	Light
Storage	Dry Environment	High

Conclusions

In conventional formwork method the Timber and steel are being used as material for formwork. In timber formwork the main problems are delay of work, inaccuracy and low strength. Installation and Dismantling period are more in timber formwork method. The repetitions of timber formwork system have 10 times. While WCM formwork can be used over 60 times. Due to its light weight it is very easy to handle as transport to one place to another place. WCM Formwork is made by using recyclable materials. The various tests reconducted such as tensile, Compression and shear so it is proved that comparatively WCM formwork is better than timber formwork. As deforestation and environmental pollution is major problems now days so the WCM formwork is alternative solution of formwork system. Thus, it concludes that WCM formwork is the economical, eco-friendly when it is used in large projects. It is increasing the speed of construction, quality as well as the productivity. Thus, it is proved

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that the WCM formwork system is more economical and improving the strength of formwork.

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