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"EFFECT OF MIXING WASTE FROM TOOTHPASTE INDUSTRY ON THE CHARACTERISTICS /STRENGTH OF CONCRETE"

ATUL KUMAR PANDEY, M.Tech Scholar, Department of Civil Engineering, Technocrats Institute of Technology-Excellence Bhopal, M.P. India.
Prof. Pankaj Dixit, **Dr. Ravindra Gautam, Prof. Sunil Kumar Thakur,** Professor, Department of Civil Engineering, Technocrats Institute of Technology-Excellence Bhopal, M.P. India.

ABSTRACT
Due to the increase in waste production by industries, there is a huge necessity for reutilization and efficient disposal methods for waste products. The major objective of this study is to investigate the effects of using waste from Toothpaste Industry Waste (TIW) on the characteristics strength of concrete to determine the optimum utilization of waste. Sludge from toothpaste industry is a serious concern because of lack of suitable disposal sites. The waste management of TIW can be resolved after this study.
The reuses of industrial wastes will help in solving the environmental pollution issues associated with their disposal, but it will also increase the preservation of natural resources that are reducing rapidly. Sludge produced by toothpaste manufacturing units contains a significant amount of calcium carbonate which is not good for discharging openly.
Cement concrete is one of the most popular building materials used worldwide.The aim of this research is to use toothpaste sludge containing calcium carbonate ($CaCO_3$) in concrete, as a binder, fine aggregate, and clay substitute.
Keywords: ***Concrete, Sand, Industrial waste material, TIW, Toothpaste sludge compressive strength, M40 Grade.***

1. INTRODUCTION
Currently, India is one of the world's fastest developing countries, with a high economic growth rate. This will result in a massive demand for physical infrastructure and housing, as well as the materials used to construct them. Concrete, the world's mostly used construction material, made of materials such as cement, coarse & fine aggregate, water, and, depending on the application, admixtures, or other additives. When the concrete is properly cured, it forms a solid stone-like substance. Concrete, in comparison to all other building materials, can be easily handled in all the following areas:

- It is possible to automate the whole planning and placement process.
- It can be easily molded into a variety of sizes and types of long-lasting structural components.
- The properties of concrete can be regulated in a wide variety by using the right materials and special manufacturing techniques.

The major motivation of this project is the increase in waste products and increasing consumption of cement in construction industry. By reducing use of cement cost of construction can be reduced and it also reduces the environmental hazards produced by cement. Concrete is found to be second-most consumed material on the planet, after water, with each human using approximately three tons per year on average. The main ingredient of concrete, Portland cement, is used to bind the components that make up concrete. The concrete industry consumes approximately 1.6 billion tons of cement per year and produces approximately 12 billion tons of concrete. There are threefold benefits of using supplementary materials in cement and concrete.
There are two basic types of cement manufacturing processes, as well as a variety of kiln types. Depending on the water content of the raw material feedstock, these are referred to as "wet" or "dry." The wet process requires more energy to evaporate the 30 % plus slurry water before heating the raw materials to the necessary calcinations' temperature.

Various studies are being conducted to see whether industrial by-products with pozzolanic properties and hydraulic action can be used as supplementary cementations admixtures or raw materials to replace cement. Fly-ash, blast furnace slag and other factory pollutants have been successfully studied and used, and provide advantages such as future reductions in renewable resources and electricity, reduction of carbon dioxide emissions, and re-use of wastes that may normally be disposed of in landfills, necessitating the implementation of a waste management scheme. As previously stated, cement, stone aggregates, sand, soil, and other materials are used in construction. Because natural resources are finite, their quantity is gradually diminishing. In addition, the cost of processing high-quality natural materials is rising. Concerned with this, scientists are searching for new building materials, and one such group is toxic waste products. Pollution and waste issues may be mitigated to an extent if these materials are properly used in construction.

2. LITERATURE REVIEWS

An extensive literature review related to concrete is done. This includes the information available in literature related to the properties of concrete. Information related to materials and mix proportioning for concrete is also studied. The literature review includes various properties of concrete such as void ratio, permeability, compressive strength, flexural strength, and density.

Lochana Poudyal, Kushal Adhikari and Moon Won (2021) Mechanical and Durability Properties of Portland Limestone Cement (PLC) Incorporated with Nano Calcium Carbonate (CaCO3). The aim of this study is to analyze the effect of Nano calcium carbonate in concrete. Further, nano $CaCO_3$ is environmentally and economically viable, as it has the potential to be produced within the cement plant while utilizing waste CO_2 and generating economic revenue to the industry. Thus, nano $CaCO_3$ has the potential to serve as an alternative to fly ash in all beneficial aspects—economic, environmental, and technical.

Muzeyyen Balcikanli Bankir (2020) Effect of $CaCO_3$ on fresh, hardened properties and acid resistance of granulated blast furnace slag added mortar. Lightweight concrete can be produced using factory by-products and toxic solid wastes including expanded fly-ash, slag, and sludge. Nano size $CaCO_3$ (n-$CaCO_3$) particles were used as an additive into the Ground Granulated Blast Furnace Slag (GGBS) added mortar to investigate their effects on fresh, hardened properties and acid resistance. Setting time, normal consistency, flow diameter, volume stability, flexural and compressive strengths tests were performed in the present study. In addition, to see how n-$CaCO_3$ and GGBS affect the acid resistance of the mortars, the produced mortar samples were stored in the acid solution and their mass losses were determined.

According to ***Almeshal et al. (2020)*** solid waste is one of the factors contributing to climate change. Issues occur because of factors such as waste recycling complexity and low recyclability. The aim of this study was to determine the effects of using poly ethylene terephthalate as a partial substitute for sand in concrete, as plastic is a widespread type of solid waste with a major environmental effect, different solid wastes could be used to make building products. The environmental consequences of the generation of different solid wastes are discussed in this article, as well as their disposal potential and potential use in the production of construction materials.

Sivaprakash et al. (2016) conducted an experimental analysis on the mechanical strength properties of M-25 grade concrete using ceramic waste as a partial replacement for sand. The samples were cast with a 10%, 20%, 30%, 40%, 50% substitution of sand with ceramic waste and cured for 7days, 14days, and 28days to determine mechanical properties such as compressive, flexural, and break tensile power. The results of experiments performed for properties such as strength, resilience, and so on in his article. The findings showed that the inclusion or substitution of fine sand with productive alternatives resulted in positive modifications and improvements in mechanical properties of standard concrete.

Subramani & Kumaran (2015) conducted research on concrete that incorporates concrete waste and burnt brick ballast owing to their excess. As a partial substitute for natural coarse aggregate in

concrete, 25% to 50% (M-15, M-25) incorporation was used. Compaction factor test, slump, unit weight, and compressive strength of concrete were all measured in both fresh and hardened states of integrated concrete. Replacement of waste and burnt brick decreases the density of concrete and makes it durable and light. Concrete will become economical with substitute with waste.

Kumar & Kumar (2014) conducted research on sintered fly-ash and demonstrate how sintered fly-ash differs from ordinary Portland cement in terms of applications. Its use as a raw material for cube (brick) production would be a very cost-effective and environmentally friendly option. OPC, which are widely used in the building industry, are 33, 43, and 53. Fly-ash reduces the cement amount in concrete and help to increase the surface area of cement in concrete. Fly ash helps in increasing the workability and strength of concrete. Fly ash also makes concrete light and durable with having less density. Fly-ash is also very eco-friendly in environment.

Sahu and Gayathri (2013) investigated the use of sludge from water treatment plants and fly-ash from thermal power plants. Fly-ash and water softening sludge (lime-sludge) were used in the mortar in this analysis. Two types of mortar (type I and II) were tested, along with four different binder combinations. The structure of the composite material, the process of preparing mortar specimens, the measuring technique, and the most important findings are all discussed in this paper. According to the 42nd World Casting Production Census, India ranks 4th in overall foundry production (7.80 million tons), Foundry waste is regularly discarded in the metal industry, which is rich in silica.

Pitroda et al. (2013) performed an experimental analysis on the novel use of hypo sludge as a supplemental cementations substance in concrete formulations. It was put to the test as a concrete substitute. Concrete mixtures were produced, tested, and compared to standard concrete in terms of strength. These experiments were performed to assess mechanical properties such as compressive-strength for up to 28days and split strength for up to 56days.Use of industrial wastes such as paper-pulp, marble powder, quarry dust, and wood ash to mitigate natural resource and energy consumption as well as contamination in the atmosphere.

Solanki and Pitroda (2013) investigated the flexural-strength of beams for M40 grade concrete. Based on experimental investigations into the flexural-strength of concrete by partly replacing cement with fly-ash and hypo-sludge, it was discovered that when 20 % of the cement is replaced by fly-ash, the flexural-strength of the concrete increases. With the aim of assisting the building industry in designing appropriate policies for the uses of waste and recycled materials as construction products. Experimental experiments on mortar incorporating fly-ash as a partial-substitution of sand by weight and volume were carried out to measure its utilization. The fly-ash mortar blend 1:1:5 (cement: fly-ash: sand) by weight, on the other hand, uses around twenty % less cement and consume twenty % less fly-ash overall.

The viability of artificial sand in concrete was investigated by ***Rajendra et al (2013)***. In these tests, natural sand is supplemented with artificial sand at a rate ranging from 0% to 100% with a twenty % increment. According to studies, sixty to eighty % of natural sand can be substituted with artificial sand. The properties of concrete and mortar e in which Crushed Rock Powder is used as a partial to complete substitute for natural sand .This research shows that crushed rock powder can be used to substitute natural sand in cement mortars. A mortar containing forty % crushed rock powder has a much greater strength than a mortar containing only sand as fine aggregate.

Badur and Choudhary (2008) the study discusses how chemical and mineral admixtures aid in improving the properties of lightweight concrete. Fly-ash, which makes up 15 to 35 % of the concrete mix, takes the place of cement. Fly-ash improves the workability of concrete, increases its resilience, improves sulphate tolerance, reduces permeability, and lowers the water ratio needed. This lightweight concrete blend is good enough to use in environmentally friendly applications such as roadbeds, filling materials, and so on.

3.CONCLUSIONS

- The findings of this study also provide the construction industry with readily available new raw materials for concrete, as well as the waste-generating industry with the potential to save money by reducing or removing waste disposal.
- Nano $CaCO_3$ has the potential to serve as an alternative to fly ash in all beneficial aspects—economic, environmental, and technical.
- Lightweight concrete can be produced using factory by-products and toxic solid wastes including expanded fly-ash, slag, and sludge.
- The inclusion or substitution of fine sand with productive alternatives resulted in positive modifications and improvements in mechanical properties of standard concrete and increases strength by 40%.
- Natural sand is supplemented with artificial sand at a rate ranging from 0% to 100% with a twenty % increment. According to studies, sixty to eighty % of natural sand can be substituted with artificial sand
- The concrete produced are light in weight, durable.
- The concrete produced are environmentally friendly and can be promoted as a long-term construction material.
- Fly-ash improves the workability, resilience, improve sulphate tolerance.
- Fly-ash reduces the permeability and water cement ratio.

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