MECHANICAL PROPERTIES OF PAPERCRETE- A REVIEW

G.B. Ramesh kumar  
Associate Professor  
Department of civil engineering  
Saveetha School of Engineering  
SIMATS, Chennai-602105  
rameshkumargb@gmail.com

M. Chandu  
U.G Student  
Department of civil engineering  
Saveetha School of Engineering  
SIMATS, Chennai-602105

ABSTRACT

Now a day’s consumption of Non – renewable resources is more in the construction industry. Instead of Non – renewable, we can use Renewable resources such as paper. Papercrete, which utilizes the waste paper and it, works as a building material in construction field which constitutes a step forward to the sustainable development in future. By using the waste paper, the papercrete concrete is an eco – friendly material. Due to absence of aggregates in the concrete the weight will be reduced and using paper the tensile strength will be increased. Because of change in weight and tensile strength it alters our design and economic cost. By using paper instead of aggregates, economic cost of the building construction will get reduced. So, that almost all over the world, homeless people can build their own home, by using of this papercrete concrete. It is perceived as an environmental friendly material due to the significant recycled content, by the presence of cement. Paper is principally wood cellulose, which is considered a fibrous material. Cellulose is the second most abundant material on earth after rock. Cellulose is a natural polymer, a long chain of linked sugar molecules made by the linking of smaller molecules. Due to the cellulose content it will strongly binds with the cement. In this case we are using M25 mix design.

Key words: Cellulose, Polymer, Renewable and Non – renewable sources.

INTRODUCTION

Papercrete is a new composite material using waste paper as a partial replacement of coarse aggregates. This increase in the popularity of using environmental friendly, low-cost and light weight construction materials in building industry has brought about the need to investigate how this can be achieved by benefiting the environment as well as maintaining the material requirements affirmed in the standards. As natural sources of aggregates are becoming exhausted, it turns out urgent to develop. The majority of abandoned paper waste is accumulated from the countries all over the world causes certain serious environmental problems. In these days, the construction is more improving with the new building materials. For instance, the use of waste rubber, glass powder, industrial waste fibers, wood sawdust wastes and limestone powder wastes in building material production has received diligent attention over the past few years.

LITERATURE REVIEW

[1] Fuller.B and Fafitis.A (2006) had done a research on “Structural Properties of a New Material Made of Waste Paper”. They conducted a research to determine papercrete is suitable to mechanical and physical properties to be used as construction material for homes or not. The parameters that he studied are the Young’s Modulus (E), thermal conductivity (K), thermal resistance (R), bond characteristics, and creep behavior. The Stress vs. Strain graphs suggests that, papercrete is a ductile material that can sustain large deformations. Cement plays an important role in the compressive strength and behavior. Specimens with higher proportion of cement exhibit larger Young’s Modulus.

[2] H.Jung, H.Yun (2007) conducted an experiment on “Mechanical properties of papercrete containing waste paper”. They have done an experiment on bricks for finding the mechanical properties of waste paper and they reported that the density of Papercrete was decreased when the ratio of waste paper in Papercrete increased and the shrinkage of Papercrete was increased according to increase of paper-cement ratio. The stress-strain curves showed that ultimate strain ranges 0.002-0.003, 0.005-0.007.

rameshkumargb@gmail.com
and 0.008-0.010 when included waste paper ratio in papercrete is 5%, 10% and 15%.

[3]Titzman L.C (2008) had done a research on “Analysis of Low Cost Building Material for the Mix Alco Process”. Titzman carried out a research regarding the weight and density of papercrete, according to his research the density of the material increased when the percentage of cement in the mixture increased but when the amount of the paper in the mixture increased, the density decreased. Titzman showed that the tensile strength was very low. The maximum and minimum tensile strength of the papercrete was 28.3 and 7.5psi (0.195 and 0.052MPa) respectively.

[4] Gallardo R.S. and Adajar M.A (2008) had done an investigation on “Structural performance of concrete with paper sludge as fine aggregates partial replacement enhanced with admixtures”. The investigation covered the following criteria; comparison of physical properties which includes moisture content, specific gravity and absorption of paper sludge versus ordinary river sand, the chemical properties, and the quality and durability of concrete with paper sludge in terms of compressive strength and splitting tensile strength. Based from results of the study, the most suitable mix proportion is the 5% to 10% replacement of paper sludge to fine aggregates. Percentage replacement higher than 10% resulted to a decrease in both compressive and tensile strength. The reduction of concrete strength can be attributed to the high water-cement ratio and the absence of silica compound in paper sludge, which is essential for bonding and structuring of fresh concrete.

[5] Malthy.R, Jegatheeswaran.D (2011) had done an experiment on “Comparative Study on Papercrete Bricks with Conventional Bricks”. They have done an experimental study which shows the potential use of paper waste for producing a low-cost and light weight composite brick as a building material. They investigated three different mix proportions of fly-ash mixed papercrete blocks with and without sand. In all three bricks, the compressive strength was more than the required i.e. 3.5 MPa. The bricks have water absorption more than 20%. Papercrete blocks did not burn with an open flame. They smoldered like charcoal. If the interior plaster and exterior stucco is provided on the bricks, the bricks won’t burn at all. The results shows that if we increase the percentage of paper then the strength will be frequently decreases.

[6] S.Suganya (2012) had done a research on “Light weight bricks made up of waste paper”. After finishing the research, she reported that Papercrete bricks are relatively light weight, and more flexible. Papercrete bricks are potentially an ideal material for earthquake prone areas. Papercrete bricks can be used in auditoriums. Since, the waste materials are used; it will reduce the landfills and pollution.

[7] V.Agilan (2012) had done an experiment on “Energy saving lightweight bricks using waste newspapers”. He carried out an experiment on bricks to know the properties of papercrete. After finishing the experiment he reported that Papercrete bricks are used for non-load bearing walls. He compared this bricks based on their weights and he has reported that weight of this brick is 1/3rd to 2/5th lesser than conventional clay brick.

[8] Isaac Akinwumi, Olasunkanmi M. Olutunbosun.OluwarotimiM. Olofinnade, Paul O. Awoyera (2014) done an experimental research on “Structural evaluation of lightweight concrete produced using waste newspaper and office Paper” and they also determined that the density, water absorption capacity, compressive strength and fire resistance of papercrete produced using waste newspaper and office paper. They prepared two categories of papercrete cubes were produced using either waste newspaper or waste office paper.

After finishing the research, they concluded that the low bulk density of papercrete indicates that they are lightweight and can be used in the form of either hollow or solid blocks for making walls of buildings. Especially, high-rise buildings. This property also makes papercrete good for building arches and domes.

[9] M.RameGowda and K.Prasanna (2014) conducted an experiment on “Development and study of properties of papercrete”. They work on the Papercrete cubes made with cement, sand, paper and fly ash in different mix proportions to determine the mechanical properties. They reported that Papercrete can easily be moulded into any desired shape.

rameshkumargb@gmail.com
shape, light in weight compared to conventional blocks and very good surface finish can be achieved.

[10] Bhooma Nepal and Vanita Aggarwal (2014) had done an experiment on “Papercrete: A Study on Green Structural Material”. They had done an experiment to obtain mechanical properties like durability, basic physical and chemical properties and the structural performance of papercrete. In this experiment results indicates that, it is feasible to reuse waste paper which can be adopted in both self-bearing members and load-bearing members in civil engineering. It is also found that some differences in the mix proportion and structure performance exist in such concrete. At last, some suggestions on further studies of papercrete are recommended according to the ideology of environment protection and the policy of sustainable development in construction industry. This study focused on the review of performance of papercrete as an alternative building material. The results suggested that papercrete if properly mixed and applied, can be used as a great environment friendly construction material.

[11] Joo-Hong Chung, Byoung-Hoon Kim, Hyun-Ki Choi and Chang-Sik Choi (2010) investigated on “Development of papercrete due to paper mixing ratio”. They had done the experiments to obtain some mechanical and physical parameters of papercrete and several laboratory tests were performed. The results showed that the compressive strength is more than 1.2MPa. The experimental results of papercrete will provide some recommendations for using papercrete. According to their investigation, there was no formal mix design of papercrete. Mechanical properties of papercrete were changed by paper-cement ratio.

[12] G.V.S Siva Prasad, P.Padmanabha Reddy (2015) had done a research on “Study and behavior of some properties of papercrete brick with modular brick”. They determine the density, water absorption capacity, compressive strength and fire resistance of papercrete. They also conduct soundness and efflorescence tests. After finishing the experiments they concluded that bricks can be used in inner partition walls. Papercrete has good fire resistance. The Papercrete bricks are good sound absorbent; hence paper is used in these bricks. So, these bricks can be used in auditoriums.

CONCLUSION

In this research we learnt about the manufacturing of papercrete by different proportions. We find out the ways how to come over the obstacles faced during the project. In view of our past research we proposed a definite mix and calculations to success the project.

FUTURE WORK

In future research we go for the definite and perfect mix proportion i.e. mix design for the papercrete. It will also give the results of papercrete strengths by doing compressive and flexural strengths.

REFERENCES


