पेटेंट कार्यालय
शासकीय जर्नल

OFFICIAL JOURNAL
OF
THE PATENT OFFICE

निर्गमन सं. 08/2022	शुक्रवार	दिनांक: 25/02/2022
ISSUE NO. 08/2022	FRIDAY	DATE: 25/02/2022

पेटेंट कार्यालय का एक प्रकाशन
PUBLICATION OF THE PATENT OFFICE

INTRODUCTION

In view of the recent amendment made in the Patents Act, 1970 by the Patents (Amendment) Act, 2005 effective from 01st January 2005, the Official Journal of The Patent Office is required to be published under the Statute. This Journal is being published on weekly basis on every Friday covering the various proceedings on Patents as required according to the provision of Section 145 of the Patents Act 1970. All the enquiries on this Official Journal and other information as required by the public should be addressed to the Controller General of Patents, Designs & Trade Marks. Suggestions and comments are requested from all quarters so that the content can be enriched.

(Shri Rajendra Ratnoo)
CONTROLLER GENERAL OF PATENTS, DESIGNS & TRADE MARKS

25TH FEBRUARY, 2022

(12) PATENT APPLICATION PUBLICATION
(19) INDIA
(22) Date of filing of Application :15/02/2022

(21) Application No.202241007833 A
(43) Publication Date : 25/02/2022

(54) Title of the invention : A METHOD TO STRENGTHEN REINFORCED CONCRETE USING CARBON FIBER

(51) International classification	:C08J0005040000, B29C0070060000, B29K0307040000, B29C0048920000, B29C0070460000
(86) International Application No	:PCT//
Filing Date	:01/01/1900
(87) International Publication No	: NA
(61) Patent of Addition to Application Number	:NA
Filing Date	:NA
(62) Divisional to Application Number	:NA
Filing Date	:NA

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(57) Abstract :
The present invention describes the construction of CFRP structures to determine the development length & flexural strength. Carbon fibre reinforced polymer (CFRP) is a combination of high performance that provides high strength, low weight, corrosion resistance, and fatigue resistance. This is especially true in hostile coastal areas, especially in areas where the sea is frequently changing, including salts that enter the concrete and dissolve the metal. However, the cost of pre stressing strand materials is relatively small percentage of bridge‘s overall cost. CFRP will reduce the maintenance cost of high bridge’s service life.

No. of Pages : 17 No. of Claims : 3

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Department of Industrial Policy & Promotion,
Ministry of Commerce & Industry,
Government of India

(http://ipindia.nic.in/index.htm)

(http://ipindia.nic.in/index.htm)

Application Details	
APPLICATION NUMBER	202241007833
APPLICATION TYPE	ORDINARY APPLICATION
DATE OF FILING	15/02/2022
APPLICANT NAME	**PAAVAI ENGINEERING COLLEGE (AUTONOMOUS)**
TITLE OF INVENTION	A METHOD TO STRENGTHEN REINFORCED CONCRETE USING CARBON FIBER
FIELD OF INVENTION	POLYMER TECHNOLOGY
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E-MAIL (UPDATED Online)	
PRIORITY DATE	
REQUEST FOR EXAMINATION DATE	15/02/2022
PUBLICATION DATE (U/S 11A)	25/02/2022

Application Status	
APPLICATION STATUS	**Application Awaiting Examination**

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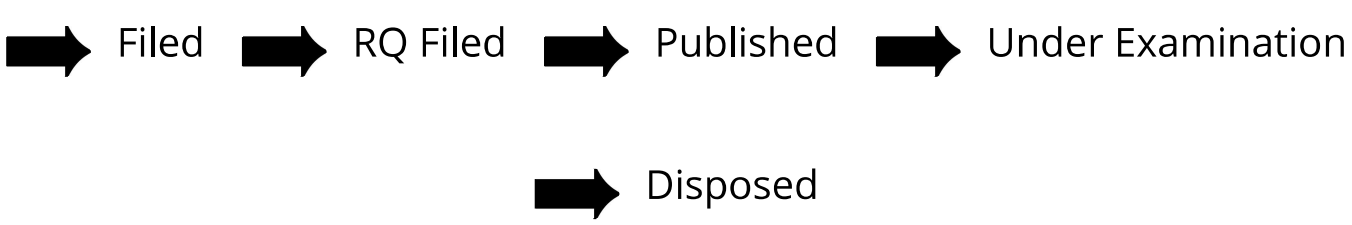

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FORM 1
THE PATENTS ACT, 1970
(39 of 1970)
&
THE PATENTS RULES, 2003
APPLICATION FOR GRANT OF PATENT
[See sections 7,54 & 135 and rule 20(1)]

(FOR OFFICE USE

Application No.: .....
Filing Date: .....
Amount of Fee Paid: .....
CBR No.: .....
Signature: .....

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Sr.No.	Country	Application Number	Filing Date	Name of the Applicant	Tilte of the Invention

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International Application Number	International Filing Date as Allotted by the Receiving Office
PCT//	

7. PARTICULARS FOR FILING DIVISIONAL APPLICATION

Original (first) Application Number	Date of Filing of Original (first) Application

8. PARTICULARS FOR FILING PATENT OF ADDITION:

Main Application / Patent Number:	Date of Filing of Main Application

9. DECLARATIONS:

(i) Declaration by the inventor(s)

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(a) Date: -----

(b) Signature(s) of the inventor(s): .....

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(ii) Declaration by the applicant(s) in the convention country

I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date: -----

(b) Signature(s) : .....

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(iii) Declaration by the applicant(s)

- **The Complete specification relationg to the invention is filed with this application.**
- **I am/We are, in the possession of the above mentioned invention.**
- **There is no lawful ground of objection to the grant of the Patent to me/us.**
- **I am/We are, the assignee or legal representative to true first inventors.**

10. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION:

Sr.	Document Description	

I/We hereby declare that to the best of my/our knowledge, information and belief the fact and matters stated hering are correct and I/We request that a patent may be g

Dated this(Final Payment Date): ----------

To The Controller of Patents

The Patent office at CHENNAI

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FORM 2

THE PATENTS ACT, 1970
(39 of 1970)
&
The Patent Rules, 2003

COMPLETE SPECIFICATION

(See sections 10 & rule 13)

1. TITLE OF THE INVENTION

A METHOD TO STRENGTHEN REINFORCED CONCRETE USING CARBON FIBER

2. APPLICANT(S)

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3. PREAMBLE TO THE DESCRIPTION

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner in which it is to be performed

A METHOD TO STRENGTHEN REINFORCED CONCRETE USING CARBON FIBER

FIELD OF INVENTION

[001] The present invention relates to the field of concrete materials and more particularly it describes a method for strengthening reinforced concrete with the mix of carbon fibers.

BACKGROUND OF INVENTION

[002] Background description includes information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[003] After water, concrete is the second most used source of energy in the world. Public engineering institutions, although working long hours, cannot be called neglected. These engineering structures represent the most important investments and assets. The tragic failure of public infrastructure around the world is a reminder that proper protection is essential to prevent the unexpected collapse of public institutions and the loss of money and health. Concrete structures deteriorate and collapse due to a variety of conditions, including the aging of the material, severe weather conditions, extended use, overloading, problems in conducting routine inspections, and lack of repair.

[004] Numerous nano-scale fissures may be seen inside the microstructure of concrete. These fractures develop as a result of the production or usage of the product. Nano-cracks unite to produce micro-cracks over time, causing macro-cracks to develop and structures to fail. Many investigations on damage detection using various non-destructive evaluation approaches have been spurred by growing concern about the state of existing structures, particularly following earthquakes. Sudden collapse and accidents can be averted with early diagnosis of these intrinsic problems. The service life of concrete buildings can be considerably increased by early diagnosis of faults and careful maintenance. Strengthening procedures for traditional construction are often accompanied by side effects and limitations. The extension of the cross section to the most widely used load-bearing parts reduces storage space and also indicates the need for longer removal from normal use due to the time-consuming construction process. Worse, broad reinforcement creates the complexity of the second structure. Revealed downfalls are disclosed.

[005] Fiber Reinforced Plastic Concrete is a composite material made of cement, mortar, or concrete mixed with suitable non-abrasive fibers, which is unique and evenly distributed. Reinforced concrete comes in a variety of shapes and qualities, each with its own advantages. The different fibers do not include continuous machinery, woven fabrics, or long cords or rods. Fiber is a small piece of reinforcing material and a specific set of attributes. They come in a variety of shapes and sizes, including round and flat. A usable scale entitled "aspect ratio" is often used to define fiber. The average length and width of a fiber is known as the

aspect ratio. The ratio does usually vary from 30 to 150. Fiber-reinforced concrete (FRC) is a type of concrete that consists of fiber materials to improve structural strength. It is made up of short divided strands that are evenly distributed and randomly directed. Metal fibers, glass fibers, synthetic fibers, and natural fibers are examples of fibers. With various concretes, fiber materials, geometries, distribution, shape, and durability, the character of reinforced concrete transformations within these various threads.

[006] A prior art of a researcher analysed the numerical investigation to create the action of retrofitted RC shear beams. The un retrofitted RC beam design selected as conventional beam and RC beams retrofitted by CFRP composites with ±45o and 90o fiber orientations. The cause of retrofitting on without crack and with crack beams was calculated also. The FE model accepted by ANSYS was used in this investigation. This numerical modelling assists to track the crack formation and propagation particularly in case of retrofitted beams within the crack formations cannot be seen by the investigational study because of wrapping of CFRP composites. This numerical analysis can be used to forecast the actions of retrofitted RC beams more accurately by transmission appropriate material properties.

[007] Another researcher analysed the nonlinear finite element analyses of rectangular RC beams strengthened by FRP. The impact of fiber orientation, span, and ratios of reinforcement on the final strength of the beams is evaluated. It has been shown that the use of fiber-reinforced polymers may significantly improve the strength

and strength of RC beams. In addition, with fiber-reinforced plastic layer figures, the strength of fiberglass-reinforced plastic bars under design beams is much greater than those of fiber-reinforced plastic on both sides of the beams.

[008] Yet another researcher stated that the flexural strengthening of RC beams by outside bonding of high-strength lightweight CFRP plates to tension face of the beam. Three collections of beams were investigated thoroughly and evaluated with presented investigational results. Outcome of the numerical investigation explained that, while addition of CFRP plates to the tension face of the beam increases the strength, it decreases the beam ductility. FE designing of 15 various beams in a parametric analysis indicates that steel area ratio, CFRP depth, CFRP ultimate strength and elastic modulus significantly influence the height of strengthening and ductility. The statistical findings of the limitation material indicate that by attaching a small amount of CFRP to the surface roughness of the RC logs, a significant stabilization can be achieved. The analysis process accurately predicts available test data.

[009] Yet another researcher looked at the performance of advanced RC connectors. The main purpose of this study was to compare the power of connectors to improve their systematic performance. A FE investigation using ANSYS was developed to perform a parametric investigation. The FE sample takes into concern the nonlinear action of the constituent materials. To model the anchorage slip and anchorage extension of the reinforcement in the external relations, the nonlinear spring sample was employed. The investigation outcome designate that

utilize of FRP laminates increases both the stiffness and load carrying capacity of the RC connections. By raising the length of laminates for strengthening the joint, trends of development the structural action of connections have been intensified. The strength of the flexural cracking is reduced due to the presence of FRP composites reinforcement.

[0010] In yet another research output, the model made of steel reinforced concrete with a pre-compressed CFRP plate was discussed. The beams were reinforced with Carbon Fiber Reinforced Polymer and the ANSYS was used to mimic them. The paid results were compared with those obtained during the test and found to be in good agreement.

[0011] In yet another research, the researcher examined to observe the outcomes of various factors on the overall actions of outwardly prestressed beams in conditions of the results of compressive concrete strength and effectual pre stressing stress. That performance was slightly affected compared with investigational outcome. The un deviated exterior tendons mobilized lesser small flexural resistance and inelastic deflection than deviated tendons did. The augment in the beam ability in the beam subjected to loads at the third extent is larger than in the beam by a single load at the mid – span. The conclusion of raising the effectual depth is that the ultimate load power is effectively increased. However, there comes a need for further increasing the strength of concrete by ensuring the weight parameters of concrete to be lower.

[0012] Further limitations and disadvantages of conventional and traditional approaches will become apparent to one of skill in the art through comparison of described systems with some aspects of the present disclosure, as outlined in the remainder of the present application and concerning the drawings.

[0013] In some embodiments, the numbers expressing quantities or dimensions of items, and so forth, used to describe and claim certain embodiments of the invention are to be understood as being modified in some instances by the term "about." Accordingly, in some embodiments, the numerical parameters outlined in the written description and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by a particular embodiment. In some embodiments, the numerical parameters should be construed in light of the number of reported significant digits and by applying ordinary rounding techniques. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of some embodiments of the invention are approximations, the numerical values outlined in the specific examples are reported as precisely as practicable. The numerical values presented in some embodiments of the invention may contain certain errors necessarily resulting from the standard deviation found in their respective testing measurements.

[0014] As used in the description herein and throughout the claims that follow, the meaning of "a," "an," and "the" includes plural reference unless the context dictates otherwise. Also, as used in the description herein, the meaning of "in" includes "in" and "on" unless the context dictates otherwise.

[0015] Groupings of alternative elements or embodiments of the invention disclosed herein are not to be construed as limitations. Each group member can be referred to and claimed individually or in any or a combination with other members of the group or other elements found herein. One or more members of a group can be included in, or deleted from, a group for reasons of convenience and/or patentability. When any such inclusion or deletion occurs, the specification is herein deemed to contain the group as modified thus fulfilling the written description of all groups used in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The accompanying drawings are included to provide a further understanding of the present disclosure and are incorporated in and constitute a part of this specification. The drawings illustrate exemplary embodiments of the present disclosure and, together with the description, serve to explain the principles of the present disclosure.

[0017] FIG. 1 illustrates an exemplary representation of the invention's process diagram.

DETAILED DESCRIPTION

[0018] The following is a detailed description of embodiments of the disclosure depicted in the accompanying drawings. The embodiments are in such detail as to communicate the disclosure. However, the amount of detail offered is not intended to limit the anticipated variations of embodiments; on the contrary, the

intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present disclosure as defined by the appended claims.

[0019] Embodiments of the present invention include various steps, which will be described below. The steps may be performed by hardware components or may be embodied in machine-executable instructions, which may be used to cause a general-purpose or special-purpose processor programmed with the instructions to perform the steps. Alternatively, steps may be performed by a combination of hardware, software, and firmware and/or by human operators.

[0020] Furthermore, embodiments may be implemented by hardware, software, firmware, middleware, microcode, hardware description languages, or any combination thereof. When implemented in software, firmware, middleware, or microcode, the program code or code segments to perform the necessary tasks (e.g., a computer program product) may be stored in a machine-readable medium.

[0021] Various terms as used herein are shown below. To the extent a term used in a claim is not defined below, it should be given the broadest definition persons in the pertinent art have given that term as reflected in printed publications and issued patents at the time of filing.

[0022] Cement is a broad term that encompasses all commitment. There are many types of cement used in the construction and construction industries, as well as to solve specific challenges. Although the chemical composition of various cement varies, the formation of Portland is due to the majority of the concrete produced today. Portland cement is a hydraulic bond made by grinding a small amount of gypsum

with Portland cement clinker, which is made by heating a certain mixture of clay and clay elements. The term "cement paste" means a mixture of cement and water. The function of the cement paste in a concrete is to cover the surfaces of the aggregate particles, to fill the spaces between the particles and produce a compact mass by binding the aggregates particles.

[0023] The sand past the 4.75mm IS filter was selected because it was easily accessible. A good combination has a gravity of 2.60. River sand compliant with IS: 383 – 1970's Grading Zone I. The sand will be clean and dry river sand from the area. All species will be thrown into the previous sand with an IS 4.75mm filter. A good combination aggregate is an asset that passes through filter No. 4 but is kept on 200 screen. A good combination should have a rounded form of better performance and economy (as evidenced by the use of small cement). Good collection fills the gaps in the compound and serves as a workspace.

[0024] Coarse Aggregates Because aggregates make up 70 to 80 percent of concrete volume, they are expected to have a significant impact on their properties. They are granular materials found mainly in natural rock (natural stones or crushed stone) and sand, but sometimes synthetic materials such as slag are used. To some extent, clay or expanded shale is used, especially for light concrete. In addition to acting as an inexpensive filler, aggregates offer concrete for a variety of benefits. The durability of the size and durability of the wear are improved. Combined categories are created primarily to make it easier to identify a specific category or to identify different types of combinations. Aggregates can be categorized in a

variety of ways. These categories are based on composite source, gravity or unit weight, composite particle size, composite shape, composite texture, composite preparation method, composite composition, composite mineral composition, and composite recycling. Mineralogy is not used for integrated classification; basic and practical distinctions are based on the source and specific gravity.

[0025] Water is an essential element in the production of concrete. It's interesting and alone. Understanding its characteristics helps to understand your impact on concrete and other building materials. Although water is an important component of concrete, there is little need to discuss the quality of water because it does not affect the quality of the concrete. However, mixing water can create problems by adding impurities that adversely affect the quality of the concrete. Although acceptable energy development is very important, contamination in water mixing can disrupt setting times, drying shrinkage, and stiffness, and producing efflorescence.

[0026] Strengthening with noticeably bonded CFRP fabric has shown to be valid to many varieties of structures. Presently, This process is now used to strengthen structures such as pillars, beams, walls, slabs, and so on. The use of visual CFRP reinforcement can be divided into two categories: flexural strengthening, which improves pressure on the joints, and strengthening shear. It is well known that the reinforced concrete beam is reinforced with visible binding CFRP in the face of conflict can show greater flexibility than the original flexural strength. However, these reinforced FRP and CFRP instruments can be placed in the wrong place

some of their reduction due to the stiffness of the FRP and CFRP plates. Carbon Consumption Fiber Reinforced Polymer (CFRP) for reinforcing reinforced concrete structures has it has become a very common form of rejuvenation. The technique of strengthening reinforced concrete structures by externally bonded CFRP fabrics was happening 1980's and has since concerned researchers around the world.

[0027] Compression Pressure testing is used to determine how a product or device reacts when pressed, crushed, crushed, or lubricated by determining the key factors that control a sample of behavior under pressure. Specimens were pressed at the end of 7 and 28 days after casting. The intensity is brought continuously and without shock until the specimens have failed. Specimens are exposed to under heavy load until they fail.

[0028] The cracked strength of the concrete should be determined to determine the load on which the concrete members will break. The ability to distinguish the strength of concrete tests is easy to perform, and the most important factor is that it produces consistent results when compared to other resistance tests such as ring incompatibility tests and double punching tests. The cylindrical mold will have a diameter of 150 mm and a height of 300 mm, according to IS: 10086-1982. The resulting concrete will be placed on the mold with layers of 5 cm thick.

[0029] Using a lubricating rod, each layer will be crushed with at least 35 lashes per layer (a metal bar with a diameter of 16 mm and a length of 60 cm, a bullet pointed at the lower end). A trowel will be used to measure and polish the surface. The test

specimens will be stored in a place free of vibration in wet air with a relative humidity of at least 90% and at a temperature of 25 ° C to 29 ° C for 24 hours 12 hours from the time the water is applied to dry parts. After this time, the specimens will be labeled and removed from the mold, then immersed in clean water 7, 14, or 28 days prior to testing.

[0030] All the casted specimens were demoulded and tested in saturated dry surface condition, after wiping out the surface moisture. For each specimen tested were carried out at the age of 7 days, 14 days and 28 days. After wiping off excess moisture, all installed specimens are dismantled and tested in an area covered with dry soil. Each model was tested in three different days seven days, fourteen days, and twenty-eight days. The largest load used in a template before it fails is recorded. The final compressive strength of the cube is equal to the final load divided by the shortcut area of the template. At 28 days, the template reaches its maximum load and power of 30.5 N / mm2.

[0031] To find the strength of the cylinder, tests were performed 7 days old, 14 days and 28 days. The size of the concrete cylinder range is approximately 150 mm in diameter and 300 mm in height per IS: Tensile Code Book 5816-1970 check for M30 range. The strength of cylinder with 4mm carbon fibers attain maximum tensile strength is 3.15N/mm2 strength at 28 days.

[0032] The performance of RC beams lined with carbon fiber beams was studied, tested and evaluated for M30 grade marks with different CFRP layers. From the comparison made results are is found that CFRP wrapped beam reduces the

deflection and increases the load carrying capacity. Also, the deflection obtained from the experimental results are found to be relatively higher (varying from 0.2mm to 0.4mm) than the results obtained from manual method. The flexural strength of concrete with 4mm thickness of carbon fibre increases the strength when compared with the conventional concrete. The control specimen beam has nominally higher ductility index than carbon fiber specimen. And the optimum percentage of carbon fibre for maximum strengths (split tensile and Flexural strength) was found to be beam 4 for M30 grade of concrete.

[0033] While the foregoing describes various embodiments of the invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof. The scope of the invention is determined by the claims that follow. The invention is not limited to the described embodiments, versions, or examples, which are included to enable a person having ordinary skill in the art to make and use the invention when combined with information and knowledge available to the person.

######DIGITALLY SIGNED########
PREM CHARLES I
REGISTERED PATENT AGENT INPA-3311
On Behalf of the Applicants

CLAIMS

We claim,

1. A method to strengthen reinforced concrete using carbon fiber comprising,

   M30 grade of cement and sand mixture;

   a reinforcement of carbon fiber particles to the cement

2. The said method as claimed in claim 1 wherein, the flexural strength of the beam increases compared to a manual regular concrete mix.

3. The said method as claimed in claim 1 wherein, the deflection shown was considerable less compared to a regular mix.

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ABSTRACT

A METHOD TO STRENGTHEN REINFORCED CONCRETE USING CARBON FIBER

The present invention describes the construction of CFRP structures to determine the development length & flexural strength. Carbon fibre reinforced polymer (CFRP) is a combination of high performance that provides high strength, low weight, corrosion resistance, and fatigue resistance. This is especially true in hostile coastal areas, especially in areas where the sea is frequently changing, including salts that enter the concrete and dissolve the metal. However, the cost of pre stressing strand materials is relatively small percentage of bridge‘s overall cost. CFRP will reduce the maintenance cost of high bridge’s service life.

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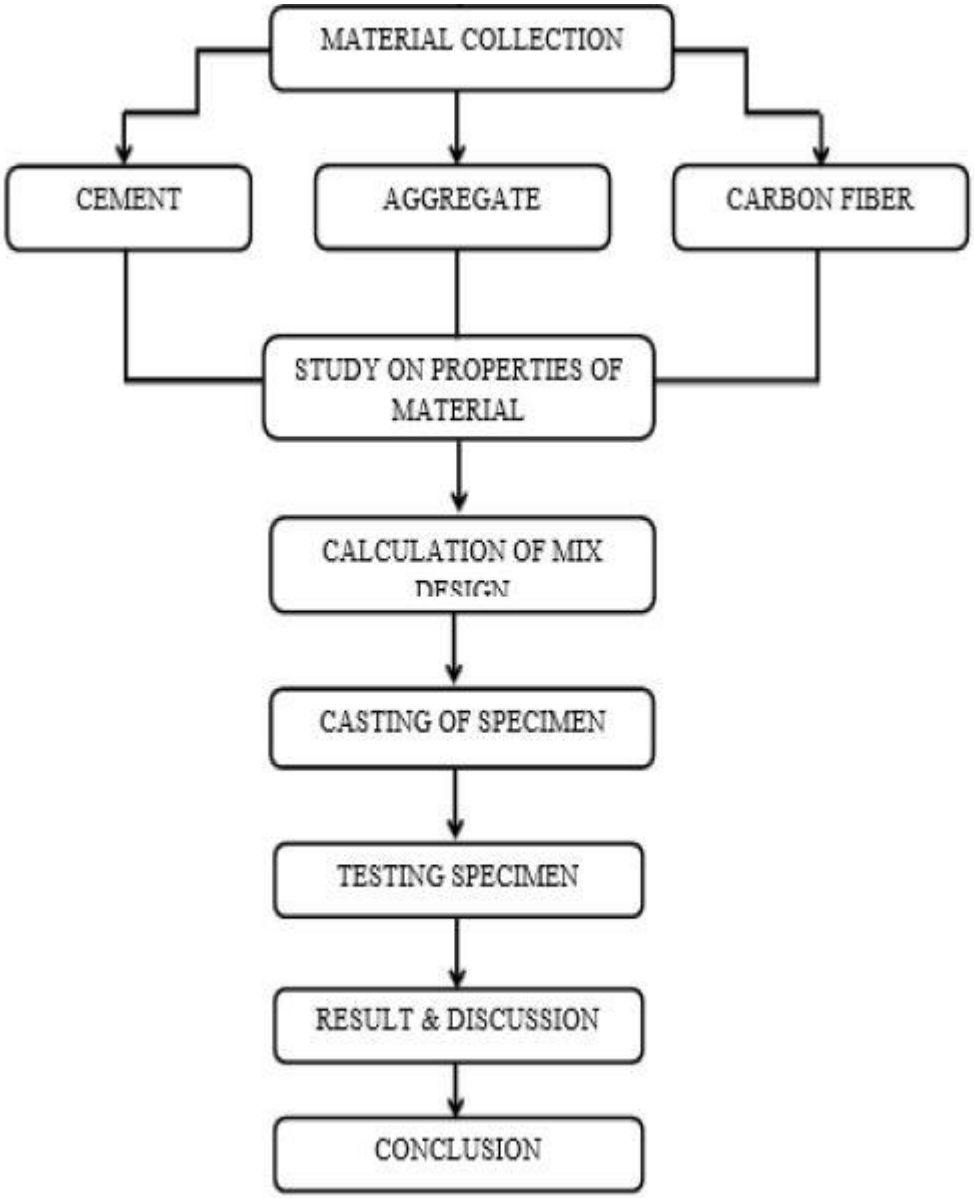

FIGURE 1

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On Behalf of the Applicants

FORM 3
THE PATENTS ACT, 1970
(39 of 1970)
and

THE PATENTS RULES, 2003

STATEMENT AND UNDERTAKING UNDER SECTION 8

(See section 8; Rule 12)

I / We,

Name Of Applicants	Nationality	Address
PAAVAI ENGINEERING COLLEGE	INDIAN	NH-44, PAAVAI NAGAR, PACHAL, NAMAKKAL- 637 018, TAMIL NADU, INDIA.

hereby declares:-

(i) that I/We who have made this application No.: 202241007833 dated 15-02-2022; alone/jointly has made for the same / substantially same invention, application(s) for patent in the other countries, the particulars of which are given below:

NAME OF THE COUNTRY	DATE OF APPLICATION	APPLICATION NO.	STATUS OF THE APPLICATION	DATE OF PUBLICATION	DATE OF GRANT
—	—	—	—	—	—

(ii) that the rights in the application(s) has/have been assigned to

"NONE" and the rights are held with applicants only;

that I/We undertake that upto the date of grant of the patent by the Controller, I/We would keep him informed in writing the details regarding corresponding applications for patents filed outside India within six months from the date of filing of such application.

Dated This 16th day ofFeb,2022

Signature,
NAME: PREM CHARLES I(INPA 3311)
PATENT AGENT ON BEHALF OF THE APPLICANT(S)

To,
THE PATENT OFFICE, INTELLECTUAL PROPERTY BUILDING, BOUDHIK SAMPADA BHAVAN, GUINDY, CHENNAI- 600037 TAMIL

FORM 5
THE PATENTS ACT, 1970
(39 of 1970)
and

THE PATENTS RULES, 2003

DECLARATION AS TO INVENTORSHIP

[See section 10(6) and rule 13(6)]

1. NAME OF APPLICANT (S)	PAAVAI ENGINEERING COLLEGE (AUTONOMOUS)

hereby declare that the true and first inventor(s) of the invention disclosed in the complete specification filed in pursuance of my/our application numbered **202241007833** Dated **15thday ofFeb,2022** are

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Dated This 15thday ofFeb,2022

Signature,

NAME: PREM CHARLES I(INPA 3311)

PATENT AGENT ON BEHALF OF THE APPLICANT(S)

3. DECLARATION TO BE GIVEN WHEN THE APPLICATION IN INDIA IS FILED BY THE APPLICANT(S) IN THE CONVENTION COUNTRY:-
-N.A-

To,

THE PATENT OFFICE, INTELLECTUAL PROPERTY BUILDING, BOUDHIK SAMPADA BHAVAN, GUINDY, CHENNAI- 600037 TAMIL