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UTILIZATION OF PAPER WASTE AND FLY ASH IN CEMENT CONCRETE – A REVIEW

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Abstract- *Production of waste materials, is the way to reduce the environmental impact for construction activities, which in some cases will result in the production of environmentally friendly products and will minimize the use of natural resources. One reason why an ongoing study on the creative use of waste products in the building is the need for secure and economical disposal. The advantages that could be gained from using recycled waste material such as recycled aggregates, recycled glass, recycled paper, recycled plastic, recycled metal, recycled textile and recycled fiber in construction products are the clean environment, the decreased utilization of natural resources and dumping places.*

Keyword: Paper, waste materials, natural resources, Fiber.

1. INTRODUCTION-

The Most waste paper is incinerated at landfill locations. So, air, water, and soil are polluted. Recycling of waste paper could not match the generation of waste paper. The use of waste paper as building material represents one distinctive recycling chance. The building industry is one of the biggest consumers of non-renewable resources. Thus, waste paper is not only used to produce waste paper but also reduces demand stress on worldwide natural resource, as is possible through recycling waste paper.

1.1. Use of Paper Waste-Paper waste is a construction material recently explored that consists of re-pulped cement or clay paper fibre. It is an experimental material, which is an ordinary concrete mix replaces a certain amount of cement with paper. The essential recycled content is regarded as environmentally friendly material. This reduces complete manufacturing weight, costs and carbon emissions. Due to the absence of formal information on structural, mechanical and durability, the use continues restricted. If a paper is blended with cement, a very nice link is created and the final product is both light and powerful. Fibres add to the characteristics of sound insulation and help to regulate cracks. Portland Cement is a mixture essential and serves as a binding agent. Cement decreases pulp shrinking time and impact, and strength and dimensional stability increase. It adds weight to the blend, however, and makes it more broken. Increasing the quantity and the mineral content by adding coir, sand, dirt or pumice. Thermal mass is increased with sand and the water is strengthened and imperceptible to the mix, but the structure is lighter.

Table-1 Chemical composition of waste paper pulp [1]

Element	Percentage Content
O	15.83
Ca	14.94
Si	60.57
Al	2.06
Mg	3.59
S	1.07
K	0.16
Fe	0.92
Na	0.22

1.2. Uses of Fly Ash- Fly ash is a pozzolan, a substance that contains aluminous and silica substances, which in the presence of water forms cement. When combined with water and lime, fly ash forms a similar compound to Portland cement. The application of high-quality fly ash with high fineness and low carbon concentration decreases the water requirement for concrete, which means that fly ash should allow the concrete to be generated with less water content compared to Portland cement concrete of the same workability. In a specified slump, the concrete flows and consolidates better in vibration than standard portland concrete. The application of fly ash also increases cohesion and decreases concrete separation.

The reduction in heat production, and consequently the increase in internal temperatures of concrete, has long been an incentive for using fly ash in solid concrete construction. The maximum temperature rise for fly ash concrete is mainly a function of the amount and the composition of the Portland cement and fly ash used together. in solid concrete versions where the heat loss rate is low, specially for minimizing autogenous

temperature increases, concrete with low cement content in Portland and elevated fly ash content.

2. LITERATURE REVIEW-

Based on literature review and research planning, the outcomes of the researches are as follows-

Luis Agullo´, Antonio Aguado, Toma` s Garcia (2006) An experimental study to assess the reuse by plaster-pulp-composite material of paper waste produced by the production of non-structural components. In relation to the characteristics of the new and difficult material, an assessment of several factors, like the percentage of the pulp added or the mixing methods, has proved to be viable although the natural condition of the waste material used, elevated water contents and comprehensive caking makes it advisable to previous therapy.

Bashar S. Mohammed, Ong Chuan Fang (2011) In his Experimental research the mechanical and durability characteristics of concrete containing paper-mill waste gathered in a treatment plant for wastewater have been assessed. Class F fly ash was used as a substitute for the Portland cement (PC) when the resulting products had been compared with normal concrete in concrete mixtures containing paper mill residues. To assess mechanical characteristics during up to 90 days, compressive splitting, bending force, and drying shrinkage tests have been conducted. The durability characteristics were determined by rapid chloride permeability exams and original surface absorption tests in 28 days. Concerning the residues of the paper mill, improvements in the durability test outcomes were observed when PC was superseded with fly ash class F.

Bashar S. Mohammed, Ong ChuanFang ,Khandaker M. Anwar Hossain , Mohamed Lachemi (2012) In his Experimental research a statistical reaction surface methodology for the slump-and compressive force impact of concrete containing residual material from the paper mill was developed, with and without a substitute of Class F fly ash. The variables included the water/ cement ratio (w / c), the residual content of paper mills and the fly ash content for the total cement material (FA / CM). The performance of the derived models was further discussed to obtain a nice equilibrium of workability and compression force. The findings indicated that it would be possible to predict the compressive strength of the concrete containing residue from the stated downturn value.

Isaac I. Akinwumi, Olasunkanmi M. Olatunbosun, Oluwarotimi M. Olofinnade, Paul O. Awoyera (2014) In his Experimental research determination of the density, water absorption, compressive strength and fire resistance of paper produced using waste paper and office paper in order to determine whether they are suitable for construction materials. The bulk density, water absorption, compressive strength and fire resistance of journal produced paper were found to be greater in each of the mixing ratios considered than in the case of office paper. The absorption of water and the fire resistance of paper was large and increased with the growing amount of waste paper, while the bulk density and compressibility of paper was small and reduced with the growing content of the waste paper. Waste paper concrete was suggested for the manufacturing of lightweight and fire-resistant hollow or solid blocks to be efficient and sustainable to be used for partition walls of, particularly large houses. For the manufacturing of hollow and solid blocks using waste paper concrete, mixing proportions were suggested.

Michal ˇSejnoha, Miroslav Brouˇcek, (2014) In his Experimental research cement reduced (fly ash replaced)concrete in precast segmental tunnel line manufacture for TBM tunnels. This document particularly focuses on comparing the resilience of the fire to improved combustions loaded by a firing curve of the Rijkswaterstaat (RWS). The findings submitted include spalling, harm to the surface and distribution of the temperature of the tested panels. The paper also describes the method proposed for evaluating the extent of spalling during the experiments, as the direct observation of the exposed surface is not possible due to extreme temperatures.

Hong S. Wong, Robert Barakat, Abdulla Alhilali, Mohamed Saleh, Christopher R. Cheeseman (2015) In his Experimental research the powder is manufactured from PSA, a by-product of recycled paper production. Hydrophobic PSA effects on operational capability, strength and transport characteristics such as absorptiveness, water absorption, diffusiveness, permeability, and conductivity are recorded. At the water/cement ratio of 0.38, samples were prepared, cured up to 28 days and conditioned to a constant mass of 50 ° C before the test. It was discovered that the substitution of Portland cement with 12 % hydrophobic PSA decreased water intake, surprisingness, and conductivity by 84 %, by 86 % and 85 % respectively.

OkanKarahan (2017) In his Experimental research concrete material containing 0%, 30%, 50%, 70% and 90% fly ash or slag were prepared and humidly cured up to 28 days. High temperatures at 400 ◦ C, 600 ◦ C and 800 ◦ at 1 hour in an electrically-heated computer kiln have occurred to fly ash and concrete samples for slags. The samples were then cooled to the temperature of the laboratory. The samples were then tested for the

absorption, the vacuum ratio, surprises, permeability of the chloride ion and compressive strength tests.

Patil Asha, SarvankarDipti, PalteRupali, Prof.PatilPrerana (2017) In his Experimental research determination of the functionality of new paper created with waste office paper, to ascertain its suitability for use as a building material. The replacement of the aggregate quantity by paper pulp ranges from 10 % to 20 % at a steady interval of 2.5 %for each of the mix ratios considered. Waste paper concrete was suggested for the manufacture of a light-weight, fire-resistant hollow or solid blocks to create partition walls of high-rise structures in particular.

S. Ferreiro , D. Herfort, J.S. Damtoft (2017) In his Experimental research the workability of calcined clay, especially for 1:1 clay, is heavily affected, thus significantly reducing the efficiency of the superplasticizer (SP), necessary to achieve even higher w / c flows. On the other hand, delayed the addition of SP and/or fly ash substantially improve the rheology of any calcined-clay binder and maximize its strength at any given clinker level in the paste for the same workability.

Wei Wang, Caifeng Lu , Yunxia Li , Guanglin Yuan , Qingtao Li (2017) In his Experimental research the impacts of compressive and tensile stress elevated exposure temperatures and fly ash material on carbonation resistance of the fly ash concrete was performed under multiplexing circumstances to suggest the carbonization resistance and analyze real projects as well as the impacts of the compressive and tensile stress. The carbonating method was accelerated with the use of a speeded carbonation chamber, and the concrete carbonation strength was examined by evaluating the concrete carbonation depth. The results of the experiments show that the resistance to carbonation of both kinds of concrete decreased with a rise in tensile stress levels, while the strength of carbonation increased first and then reduced when the pressure level was increased. The rise in the exposure temperature had a significant effect on the compression strength and carbonation resistance of the concrete: the greater the temperature the deeper the carbonation profile was. The combination of variables such as pressure, elevated temperature and the elevated content of fly ash will significantly decrease concrete carbonation strength.

R.Ilakkiya, Dr. G. Dhanalakshmi (2018) Experimental research on concrete used as extra components in concrete mixes for use in housing projects, to ensure a suitable mechanical strength of the waste paper concrete. Concrete mixes with different materials were ready and fundamental strength features such as compressive strength, splitting tensile, compared with the control mix were determined. Cement, sand and ground aggregates respectively were protected by concrete mixtures containing the waste material, such as standard concrete (5 %, 10%, 15 %) in ratio 1:1.5:3. The coarse aggregates had a maximum size of 20 mm. With the addition of the paper pulp into the concrete, the strength of the concrete was boosted to 10%. The findings of the tests show a decrease in concrete strength of the addition of waste paper pulp in excess of 10%.

Xiangwei Liang, Chengqing Wu, Yekai Yang, Zhongxian Li (2019) In his Experimental research compression tests have been done after the UHPC was initially exposed, i.e. 200, 400, 600, 800 or 1000 ° C, first to high temperatures, and then refrigerated at room temperature, with dynamic tests performed under the high-temperature combined effect (that is, 200, 400, 600 or 800 ° C) and impact loading. The dynamic experiments were performed at elevated temperatures and comparisons between these two situations were made after cooling down. Based on the UHPC exams, the combined impact was researched on the mechanical and physical features. Furthermore, explosive outbreaks were analysed. The fact that polypropylene (PP) fibre could be an adverse factor in preventing it was interesting.

3. CONCLUSIONS-

This review paper acknowledged waste paper concrete as a sustainable building material and emphasized its performance parameters with more studies. Waste paper concrete is created as a product appropriate for low-cost accommodation and transitional shelters and facilities and also contribute to reducing carbon footprint. Waste paper concrete have the following characteristics- Affordable price, Eco friendly, Thermal insulation, Less weight, and Less water absorption.

Waste paper concrete is appropriate for the production of low-cost, sustainability and durability housing. In the view of environment, it merely implies getting an eco safe lifestyle. We can considerably reduce the quantity of material arriving in sites by using paper in houses. Waste paper concrete not only reduces cement use, but makes it environmental safe through the conception of reused disposal material. There is a lot of scope for further research and meaningful work in this endeavor. Some of these include the study of:

1. The effect of supplementary cementitious materials like metakoline, marble dust, waste fines particles of brick, etc., on the strength and durability of light weight paper waste concrete can be rewarding.

2. The strength and durability of other papercrete building elements like wall panels, floor slabs, etc., are to be studied.

3. The structural behavior of concrete in which waste paper and fly ash, both can be used on the basis of increase mechanical properties.

4. Waste paper can also be applicable for manufacturing papercrete bricks.

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