AN IMPROVED SUPPLEMENTARY CEMENTITIOUS PRODUCT AND A METHOD OF PREPARATION THEREOF

ABSTRACT

An improved supplementary cementitious product (SCP) and method of its preparation is provided. The present invention provides for a SCP prepared from modification of minerals present in industrial waste and by-products, by blending with other chemical compounds and one or more polymer types in pre-defined quantities. The present invention provides for a SCP which has optimum particle size and provides efficient packing effect. Further, the present invention provides a SCP with optimal physical and chemical effects when mixed with cement for producing a high-strength and a high-performance concrete. Furthermore, the present invention provides for a SCP, which is environment friendly, cost effective and reduces dependency on cement.

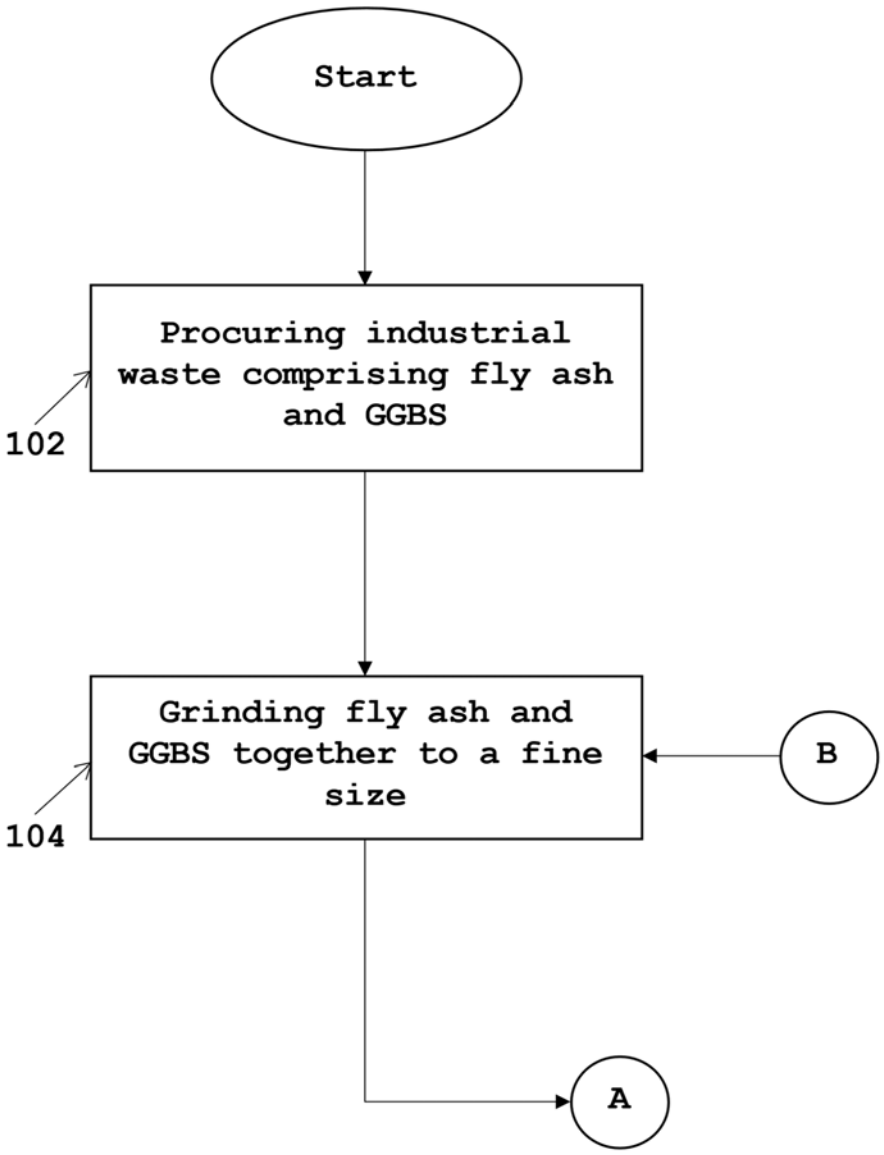


FIG. 1

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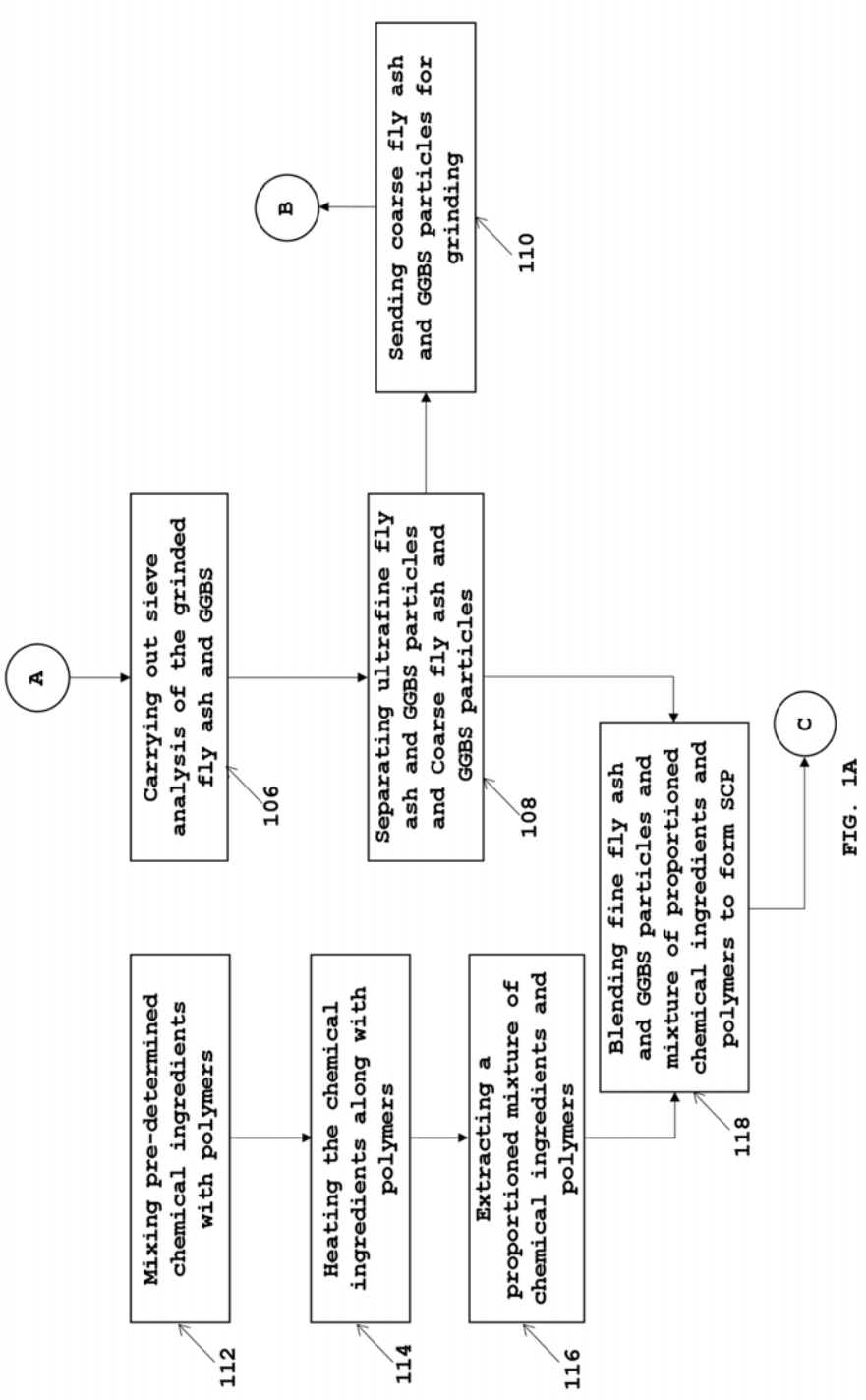


FIG. 1A

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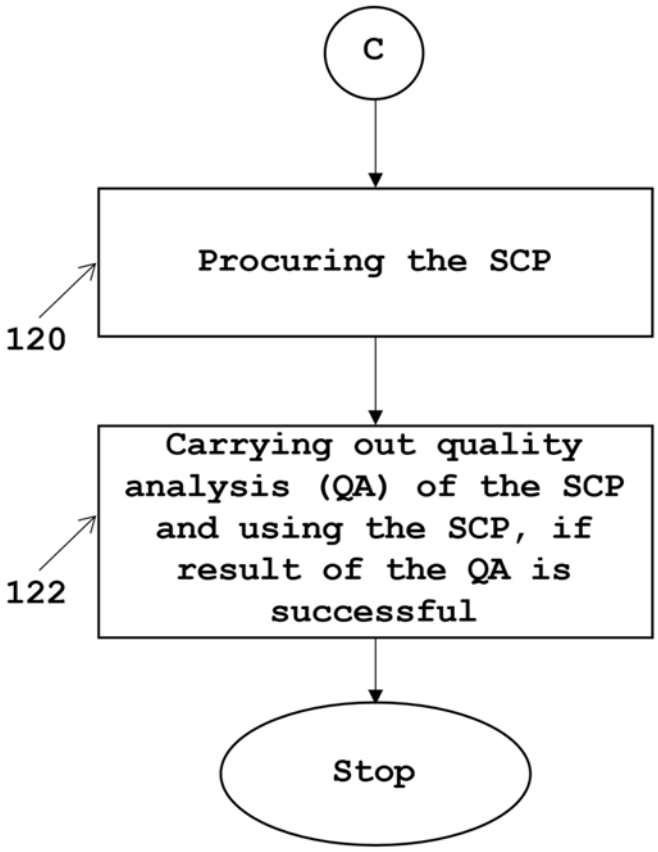


FIG. 1B

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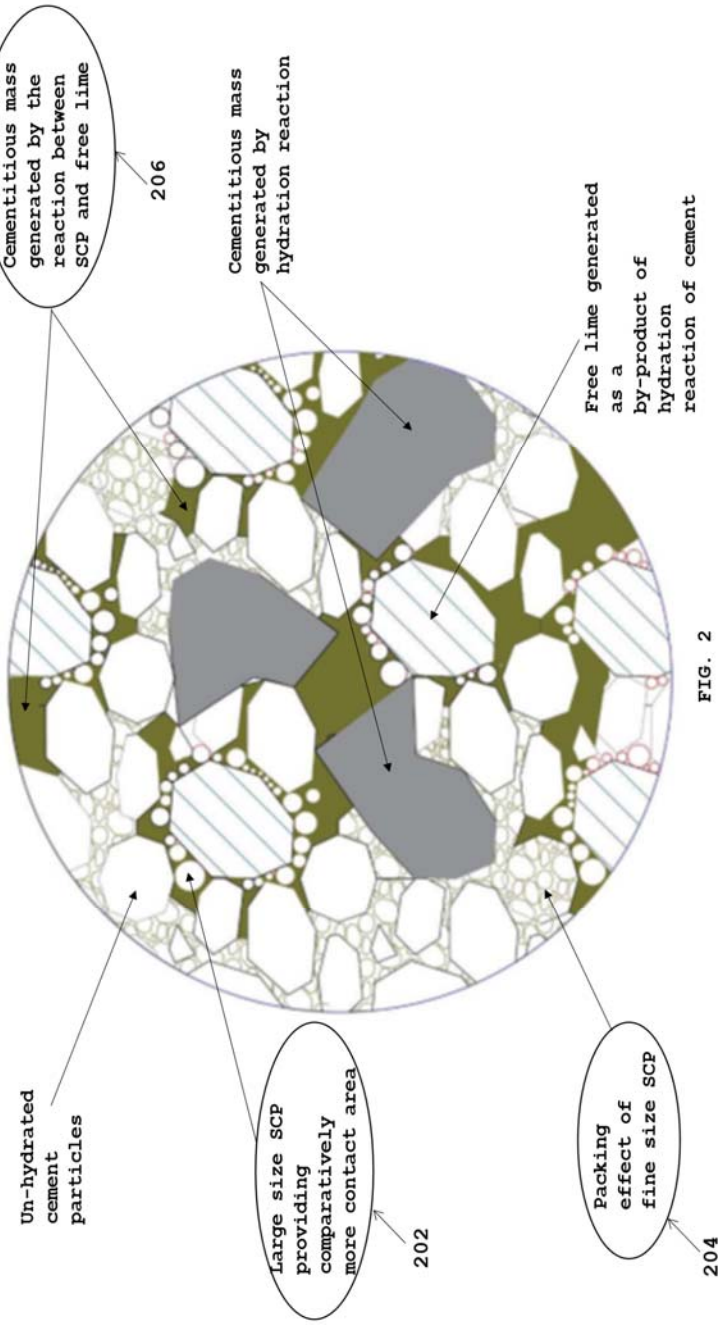


FIG. 2

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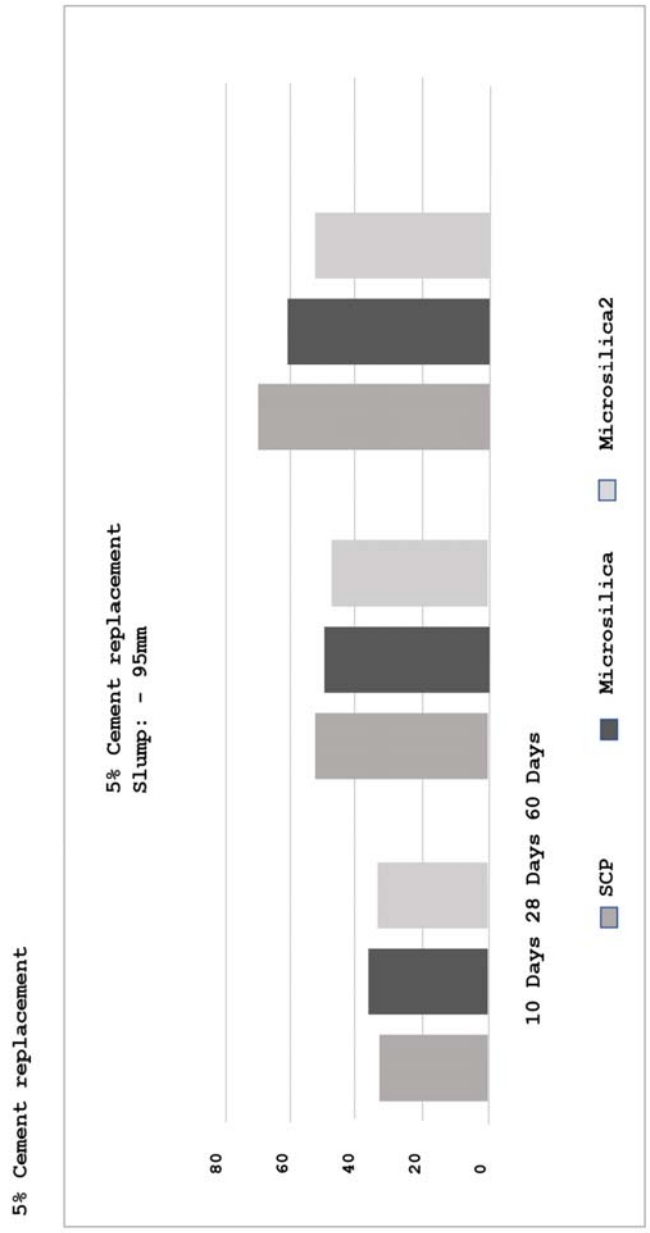


FIG. 3

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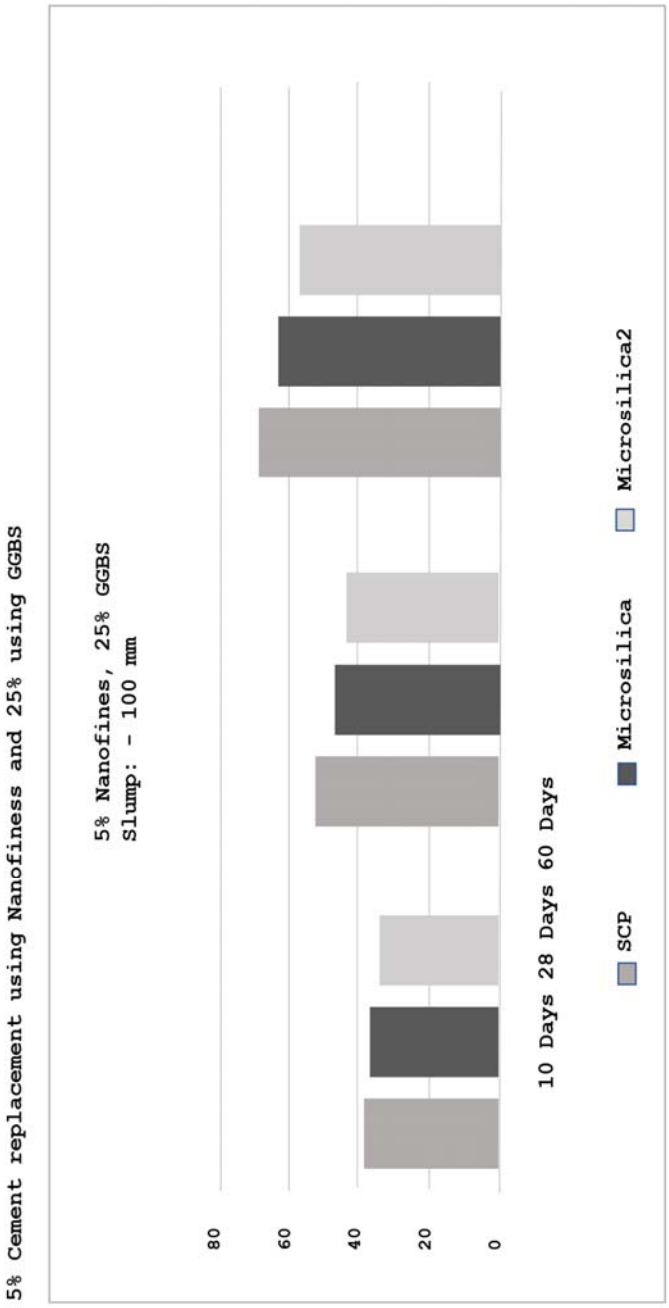


FIG. 4

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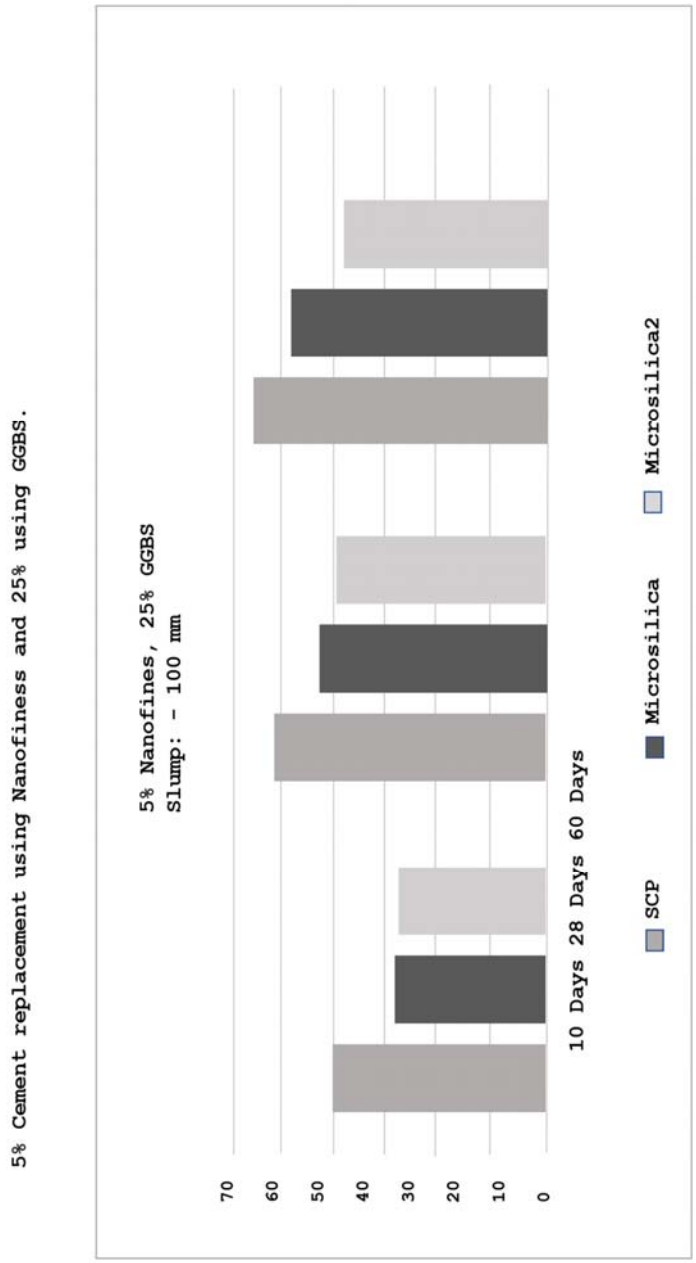


FIG. 5

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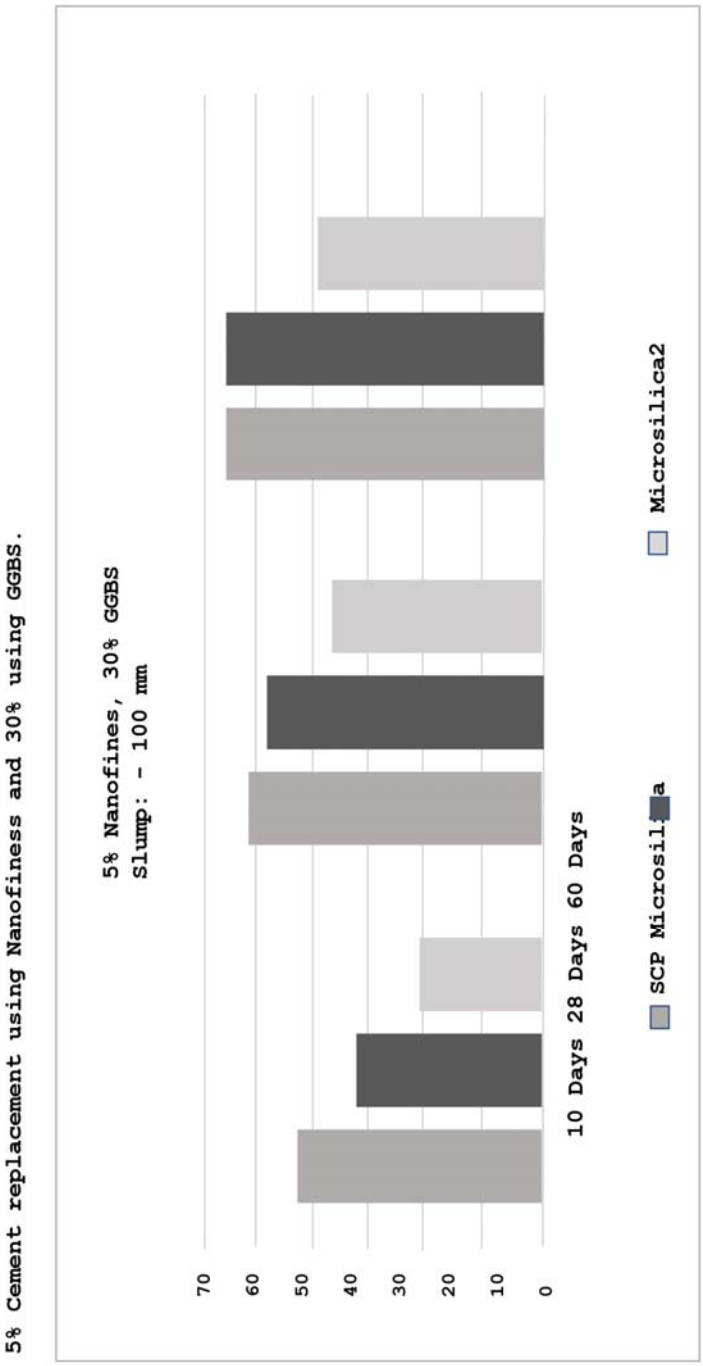


FIG. 6

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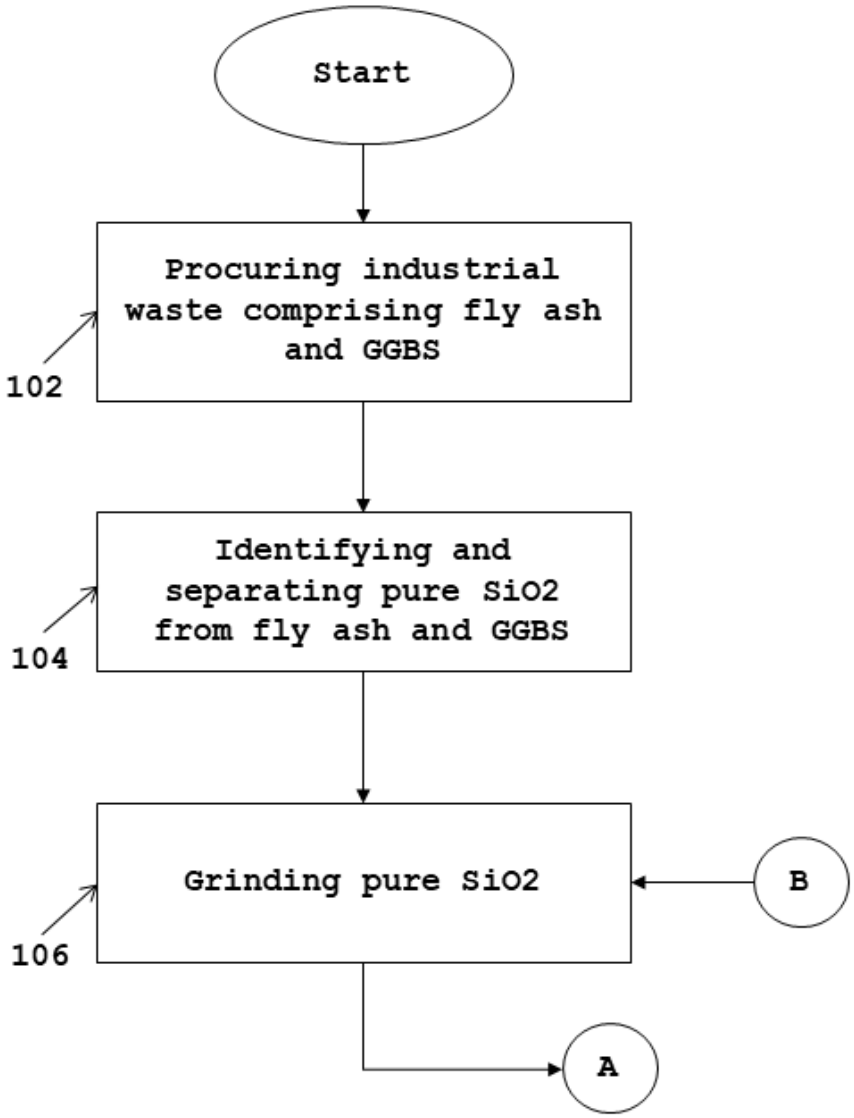


FIG. 1

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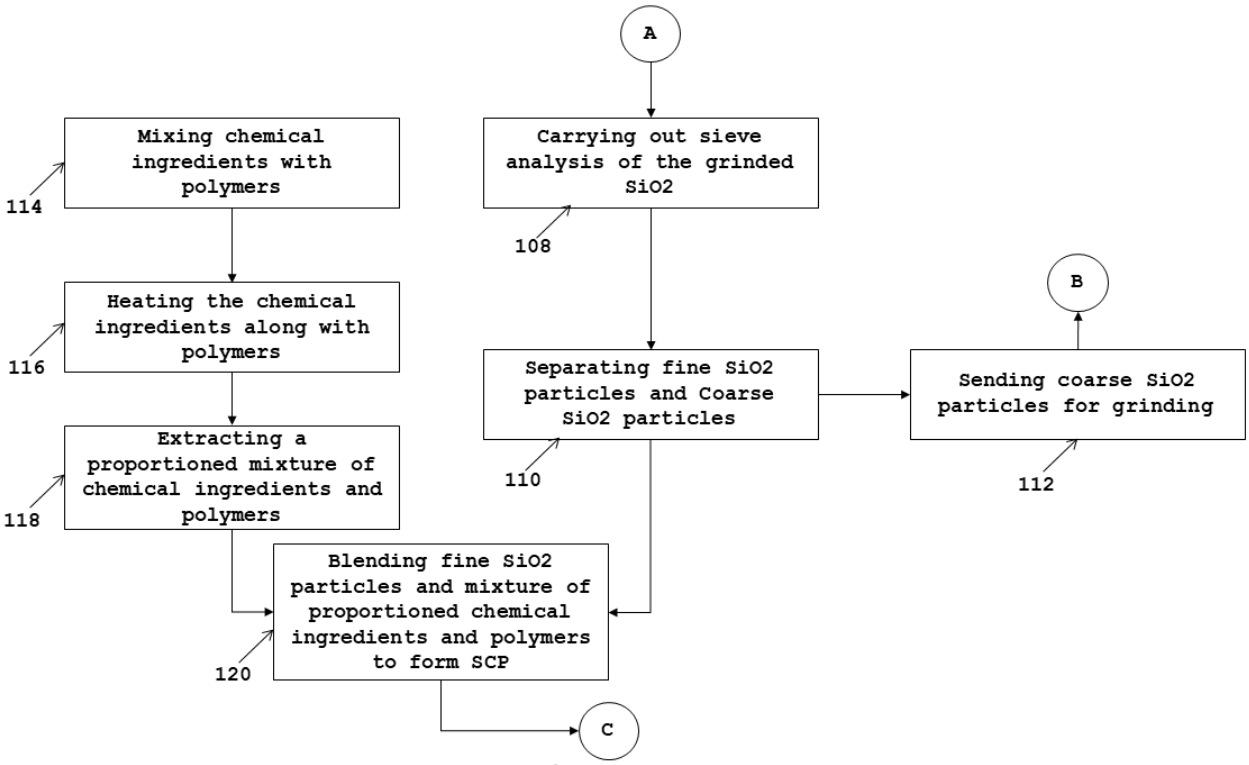


FIG. 1A

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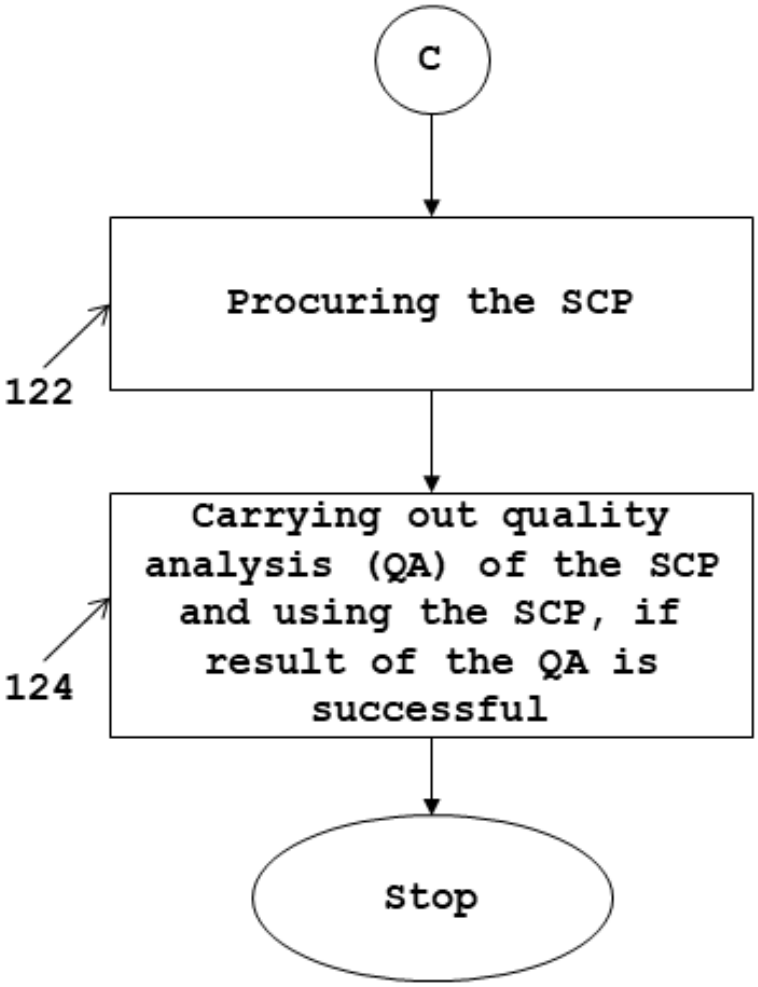


FIG. 1B

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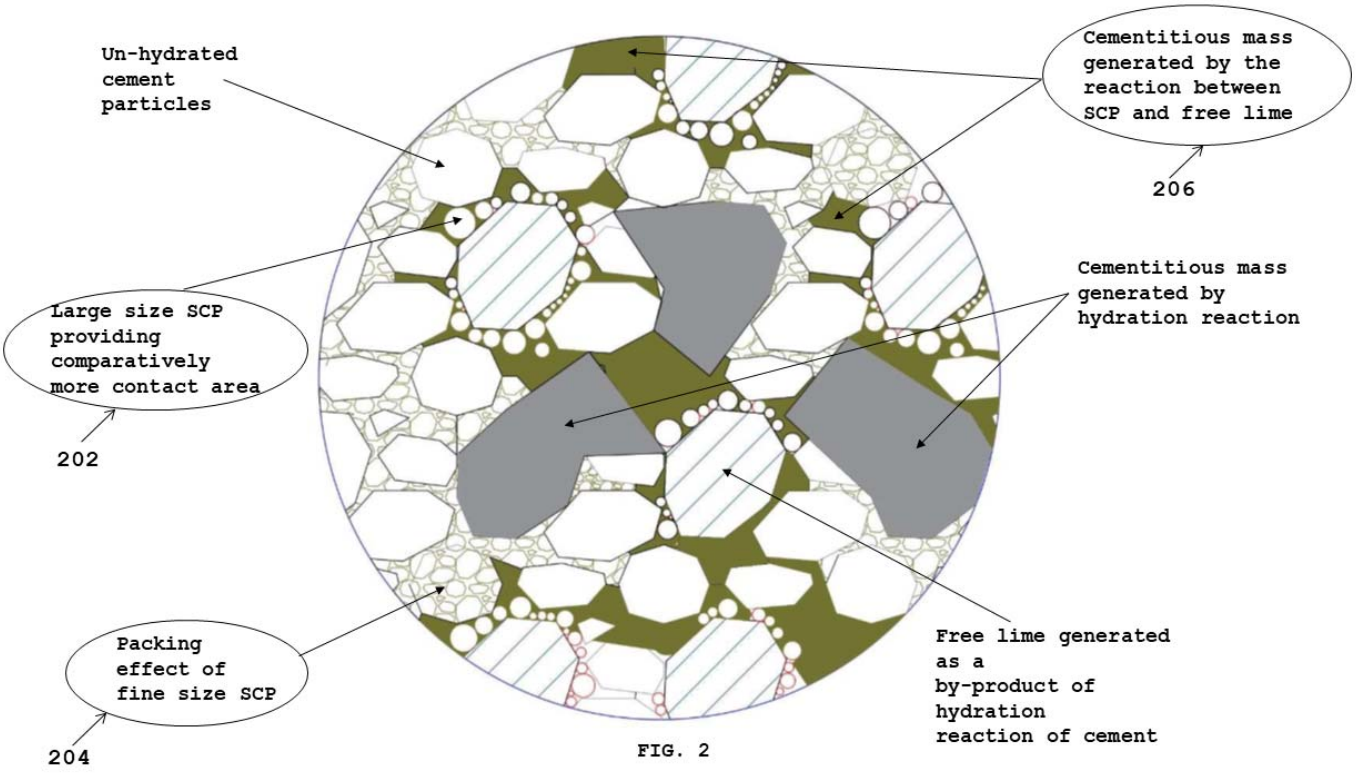


FIG. 2

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5% Cement replacement

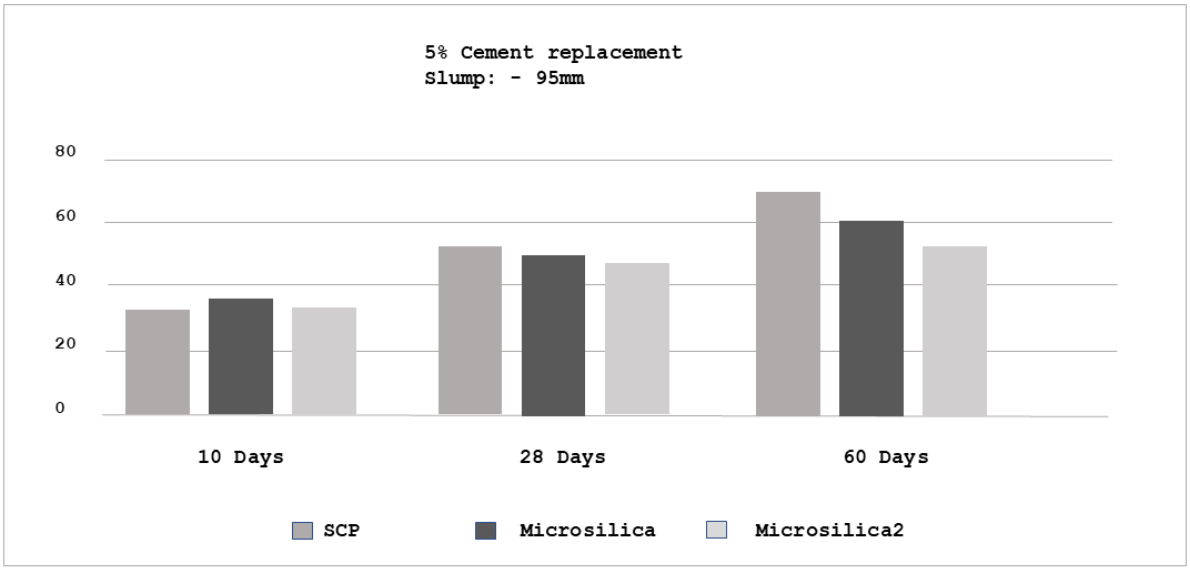


FIG. 3

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5% Cement replacement using Nanofiness and 25% using GGBS

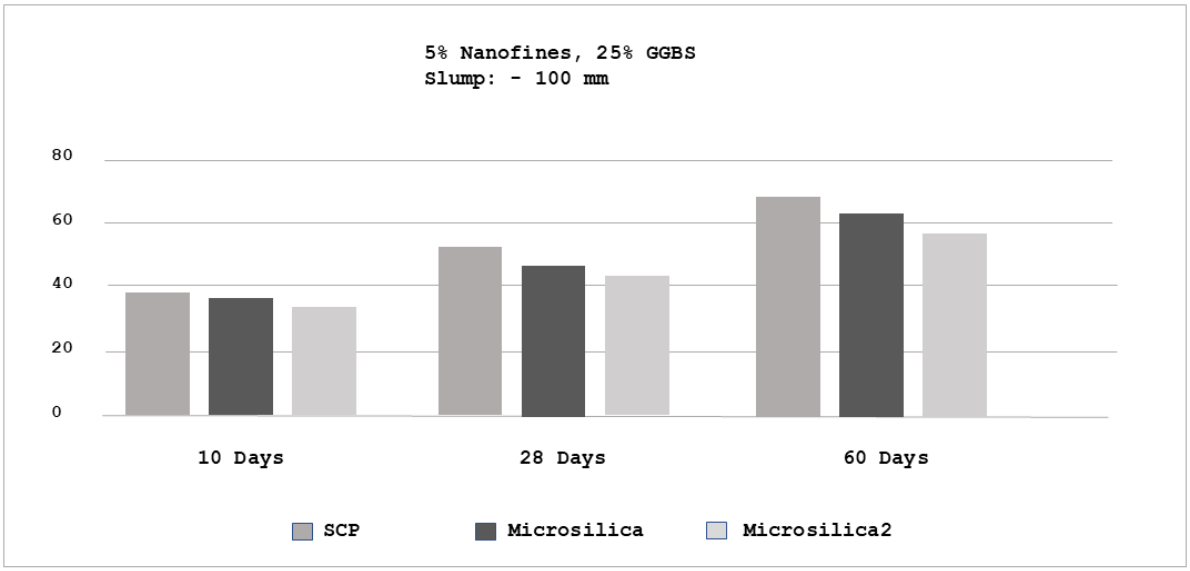


FIG. 4

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5% Cement replacement using Nanofiness and 25% using GGBS.

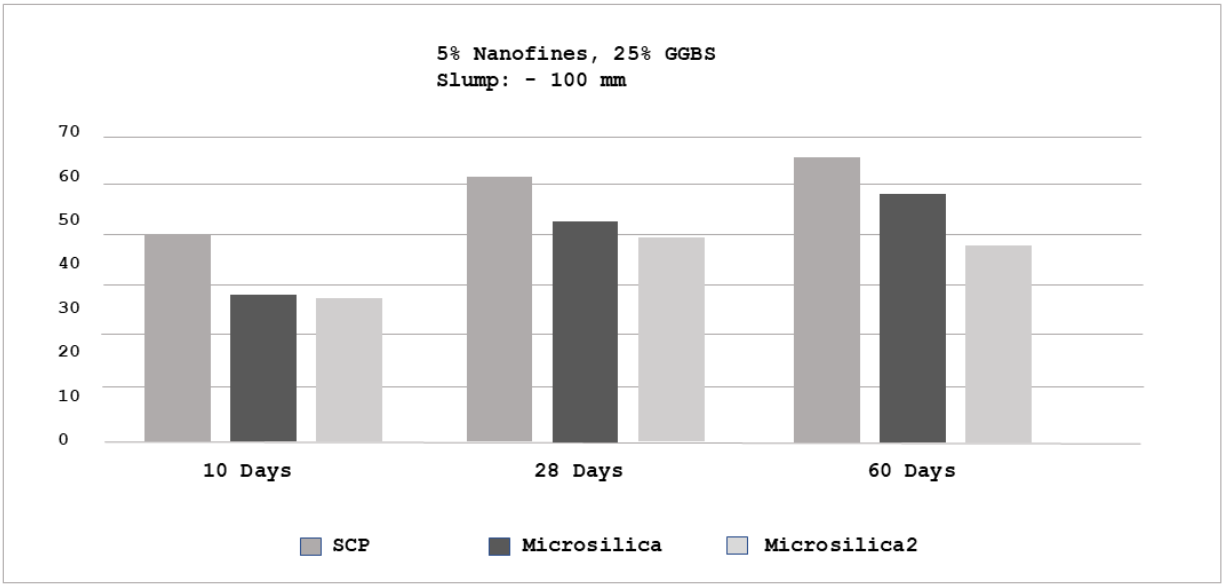


FIG. 5

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5% Cement replacement using Nanofiness and 30% using GGBS.

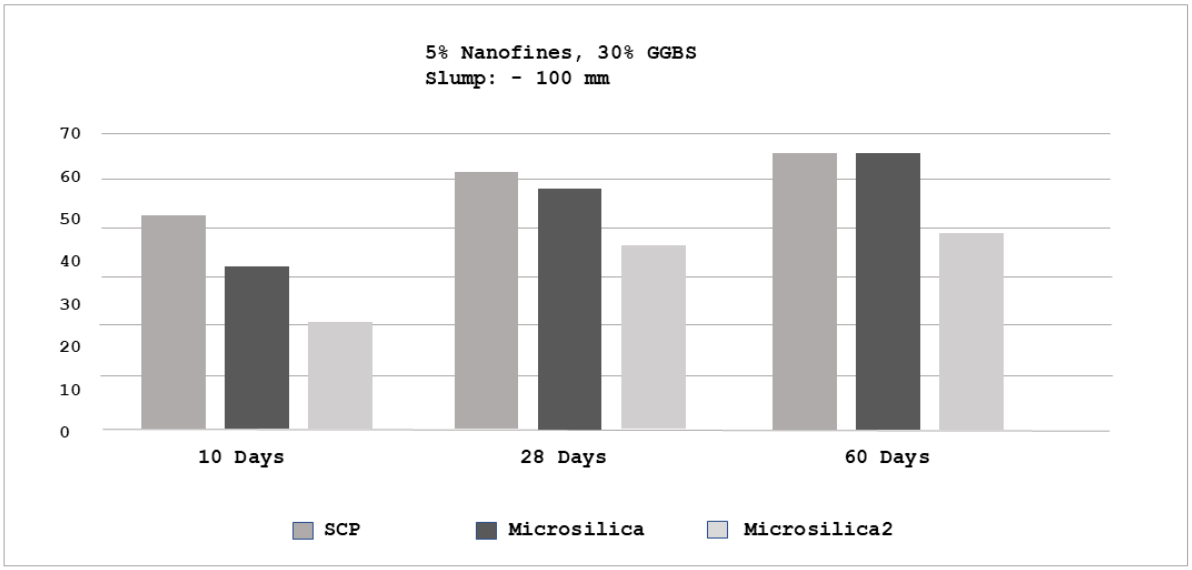


FIG. 6

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FORM 2
THE PATENTS ACT, 1970
(39 OF 1970)
&
THE PATENTS RULES, 2003
COMPLETE SPECIFICATION
(*See* section 10 and rule 13)

1. TITLE OF THE INVENTION:

"AN IMPROVED SUPPLEMENTARY CEMENTITIOUS PRODUCT AND A METHOD OF PREPARATION THEREOF"

2. APPLICANT:

(a)	NAME:	SP CONCARE PRIVATE LIMITED
(b)	NATIONALITY:	Indian
(c)	ADDRESS:	C.S.NO. 4805, Varad Plaza, Chintamani Nagar, Madhavnagar Road, Sangli-416416, Maharashtra, India

3. PREAMBLE TO THE DESCRIPTION

COMPLETE

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

Field of the invention

[0001] The present invention generally relates to supplementary cementitious products (SCP), and more particularly to an improved composition of a supplementary cementitious product and a method of preparation of the improved composition.

Background of the invention

[0002] Nowadays, disposal and management of industrial waste and by-products have become a critical problem due to grave implications on the environment. With increase in generation of industrial waste and by-products, finding and adopting an efficient means for disposal and management of such wastes and by-products are faced with a lot of challenges. Also, by-products produced by industries are hazardous in solid, liquid, or gaseous forms, which severely and often irrevocably affect the surrounding environment. Moreover, industries which are specifically involved in cement manufacturing, typically, use limestone as a raw material. Limestone is a non-renewable natural resource and, therefore, an increased demand for cement as a binding material is causing depletion of such natural resources rapidly which is harmful for environment.

[0003] Conventionally, industrial waste and by-products are used as supplementary cementitious products to decrease dependency on cement and for effective use of such wastes and by-products. Certain existing methods replace some parts of cement with supplementary cementitious products for producing concrete. It has been observed that strength provided by supplementary cementitious products to concrete is based on physical and chemical effects produced upon addition of supplementary cementitious products to cement.

Physical effect entails arrangement of particles of the supplementary cementitious products in open spaces between adjacent particles of cement. As such, for providing high strength to concrete it is necessary for particles of supplementary cementitious products to fill gaps and open spaces effectively between cement particles, which is referred to as packing effect. Existing supplementary cementitious products having particle size less than an optimum size decrease contact area with surrounding cement particles, thereby exhibiting sub-optimal packing effect.

[0004] Further, chemical effect involves reactions between silicon oxide (SiO_2) present in the supplementary cementitious products and free lime ($Ca(OH)_2$) produced from a hydration reaction upon addition of supplementary cementitious products to cement. The reactions produce a cementitious mass which provides denseness to the concrete, and as such reactivity between SiO_2 present in the supplementary cementitious products and free lime is directly proportional to surface area of supplementary cementitious product particles. Generally, silica fumes are used as supplementary cementitious products, which comprises very fine particle size and consequently a larger surface area. It has been observed that a larger surface area may enhance chemical reactivity, but contact area with surrounding cement particles decreases, thereby adversely affecting packing effect. Also, excess free lime is produced as a by-product of cement hydration reaction, which is not desirable as it has an adverse impact on the quality of concrete. Excess free lime in concrete has serious consequences on quality and durability of the product. Free lime reacts with water and expands which affects the soundness and integrity of the concrete structure in the long run. Therefore, it is necessary to use an SCP which

contributes to producing a high-strength and a high-performance concrete.

[0005] In light of the aforementioned drawbacks, there is a need for an improved composition of a supplementary cementitious product and a method of preparation of the improved supplementary cementitious product. There is a need for a supplementary cementitious product which has optimum particle size and provides an improved packing effect. Also, there is a need for a supplementary cementitious product which provides for optimal physical and chemical effects when mixed with cement for producing a high-strength and a high-performance concrete. Further, there is a need for a supplementary cementitious product that produces a superior quality concrete, is environment friendly, cost effective and reduces dependency on cement. Furthermore, there is a need for reducing harmful effects of industrial waste and by-products on the environment.

Summary of the invention

[0006] In various embodiments of the present invention, a method for preparation of an improved supplementary cementitious product is provided. The method comprises the steps of firstly, procuring industrial waste comprising fly ash and Ground Granulated Blast-furnace Slag (GGBS). Secondly, the fly ash and GGBS are ground together to an ultrafine particle size. Thirdly, pre-determined chemical ingredients are mixed and heated with one or more polymers for extracting a proportioned mixture of the chemical ingredients and the polymers. Lastly, the fly ash and the GGBS particles are blended with the extracted mixture of proportioned chemical ingredients and polymers to form a supplementary cementitious product comprising a blend of fly ash, Ground Granulated Blast-furnace Slag (GGBS), a sodium

compound, Poly-carboxylic Ether (PCE), zinc, Triethyl, Methyl Hydroxyethyl Cellulose (MHEC), and Re-dispersible Polymer Powder (RDP).

[0007] In various embodiments of the present invention, a composition of Supplementary Cementitious Product (SCP) is provided. The composition comprises a blend of fly ash, Ground Granulated Blast-furnace Slag (GGBS), a sodium compound, Poly-carboxylic Ether (PCE), zinc, Triethyl, Methyl Hydroxyethyl Cellulose (MHEC), and Re-dispersible Polymer Powder (RDP). In an embodiment of the present invention, the SCP comprises 35% by weight fly ash; 35% by weight GGBS; 20% of Sodium Metasilicate (SM); 0.25% of PCE; 1% of zinc; 0.20% of Triethyl; 1.50% of MHEC; and 7.05% of RDP

Brief description of the accompanying drawings

[0008] The present invention is described by way of embodiments illustrated in the accompanying drawings wherein:

[0009] Figs. 1, 1A, and 1B illustrate a flowchart depicting a method for preparation of an improved Supplementary Cementitious Product (SCP), in accordance with an embodiment of the present invention;

[0010] Fig. 2 (202, 204 and 206) illustrates packing effect and chemical reactivity exhibited by particles of the SCP, in accordance with an embodiment of the present invention;

[0011] FIG. 3 illustrates a graphical representation of comparative results of concrete mix proportioned by replacing cement with the improved SCP, in accordance with an embodiment of the present invention, and prior art SCPs;

[0012] FIG. 4 illustrates another graphical representation of comparative results of concrete mix proportioned by replacing cement with the improved SCP, in accordance with an embodiment of the present invention, and prior art SCPs;

[0013] FIG. 5 illustrates yet another graphical representation of comparative results of concrete mix proportioned by replacing cement with the improved SCP, in accordance with an embodiment of the present invention, and prior art SCPs; and

[0014] FIG. 6 illustrates another graphical representation of comparative results of concrete mix proportioned by replacing cement with the improved SCP, in accordance with an embodiment of the present invention, and prior art SCPs.

Detailed description of the invention

[0015] The present invention provides for an improved composition of an SCP and a method of preparation of the improved composition, in accordance with various embodiments of the present invention. In particular, the present invention provides for a SCP prepared from modification of minerals present in industrial waste and by-products, by blending with other chemical compounds (collectively referred as pre-determined chemical ingredients) and one or more polymer types in pre-defined quantities. The present invention provides for a SCP which has optimum particle size and provides an improved packing effect. Further, the present invention provides a SCP with optimal physical and chemical effects when mixed with cement for producing a high-strength and a high-performance concrete. The present invention further provides for effective re-use of industrial waste and by-product for preparing SCP. Furthermore, the present invention provides for a SCP, which is environmentally friendly, cost effective and reduces dependency on cement.

The present invention provides for an SCP which is employed to modify and enhance properties of concrete at a nanoscale level.

[0016] The disclosure is provided in order to enable a person having ordinary skill in the art to practice the invention. Exemplary embodiments herein are provided only for illustrative purposes and various modifications will be readily apparent to persons skilled in the art. The general principles defined herein may be applied to other embodiments and applications without departing from the scope of the invention. The terminology and phraseology used herein is for the purpose of describing exemplary embodiments and should not be considered limiting. Thus, the present invention is to be accorded the widest scope encompassing numerous alternatives, modifications, and equivalents consistent with the principles and features disclosed herein. For purposes of clarity, details relating to technical material that is known in the technical fields related to the invention have been briefly described or omitted so as not to unnecessarily obscure the present invention.

[0017] The present invention would now be discussed in context of embodiments as illustrated in the accompanying drawings.

[0018] In various embodiments of the present invention, the invention provides for a method for preparing an improved Supplementary Cementitious Product (SCP). In an embodiment of the present invention, the SCP is prepared by using industrial wastes and by-products comprising silicon oxide (SiO_2), which is blended with other chemical compounds and polymers, as described in detail herein below. The improved SCP is a purified and pulverized form of industrial waste

and by-products. Purification aids to remove non-reactive SiO_2 and other unwanted residues from the industrial waste and by-products and pulverization makes the SCP finer and uniform.

[0019] Fig. 1, Fig. 1A, and Fig. 1B illustrate a flowchart depicting a method for preparation of the improved SCP, in accordance with an embodiment of the present invention.

[0020] At step 102, industrial waste comprising fly ash and Ground Granulated Blast-furnace Slag (GGBS) is procured. In an exemplary embodiment of the present invention, 35% by weight of fly ash and 35% by weight of GGBS is procured from the industrial waste. The fly ash and GGBS are primary sources of activated silica in SCP formation. Further, the remaining 30% by weight of the industrial waste comprises one or more chemicals, which enhances performance of the SCP. In an exemplary embodiment of the present invention, the one or more chemicals may include, but are not limited to, zinc chromate (15%-20% by weight), and tri-ethanol amine (0.2%-0.5% by weight). Zinc chromate provides anti-corrosive properties to the SCP and tri- ethanol amine provides early strength to the SCP.

[0021] At step 104, the procured fly ash and GGBS are ground together to an ultrafine particle size. In an embodiment of the present invention, the grinding of fly ash and GGBS together is referred to as 'mechanical activation' which results in production of ultrafine particles of fly ash and GGBS. In an exemplary embodiment of the present invention, the grinding of fly ash and GGBS is carried out by using a Straight Roller grinding Mill (SRM) technique. Fly ash and GGBS undergo multiple grinding cycles between wear rings and grinding rollers present in the SRM for reducing the particle size of the fly ash and GGBS and producing ultrafine

particles of fly ash and GGBS. SRM is coupled with a classifier which produces ultrafine cut size of the fly ash and GGBS particles and separates the ultrafine fly ash and GGBS particles from coarse fly ash and GGBS particles. At step 106, a sieve analysis of the ground fly ash and GGBS is carried out. In an embodiment of the present invention, sieve analysis of the ground fly ash and GGBS aids in efficiently assessing particle size of the ground fly ash and GGBS. At step 108, ultrafine fly ash and GGBS particles are separated from coarse fly ash and GGBS particles present in the ground fly ash and GGBS particles based on the sieve analysis. At step 110, the coarse fly ash and GGBS particles are sent for further grinding and for reducing the size of the coarse fly ash and GGBS particles. The process of particle size reduction is carried out until all the fly ash and GGBS particles are reduced to the required size. Thus, the grinding process converts all the fly ash & GGBS particles into ultrafine particles for subsequent use.

[0022] At step 112, mixing of pre-determined chemical ingredients with polymers is carried out. In an exemplary embodiment of the present invention, the pre-determined chemical ingredients comprise 20% by weight of Sodium Metasilicate (SM), 1% by weight of zinc, and 0.20% by weight of Triethyl. Further, sodium metasilicate is also a primary source of activated silica in SCP. In another exemplary embodiment of the present invention, polymers comprise 0.25% by weight of Poly-carboxylic Ether (PCE), 1.50% by weight of Methyl Hydroxyethyl Cellulose (MHEC), and 7.05% by weight of Re-dispersible Polymer Powder (RDP). Further, PCE acts as a superplasticizer, MHEC acts as a rheology modifier, and RDP improves compressive and flexural strength of concrete of the SCP. At step 114, the chemical ingredients along with polymers are heated. In an embodiment of the present invention, the chemical ingredients along with polymers are

heated at a pre-defined temperature of 150°C for a time-period of 1 hour. At step 116, a proportioned mixture of chemical ingredients and polymers is extracted subsequent to heating. The proportioned mixture of chemical ingredients and polymers form a consistent mixture.

[0023] At step 118, ultrafine fly ash and GGBS particles are blended with the extracted mixture of proportioned chemical ingredients and polymers to form the SCP, which is obtained at step 120. The composition of the obtained SCP is 35% by weight fly ash, 35% by weight GGBS, 20% of a sodium compound i.e., Sodium Metasilicate (SM), 0.25% of PCE, 1% of zinc, 0.20% of Triethyl, 1.50% of MHEC and 7.05% of RDP.

[0024] At step 122, a Quality Analysis (QA) of the obtained SCP is carried out for usage. Table 1 illustrates QA data associated with various test types carried out for determining quality of the SCP.

Table 1

S. No.	**Test Type**	**Standard**
1.	Fineness (Specific Surface), M2/Kg (Blaine's Air Permeability Method)	IS: 1727- 1967
2.	Particle Retained on 45µ IS: Sieve, % by mass (Wet Sieving)	IS: 1727- 1967
3.	Lime Reactivity Average Compressive Strength, N/mm2	IS: 1727- 1967
4.	Soundness Auto Clave Expansion (%)	IS: 1727- 1967
5.	Specific Gravity	IS: 1727- 1967
6.	Compressive Strength at 28 Days, N/mm2 % of Neat Mortar	IS: 1727- 1967

[0025] In an embodiment of the present invention, the obtained SCP is a finely divided dry powder and is grey in color. The bulk weight of the obtained SCP is 0.65 ton/m^3, with an optimum particle size in a range from 2 to 25 microns, which is less than 2% retention on a 25-microns sieve. In an exemplary embodiment of the present invention, the SCP particles are spherical amorphous in shape.

[0026] In an embodiment of the present invention, the obtained SCP is mixed with cement to produce a high-strength and a high-performance concrete by replacing pre-defined parts of cement with SCP. In an exemplary embodiment of the present invention, 5 parts of cement by weight is replaced with the SCP of the same quantity in order to form a concrete of high-strength and high-performance. In another exemplary embodiment of the present invention, 10% of cement is replaced with 3% of SCP. In another exemplary embodiment of the present invention 16% of cement is replaced with 3% of SCP. Typically, an average particle size of cement is in a range of between 20 to 90 microns. In the event the cement particles form a cluster with random gaps in-between, it requires SCPs of varied size but less than 25 microns size for effective packing. Therefore, the obtained SCP having particle size in the range of between 2 to 25 microns provides effective gap filling and further enhances contact area of the SCP particles with the surrounding cement particles.

[0027] In an exemplary embodiment of the present invention, in the event three cement particles form a cluster, size of SCP required to fill the gap left in-between cement particles is around 7 microns. In another exemplary embodiment of the present invention, in the event four cement particles form a cluster, it requires approximately 19 microns of SCP to fill the gap effectively, and SCP particle may be in a

combination of size ranging from 2 to 25 microns. It has been observed that, typically, finer, and even particles size of SCPs decreases the contact area of individual particles with cement and thus decreases the packing effect. Therefore, particle size of the obtained SCP has been formulated to maximize the packing effect, which varies from 2 to 25 microns. Fig. 2, (202, 204 and 206) illustrates packing effect and chemical reactivity of the obtained SCP, in accordance with an embodiment of the present invention.

[0028] Further, the obtained SCP has an increased reactivity. Polymers used in preparation of the SCP act as chemical activators and enhance chemical reactivity of the SCP. The enhanced reactivity enables SCP to react effectively and precipitate cementitious mass, which confers high-strength and high-performance to concrete. In accordance with embodiments of the present invention, a superior quality of concrete is obtained when SCP is mixed with cement, which is environmentally friendly.

[0029] Various experiments were performed for determining strength of a concrete mixture prepared from cement and the SCP obtained, in accordance with an embodiment of the present invention, which was used to replace a proportioned amount of cement. Further, silica fumes (used as SCP) were also assessed for similar percentage replacement of cement for comparison. Experiments conducted and results obtained, in accordance with an embodiment of the present invention, are demonstrated herein below.

Experiment no. 1

[0030] In experiment no. 1, 5% by weight of cement was replaced with the obtained SCP and concrete was prepared to determine the strength of cement. The total binder content used for SCP was 460 Kg/Cum. The cubic compressive strength

of the concrete after 60 days was determined to be 69.35. Further, for concrete prepared with silica fumes, such as micro-silica and micro-silica2, the total binder content used was 460 Kg/Cum. The cubic compressive strength of concrete after 60 days was determined to be 61.20 and 54.35 respectively. It was observed that the strength of the concrete prepared with SCP was higher as compared to the concrete prepared with silica fume. Fig. 3 illustrates a graphical representation of comparative results of concrete mix proportioned by replacing cement with the improved SCP and micro-silica and micro-silica2 based on experiment no. 1.

Experiment no. 2

[0031] In experiment no. 2, 5% by weight of cement was replaced with the obtained SCP and 25% by weight of GGBS was added to prepare concrete and determine strength of the concrete. The total binder content used was 450 Kg/Cum. The cubic compressive strength of the concrete after 60 days was determined to be 66.40. Further, for concrete prepared with silica fumes, such as micro-silica and micro-silica2, the total binder content used was 450 Kg/Cum. The cubic compressive strength of concrete after 60 days was 62.10 and 54.20 respectively. It was observed that the strength of the concrete prepared with SCP was higher as compared to the concrete prepared with silica fume. Fig. 4 illustrates a graphical representation of comparative results of concrete mix proportioned by replacing cement with the improved SCP and micro-silica and micro-silica2 based on experiment no. 2.

Experiment no. 3

[0032] In experiment no. 3, 5% by weight of cement was replaced with the obtained SCP and 25% by weight of GGBS was added to prepare concrete and determine strength of the concrete. The total binder content used was 500 Kg/Cum. The cubic compressive strength of the concrete after 60 days was 64.80. Further, for concrete prepared with silica fumes, such as micro-silica and micro-silica2, the total binder content used was 500 Kg/Cum. The cubic compressive strength of concrete after 60 days was 57.05 and 56.20 respectively. It was observed that the strength of the concrete prepared with SCP was higher as compared to the concrete prepared with silica fume. Fig. 5 illustrates a graphical representation of comparative results of concrete mix proportioned by replacing cement with the improved SCP and micro-silica and micro-silica2 based on experiment no. 3.

Experiment no. 4

[0033] In experiment no. 4, 10% by weight of cement was replaced with the SCP and 30% by weight of GGBS was added to prepare concrete and determine strength of the concrete. The total binder content used was 500 Kg/Cum. The cubic compressive strength of the concrete after 60 days was 63.95. Further, for concrete prepared with silica fumes, such as micro-silica and micro-silica2, the total binder content used was 500 Kg/Cum. The cubic compressive strength of concrete was 63.60 and 49.35 respectively. It was observed that the strength of the concrete prepared with SCP was higher as compared to the concrete prepared with silica fume. Fig. 6 illustrates a graphical representation of comparative results of concrete mix proportioned by replacing cement with the improved SCP and micro-silica and micro-silica2 based on experiment no. 4.

[0034] In an exemplary embodiment of the present invention, Table 2 illustrates a comparative table depicting the results of experiment no. 1, 2, 3, and 4 in a summary form below:

Table 2

Component	Concrete Composition Ordinary Portland Cement (OPC)+ SCP + GGBS	Total Binder Kg/Cum	Slump	Cube compressive strength (After 60 Days)
Experiment No. 1				
SCP	437+23+0(95%+5%+0)	460	95	69.35
Microsilica	437+23+0	460	95	61.20
Microsilica 2	437+23+0	460	95	54.35
Experiment No. 2				
SCP	315 + 23 + 112 (70%+5%+25%)	450	100	66.40
Microsilica	315 + 23 + 112	450	100	62.10
Microsilica 2	315 + 23 + 112	450	100	54.20
Experiment No. 3				
SCP	350 + 25 + 125 (70%+5%+25%)	500	100	64.80
Microsilica	350 + 25 + 125	500	100	57.05
Microsilica 2	350 + 25 + 125	500	100	56.20
Experiment No. 4				
SCP	300 + 50 +150(60%+10%+30%)	500	100	63.95
Microsilica	300 + 50 +150	500	100	63.60
Microsilica 2	300 + 50 +150	500	100	49.35

[0035] Advantageously, as demonstrated above, unexpected and surprising results were obtained in terms of compressive strength of the concrete prepared with the improved SCP composition prepared, in accordance with an embodiment of the present invention. The prepared SCP is a purified composition that contains highly reactive SiO_2 and specialized polymers (as described above), which surprisingly enhances its chemical reactivity. The optimum

particle size of the SCP particles, which is in the range of 2 to 25 microns, provides effective packing effect and contact area with the adjacent cement particles, when SCP is mixed with cement, thereby forming concrete with high-strength and high-performance. The prepared SCP utilizes free lime and converts it into a more usable form which does not affect properties of the concrete in the long term. Further, the concrete formed using the SCP provides improved workability and pumpability in order to achieve high durability of structures. Further, the prepared SCP is environmentally friendly as it enables effective use of industrial wastes and by-products and decreases dependency on cement for concrete preparation. Furthermore, the obtained SCP provides superior quality of concrete when mixed with cement and is environmentally friendly.

[0036] While the exemplary embodiments of the present invention are described and illustrated herein, it will be appreciated that they are merely illustrative. It will be understood by those skilled in the art that various modifications in form and detail may be made therein without departing from the scope of the invention.

We claim:

1. A method for preparation of an improved supplementary cementitious product, the method comprising the steps of:

procuring industrial waste comprising fly ash and Ground Granulated Blast-furnace Slag (GGBS);

grinding the fly ash and GGBS together to an ultrafine particle size;

mixing and heating pre-determined chemical ingredients with one or more polymers for extracting a proportioned mixture of the chemical ingredients and the polymers; and

blending the fly ash and the GGBS particles with the extracted mixture of proportioned chemical ingredients and polymers to form a supplementary cementitious product comprising a blend of fly ash, Ground Granulated Blast-furnace Slag (GGBS), a sodium compound, Poly-carboxylic Ether (PCE), zinc, Triethyl, Methyl Hydroxyethyl Cellulose (MHEC), and Re-dispersible Polymer Powder (RDP).

2. The method as claimed in claim 1, wherein a sieve analysis of the ground fly ash and GGBS is carried out for assessing the particle size of the ground fly ash and GGBS.

3. The method as claimed in claim 2, wherein ultrafine fly ash and GGBS particles are separated from coarse fly ash and GGBS particles present in the ground fly ash and GGBS particles based on a sieve analysis, and wherein the coarse fly ash and GGBS particles are sent for grinding.

4. The method as claimed in claim 1, wherein the pre-determined chemical ingredients comprise 20% by weight of Sodium Metasilicate (SM), 1% by weight of zinc, and 0.20% by weight of Triethyl.

5. The method as claimed in claim 1, wherein the polymers comprise 0.25% by weight of Poly-carboxylic Ether (PCE), 1.50% by weight of Methyl Hydroxyethyl Cellulose (MHEC), and 7.05% by weight of Re-dispersible Polymer Powder (RDP).

6. The method as claimed in claim 1, wherein the chemical ingredients are heated along with the polymers at a pre-defined temperature of 150°C for a time-period of 1 hour.

7. The method as claimed in claim 1, wherein the SCP is mixed with cement by replacing pre-defined parts of cement with SCP to produce concrete.

8. A composition of Supplementary Cementitious Product (SCP), the composition of SCP comprising:

a blend of fly ash, Ground Granulated Blast-furnace Slag (GGBS), a sodium compound, Poly-carboxylic Ether (PCE), zinc, Triethyl, Methyl Hydroxyethyl Cellulose (MHEC), and Re-dispersible Polymer Powder (RDP).

9. The composition of SCP as claimed in claim 8, wherein the sodium compound is Sodium Metasilicate (SM), and wherein the composition of SCP comprises 35% by weight fly ash; 35% by weight GGBS; 20% of Sodium Metasilicate (SM); 0.25% of PCE; 1% of zinc; 0.20% of Triethyl; 1.50% of MHEC; and 7.05% of RDP.

10. The composition of SCP as claimed in claim 8, wherein the SCP is a finely divided dry powder and is grey in color, and wherein the SCP particles are spherical amorphous in shape.

11. The composition of SCP as claimed in claim 8, wherein bulk weight of the SCP is 0.65 ton/m^3 with a particle size in a range of between 2 to 25 microns, and wherein the particle size of the SCP provides effective gap filling and enhanced contact area of the SCP particles with cement particles when mixed with cement, thereby resulting in improved packing effect and formation of a concrete with high-strength and high-performance.

Dated this 28th day of September, 2023

SP CONCARE PRIVATE LIMITED

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AN IMPROVED SUPPLEMENTARY CEMENTITIOUS PRODUCT AND A METHOD OF PREPARATION THEREOF

ABSTRACT

An improved supplementary cementitious product (SCP) and a method of preparation is provided. The method comprises the steps of procuring industrial waste comprising fly ash and Ground Granulated Blast-furnace Slag (GGBS). The fly ash and GGBS are ground together to an ultrafine particle size. Pre-determined chemical ingredients are mixed and heated with one or more polymers for extracting a proportioned mixture of the chemical ingredients and the polymers. Lastly, the fly ash and the GGBS particles are blended with the extracted mixture of proportioned chemical ingredients and polymers to form the SCP. The composition of SCP comprises a blend of fly ash, Ground Granulated Blast-furnace Slag (GGBS), a sodium compound, Poly-carboxylic Ether (PCE), zinc, Triethyl, Methyl Hydroxyethyl Cellulose (MHEC), and Re-dispersible Polymer Powder (RDP).

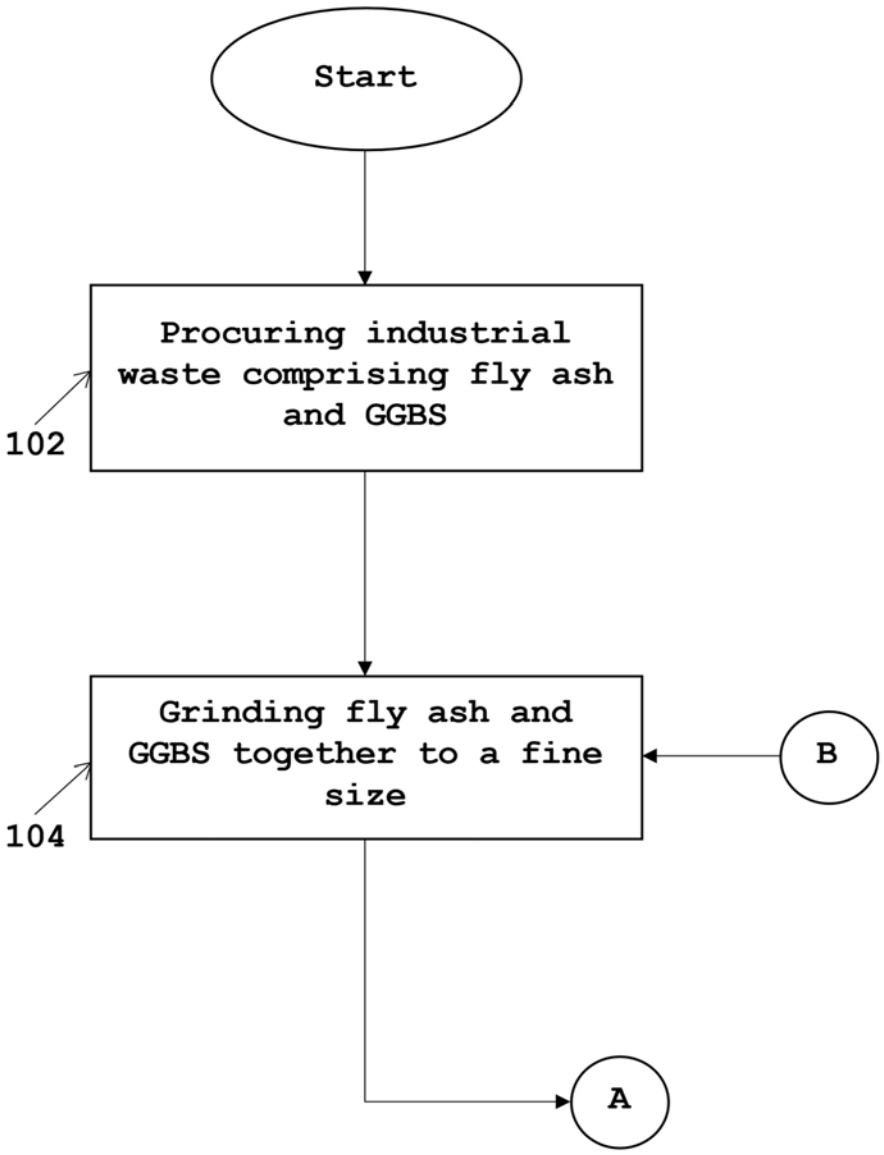


FIG. 1

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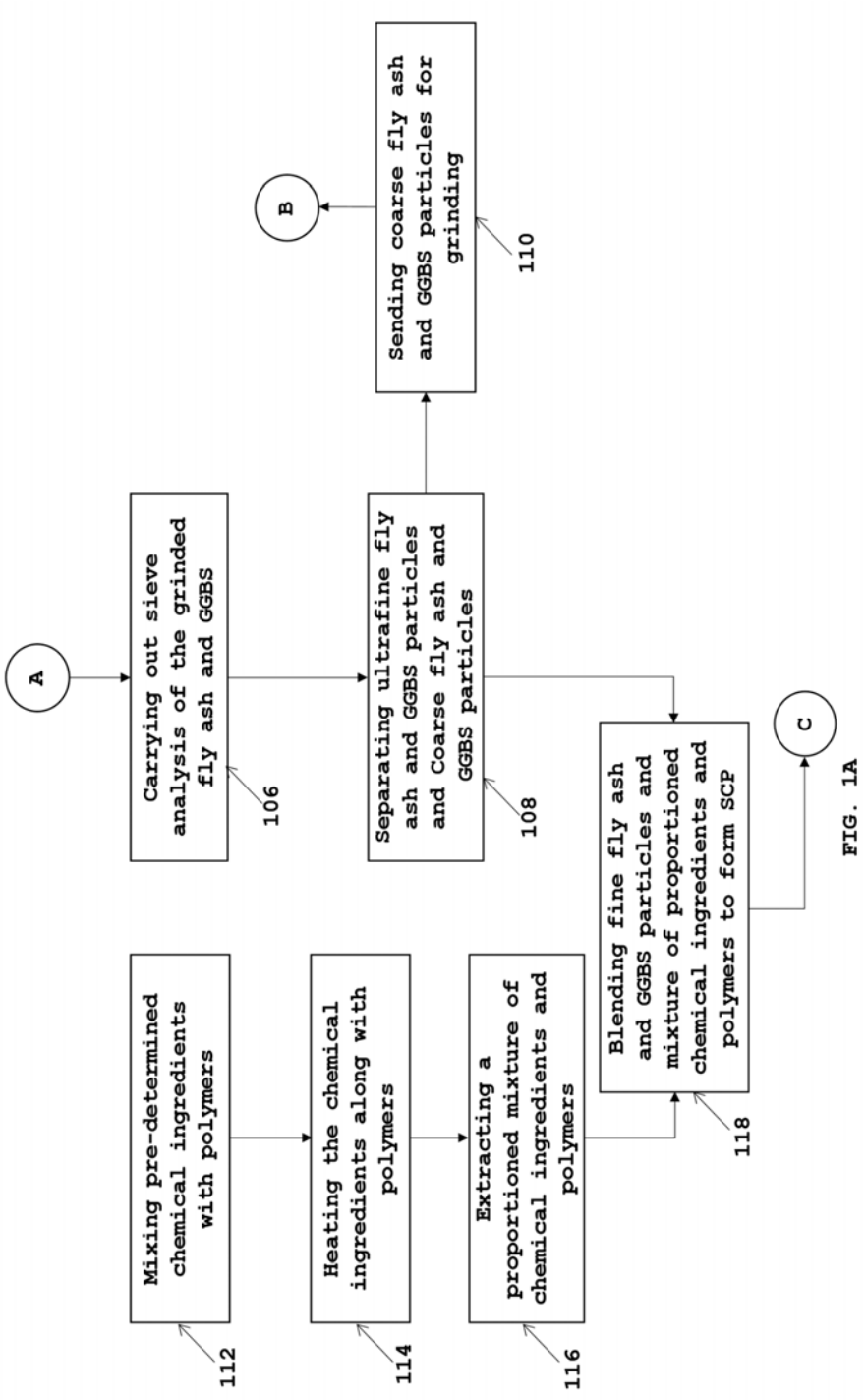


FIG. 1A

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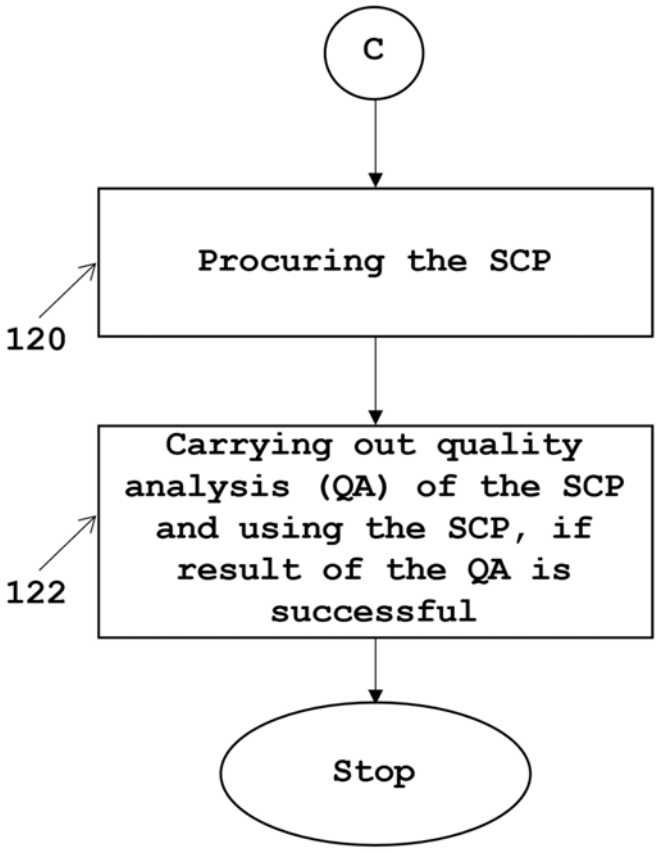


FIG. 1B

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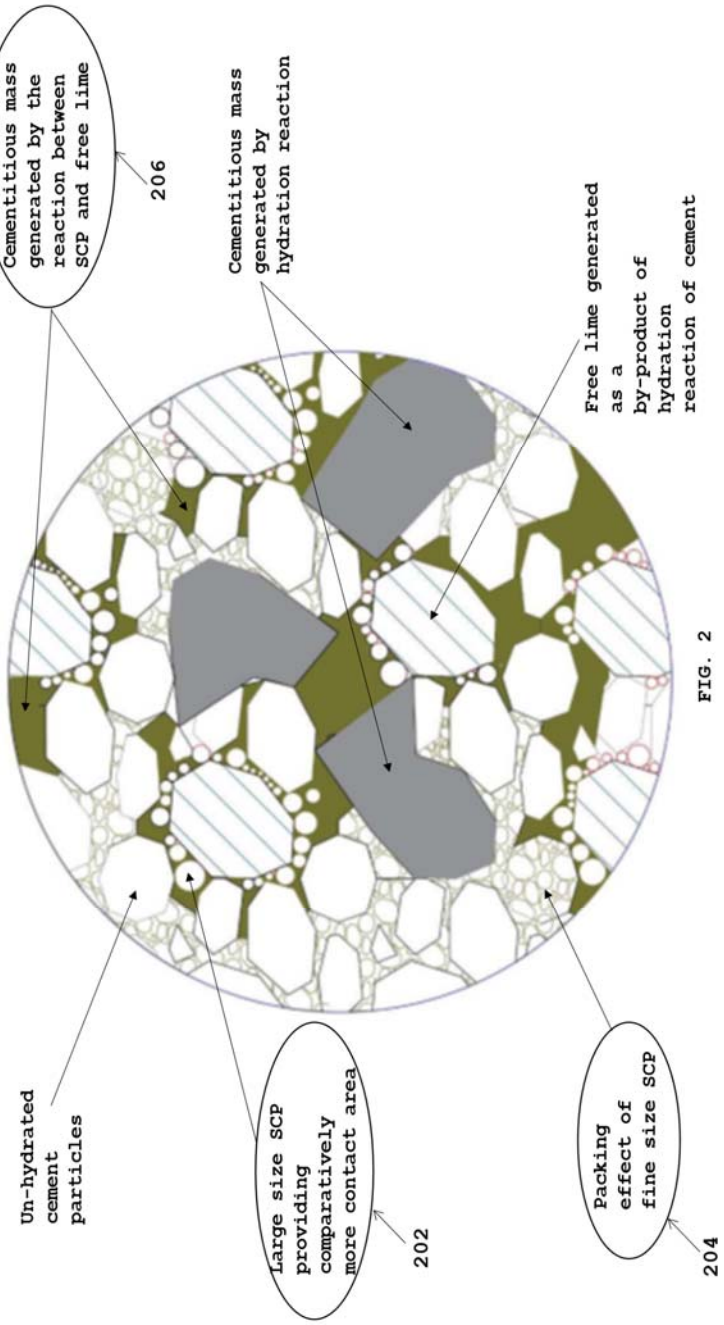


FIG. 2

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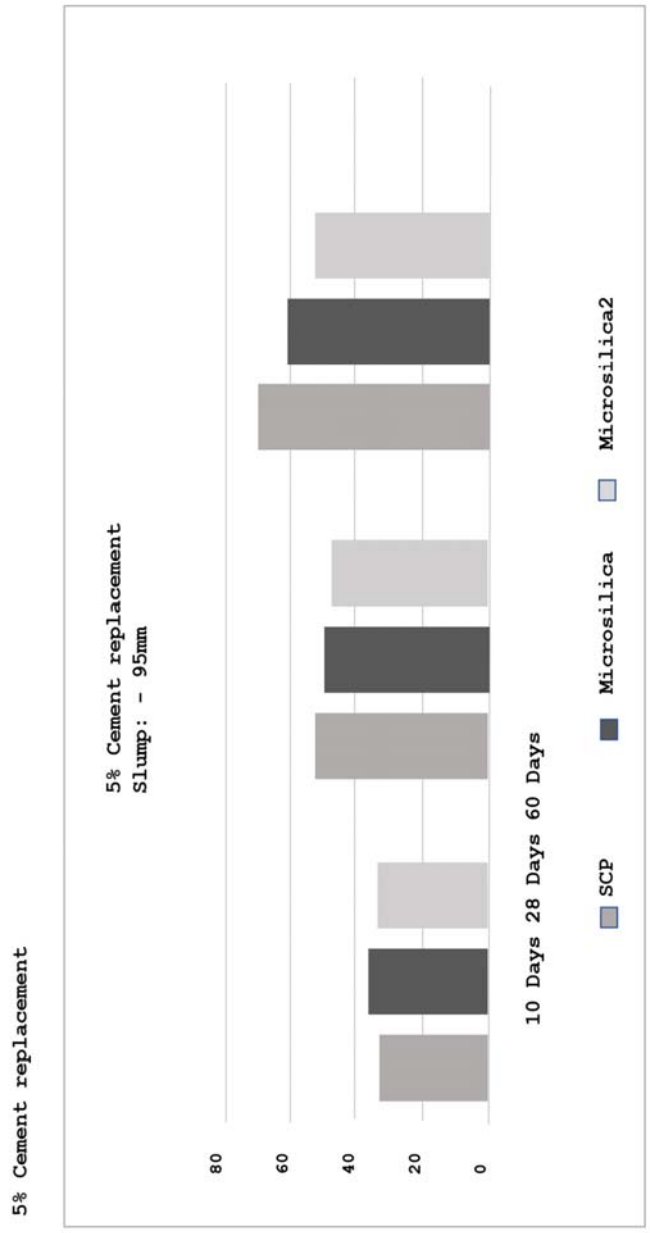


FIG. 3

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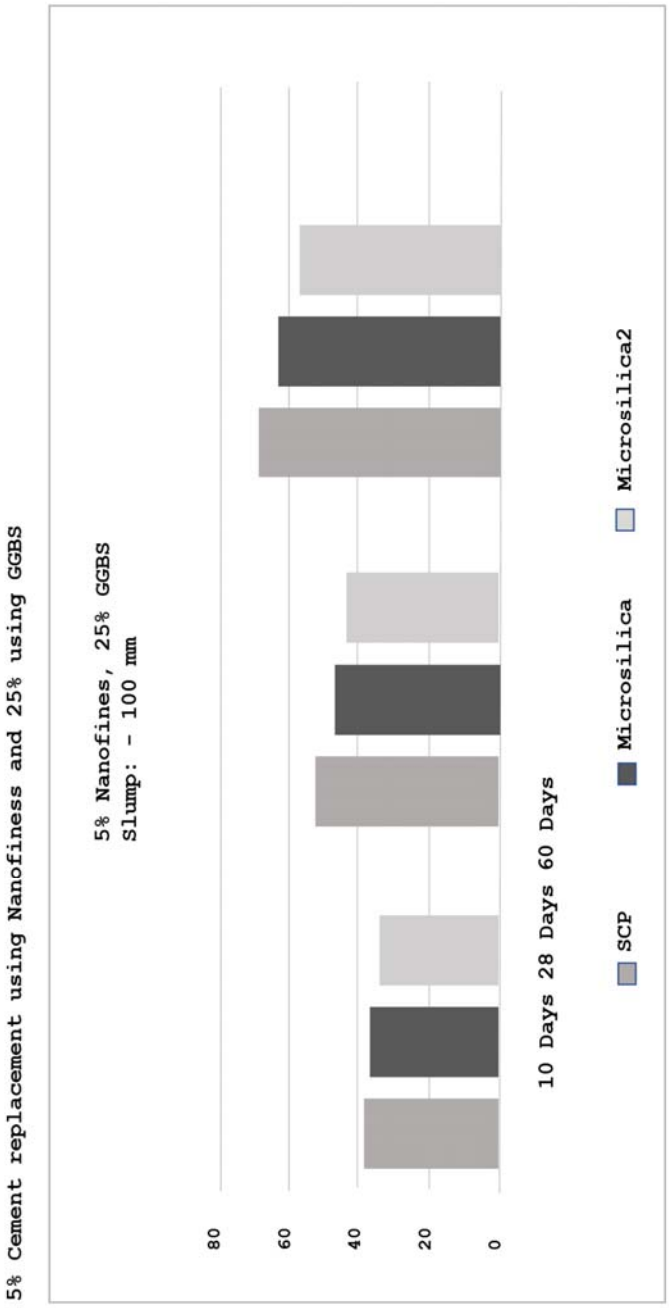


FIG. 4

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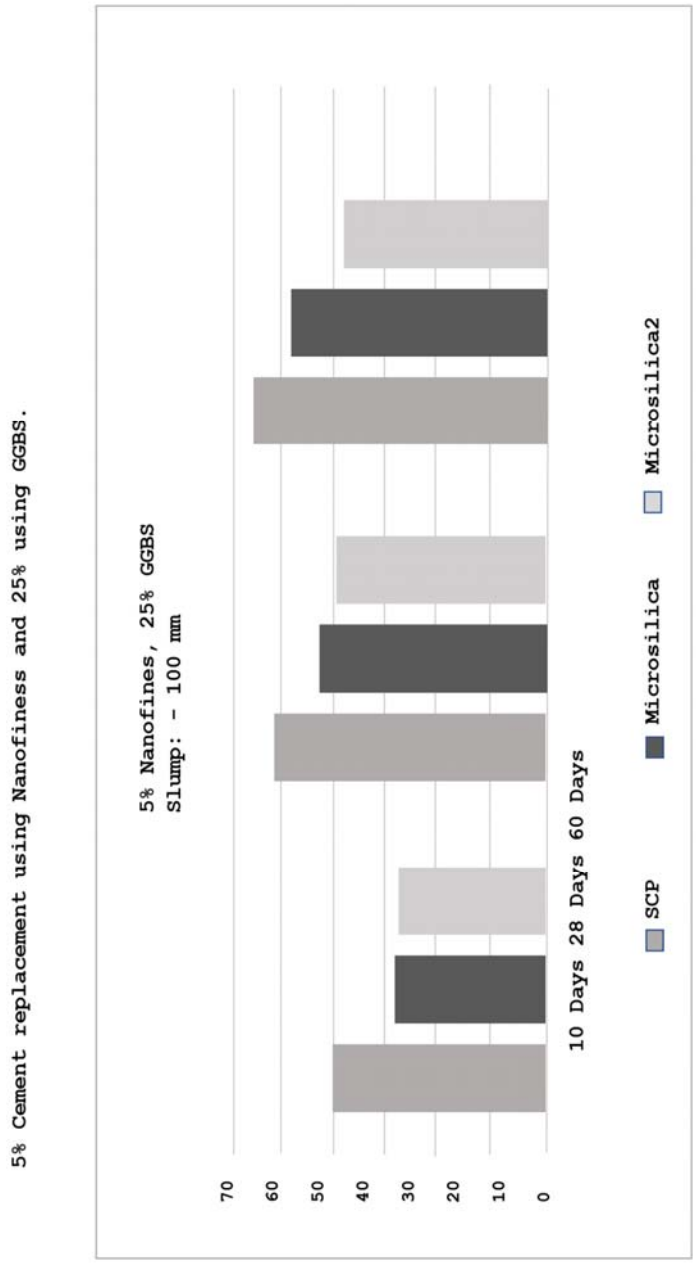


FIG. 5

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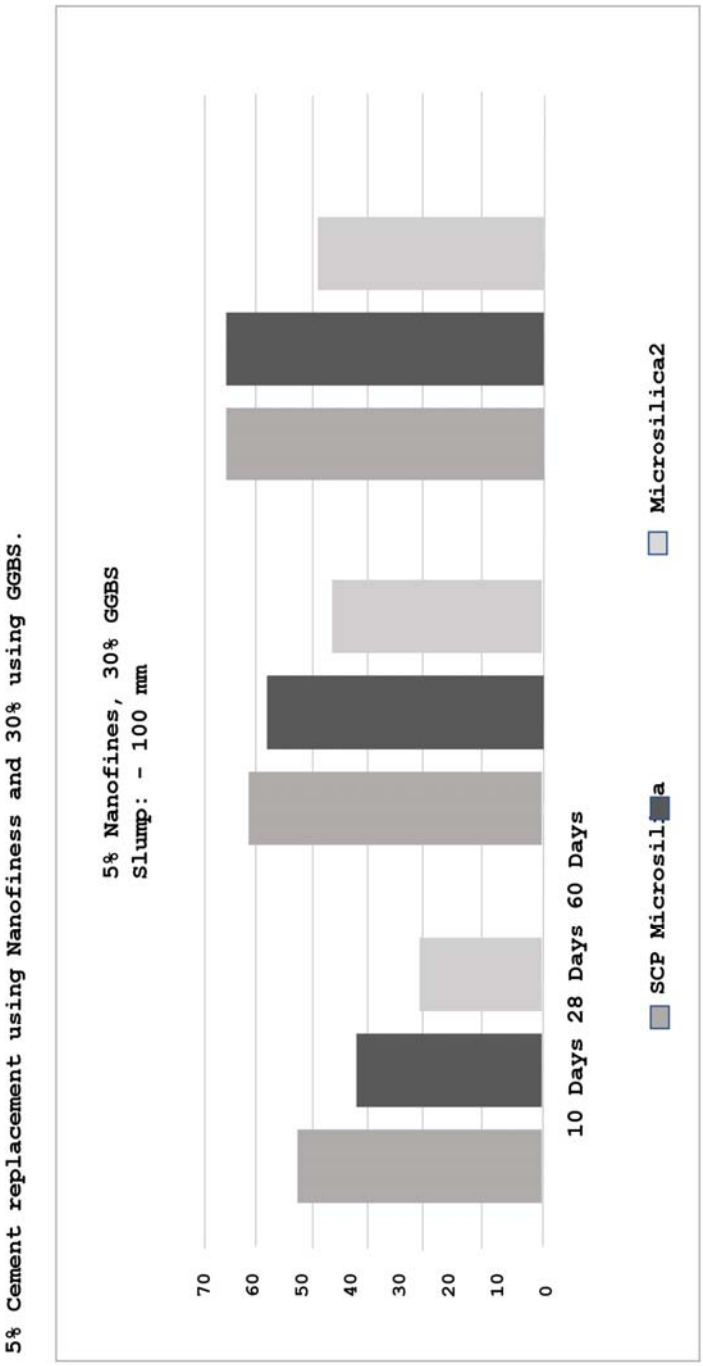


FIG. 6

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