# Studying Supplementary Cementitious Materials For Partially Replacing Cement

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***Abstract-*** *Concrete is most consumed material in the world after water. Cement being the bonding material of concrete needs to be manufactured in large amount. Production of concrete involves huge amount of carbon dioxide emissions into the atmosphere, a major contributor for greenhouse effect and global warming. Also demand of high performance concrete for infrastructural industry is growing. Thus, it becomes necessary to discover a partial replacement of material for cement in concrete which is environmental friendly and strength gaining. This paper focuses on the feasible supplementary cementitious materials which can be used as partial replacement for cement.*

***Keywords***- Concrete, Partial Cement Replacement, Supplementary cementitious materials

## I. INTRODUCTION

Construction industry is a rapid growing hub. Concrete is the backbone of any construction. Need of concrete is always increasing, due to increasing demand of construction projects in residential sector as well as infrastructural sector. One of the major components of concrete is cement. Cement is used for bonding all other components present in concrete mix. But production of cement contributes in emission of greenhouse gases which leads to haphazard increase of global warming. Hence alternative or replacement for cement is needed, but complete replacement of cement is not possible due to requirement of all the properties that cement acquires to fulfill concrete necessities. So, partial replacement of cement can be done to solve these issues. Materials carrying cementitious properties can be used as replacers of cement in concrete mixes. Studying about supplementary cementitious materials which can be used as cement replacers at their optimum percentage of replacement is the motive of this review paper.

## II. AIM AND OBJECTIVE

**Aim–**

Studying about materials having cementitious propertiesto be used as partial replacement of cement.

**Objectives–**

- Studying about waste materials having disposal issues and are contributing in environmental problems and possess cementitious properties.
- Studying about materials which can partially replace cement and also increase performance of concrete
- Studying about supplementary cementitious materials which can be used as partial replacement of cement enhancing its physical properties.

## iII. LITERATURE STUDIED

C. H. Jyothi Nikhila and J. D.Chaitanya Kumar say metakaolin is a supplementary cementetious material derived from heat treatment of natural deposits of kaolin. MK shows high pozzolana reactivity due to their high surface area and amorphous structure. The experimental work has been carried out as partial replacement of cement with MK in M70 grade of concrete at 0%, 10%, 15%, 20%, 25% and 30% of replacements. Cylinders, cubes and prisms are tested for temperature study at 15% replacement. The specimens were heated to different temperatures of $100^0$C, $200^0$C, $300^0$C, $400^0$C and $500^0$C for three different durations of 1, 2 and 3hours at each temp. The results conclude that, the use of MK Concrete (MKC) has improved the performance of concrete under various conditions.

Anas Shahid Multani, Dr. A. K. Nigam says metakaolin seems to be an auspicious additional cementitious material for superior cement. Properties of cement with MK are for the most part favoured added substances in superior cement. The MK consolidations increment the quality of the concrete specimens. In this work, the impact of various contents of MK included to concrete containing super plasticizer its compressive quality strength and workability has been contemplated. Samples with 0%, 5%, 10%, 15%, 20% and 25% content of MK replacing the cement have been evaluated for M30 grade. The outcomes have been contrasted and those for the control test and practicality of adding MK to concrete has been examined. 15% substitution is the ideal rate at which expanded quality of test sample is seen from the base sample test.

Joo-HwaTay says Shell and fiber wastes are used extensively as fuel for steam production in palm-oil mills. After combustion, large quantity of ash is produced and creates problems of disposal. The feasibility of using the shell and fiber ash as a construction material is studied. The material differs from PFA from coal-fired power plants in that it has a higher content of residual organic, a higher alkali content, is coarser. The results show that shell and fiber ash can be blended in small amounts (up to 10%) with cement for concrete mix.

Elnaz Khankhaje, Mahdi Rafieizonooz, Mohd Razman Salim, Rawid Khan, Jahangir Mirza, Ho Chin Siong, Salmiati saysthe aim of this research was to study pervious concrete pavement as a sustainable solution to control the storm water at source, reducing heat island effect and enhancing safety of driving. The sustainability of pervious concrete can be increased and the carbon dioxide emissions reduced by replacing a huge amount of ordinary Portland cement with waste materials such as palm oil fuel ash. Experimental investigations were worked to assess the substitution of control pervious concrete with palm oil fuel ash up to 40% (by mass) to produce sustainable and eco-friendly pervious concrete pavement. Skid and abrasion resistances were also employed to evaluate the effects of palm oil fuel ash on safety of driving and surface durability of the pervious concrete pavement. The results showed that void content and water permeability of pervious concrete increased slightly with increasing palm oil fuel ash, while compressive and tensile strengths decreased. The pervious concrete containing 20% palm oil fuel ash presented the most optimum mixture both technically and environmentally.

J. Monz, J. Pay, M.V. Borrachero, A. Cdrcoles says the chemical composition of sewage sludge ash (SSA) and their sized fractions are studied, some differences in chemical composition are observed. SEM studies show irregular shape of SSA particles and sized fractions; this shape has a decisive influence on workability of mortars. The effect of replacing 15% of Portland cement by SSA and their sized fractions: coarse (SSAC) and medium (SSAM) obtained by sieving on compressive (R,) and flexural strength of mortars was investigated. The study reveals an enhancement of strength properties of SSA.

Ciarán J. Lynn, Ravindra K. Dhir, Gurmel S. Ghataora, Roger P. West says Sewage sludge ash (SSA) use in concrete related applications is assessed through systematic review involving analysis and evaluation of the global literature found published since 1983. Sewage sludge ash (SSA) indicate potential for various applications: in small dosages as raw feed in Portland cement production, as fine and filler aggregates, or in ground form as cement component, with manageable effects on performance. Using manufactured SSA aggregate, concrete strength suitable for structural applications and lightweight properties are attainable. SSA can be used in bulk, in controlled low strength materials, aerated and foamed concrete.

Prof. Veena G. Pathan, Prof. Md. GulfamPathan says Sustainability in Concrete Production can be achieved by innovations in substitutions of materials used. MWP is a solid waste material generated from the marble processing and can be used either as a filler material in cement or fine aggregates while preparing concrete. It has been used as a replacement of fine aggregates in many literature works but this paper presents the feasibility of the substitution of MWP for cement to achieve economy and environment saving. The Compressive strength and Split Tensile strength of Concrete can be increased with addition of waste marble powder up to 10% replace by weight of cement. Earlier research also indicate that the effects of blending MWP on the properties of cement such as consistency, setting times, insoluble residue, and soundness remain within the acceptable ranges of different standards. The production of cheaper and more durable concrete using this waste can solve to some extent the ecological and environmental problems. Therefore this paper provides a scope for more research which is required to design consistent and durable concrete with this waste.

## IV. CONCLUDING REMARKS

- Metkaolin, Palm Oil Waste Ash, Waste Marble Dust Powder, Palm Oil Fuel Ash, Sewage Sludge Ash possess cementitious properties can be used as supplementary cementitious materials.
- Waste materials can also be used in concrete.
- Partially replacing cement might also enhance physical properties of concrete.