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Experimental Analysis on Green Concrete

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Abstract: *Concrete makes up about 5% of all global CO2 emissions and is the second most consumed material after water. On average, 927g of carbon dioxide is produced for every 1000 kg of cement. One of the most effective materials that has a significant impact on environment. We are completely substituting waste materials like fly ash and silica fume for cement in order to lessen the cement's negative environmental effects. The use of two chemicals (chem1 and chem2) that will react with fly ash to create cement-like materials and cementations properties is called a polymerization reaction. We will research how different chemical ratios affect concrete's strength and durability and get similar conclusions. Following an interpretation of the findings and conclusions by casting and testing concrete, we will state the application of the test results for both the physical and chemical properties of the materials.*

Keywords: Concrete

I. INTRODUCTION

When it comes to building structures, developers and contractors have the advantage of choosing from a variety of materials to use. Generally, the decision on material choice depends on several factors including cost and performance for specific applications. Due to growing interest in sustainable development and various incentives provided by the Government of Malaysia, the key players in the construction industry are motivated more than ever before to use materials that are sustainable or in such a way that their environmental impact is minimal. In 2009, the Malaysian government launched the green building index (GBI) to encourage the construction of buildings using green technology, and introduced incentives for owners to obtain the GBI certificate for new or existing buildings. There have also been efforts to reduce air pollution and concrete has an important role to play because a significant amount of the world's carbon emissions stem from cement and concrete production. Therefore, it is important to develop green concrete that can be used in buildings and structures. In recent years, the application of green concrete has become popular in many countries including Malaysia. The innovative concrete can be produced using waste materials as one of its components. Green concrete can also be developed using various production processes that are not detrimental to the environment. The criteria for green concrete is that the materials used for making it should be sourced from sustainable or "green materials" rather than non-sustainable resources. The use of recycled or waste materials can be considered sustainable as they can lower costs and raw materials as well as reduce landfills. In this project, researchers at Universiti Teknologi MARA introduced an innovative green concrete called "green-mix concrete" that is designed and manufactured using conventional materials but partially replaced with suitable waste and recycled materials to achieve acceptable performance, economics and sustainability. Green concrete is made of new raw materials -- namely fly ash, recycled concrete aggregates and aluminium can fibres. Fly ash is a waste product from coal power plants and is commonly disposed of in ponds and sent to landfills. Through research it was discovered that fly ash has the potential to replace cement, a material with large environmental impacts due to air pollution from the cement plants. In order to reduce consumption of raw materials and to minimise the wastes generated from demolished concrete structures, crushed concrete can be reused as aggregates. Aluminium cans were used because they can be easily processed into chopped fibres and used as reinforcement in concrete. To produce this new concrete requires technical expertise such as new concrete mix design, new raw materials and new knowledge of green concrete properties. Not only is this newly developed green concrete environmentally friendly, it is also cost-effective as a result of optimized material proportions from our new concrete mix design. In our investigation, the new concrete can achieve an increase in strength of up to 30% compared to normal concrete. In conclusion, our green concrete has the following benefits:

- designed for strength and performance during service-life of buildings or structures;

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- has lower cement/carbon footprint per unit of concrete produced;
-has potential for commercialization by providing developers and contractors with an alternative concrete that is environmental-friendly, in line with the National Green Technology Policy. A Green Concrete is a revolutionary topic in the history of concrete industry. This was first invented in Denmark in the year 1998. Green concrete has nothing to do with color. It is a concept of thinking environment into concrete considering every aspect from raw materials manufacture over mixture design to structural design, construction, and service life. Green concrete is very often also cheap to produce because for example, waste products are used as a partial substitute for cement, charges for the disposal of waste are avoided, energy consumption in production is lower, and durability is greater. Green concrete is a type of concrete which resembles the conventional concrete but the production or usage of such concrete requires minimum amount of energy and causes least harm to the environment. The CO2 emission related to concrete production, is between 0.1 and 0.22 t per tonne of produced concrete

II. LITERATURE REVIEW

Neeraj Agarwal , Nikhil Garg (2018) has founded that it use of recycled aggregates and materials, will reduces the extra load in landfills and mitigates the wastage of aggregates. Thus, the net CO2 emission are reduced. The reuse of materials also contributes intensively to economy. They concluded that We can replace cement by (glass + fly ash) upto 30%.

Supriya Kulkarni (2018) The study shows that Geopolymer concrete is more resistant to corrosion and fire, and has high compressive and tensile strengths, it also gains its full strength quickly (cures fully faster). The shrinkage is also less compared to standard concrete. Thus, taking account these structural advantages it may be concluded that, in near future Geopolymer concrete may find an effective alternate to standard cement concrete. These constituents of geopolymer concrete are capable of being mixed with low alkali activating solution and are curable in short time, under natural conditions.

Shaswat Kumar Das, Jyotirmoy Mishra, Syed Mohammed Mustakim (2018) They presented that An overview of recent advances in geopolymer in terms of fresh concrete properties: setting time and workability and hardened concrete properties: compressive strength and durability. it is concluded that geopolymer concrete provides tremendous potential to be used as a construction material in the coming future. Setting time, workability and durability characteristics of Geopolymer concrete proved to be better than OPC based concrete. However certain limitations need to be overcome which will lead to a better acceptance of geopolymer concrete

Adanagouda ,Pampapathi G S , A.Varun , RamyaMadagiriMeruguKeerthan (2017) This research work was to produce a carbon dioxide emission free cementitious material. The geopolymer concrete is totally cement free concrete. In this present study the main limitations of fly ash based geopolymer concrete are slow setting of concrete at ambient temperature and 11 Granulated Blast Furnace Slag (GBS) as replacement for natural sand. The strength of geopolymer concrete was increased with increase in percentage of GBS in a mix.

SouravKr.Das ,Amarendra Kr. Mohapatra and A.K.Rath (2014) has observes that the process and parameters which effect the geo-polymer concrete till date. It is a inorganic 3D polymer which is synthesized by activation of alumino-silicate source like fly ash or GGBS (waste materials). Due to its high mechanical properties combined with substantial chemical resistance (magnesium or sulphate attack), low shrinkage and creep and environment friendly nature (very less amount of CO2 production in comparison with OPC), The conclusion is Higher the fineness of fly ash gives a higher compressive strength because

III. METHODOLOGY

3.1 Green Concrete

Green concrete is very often also cheap to produce because for example, waste products are used as a partial substitute for cement, charges for the disposal of waste are avoided, energy consumption in production is lower, and durability is greater. Green concrete is a type of concrete which resembles the conventional concrete but the production or usage of such concrete requires minimum amount of energy and causes least harm to the environment. The CO2 emission related to concrete production, is between 0.1 and 0.22 t per tonne of produced concrete.

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However, since the total amount of concrete produced is so vast the absolute figures for the environmental impact are quite significant, due to the large amounts of cement and concrete produced. Since concrete is the second most consumed entity after water it accounts for around 5% of the world's total CO2 emission. The solution to this environmental problem is not to substitute concrete for other materials but to reduce the environmental impact of concrete and cement. The potential environmental benefit to society of being able to build with green concrete is huge. It is realistic to assume that technology can be developed, which can halve the CO2 emission related to concrete production. During the last few decades society has become aware of the deposit problems connected with residual products, and demands, restrictions and taxes have been imposed.

3.2 Optimizing the Green Concrete Materials and Volume Fraction

A. Green Concrete

Sr.No.	Materials	Quantity (per m3)	Actual Quantity (Kg)	Rate (per Kg)	Amont (INR)
1.	Fly Ash	398.412	84.46	1.5	127
2.	Chem 1	12.4	2.62	360	944
3.	Chem 2	30.98	6.56	300	1968
4.	Fine Aggregate	717.09	152.02	1.2	182.424
5.	Course Aggregate	1098.108	232.98	1.3	302.874
6.	Silica Fume	44.268	9.38	15	140.7
7.	Super-plasticizers	4.426	0.938	80	75.04
8.	Water	177.072	37.54	0.1	4
Total =			3744.038		

Table 1: Green Concrete material and volume fraction

B. Conventional Concrete

Sr. No.	Materials	Quantity (per m3)	Actual Quantity (kg)	Rate (Per kg)	Amount (INR)
1	Cenent	442.68	31.235	9	281.115
2	Fine Aggregate	717.09	50.6	1.2	60.72
3	Course Aggregate	1098.108	77.48	1.3	100.724
4	Water	177.02	12.5	0.1	1.25
5	Super Plasticizers	44.268	0.312	80	24.96
Total =			468.769		

Table 2: Quantity of conventional concrete

3.3 Mix Design Consideration

- Grade of concrete : M30
- Type of Cement and Cement Grade : OPC 53
- Maximum size of aggregate : 20 mm
- Fine aggregate confined to Zone-III (As per IS 383)
- Slump : 150 mm (Pumpable Concrete)
- Exposure condition : sever
- Water/Cement Ration : 0.5
- Green concrete
- Fly Ash-90% , silica fume -10%
- Ratios (with respect to cement)

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Sr. No.	Chem 1 (%)	Chem 2 (%)
1	10	30
2	15	40
3	20	50

Table 3: Percentage of Chemicals

3.4 Materials

1. Cement
2. Fine Aggregate
3. Course Aggregate.
4. Water.
5. Fly Ash.
6. Silica Fumes.

IV. CONCLUSION

Green concrete have reduced environmental impact with reduction of the concrete industries CO2 omissions by 30%. 2. They have good thermal and fire resistant. 3. In this concrete recycling, use of waste material such as ceramic wastes and aggregates increase concrete industry waste products by 20%. 4. Hence, they consume less energy and becomes economical. So, the use of concrete product like green concrete in future will not only reduce the emission of CO2 in environment and environmental impact but it is also economical to produce. 5. To use new types of cement with reduced environmental impact. 6. Better Performance

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