Volume : 4 | Issue : 10 | Special Issue Oct- 2015 • ISSN No 2277 - 8179

Identification of Nanocomposite Materials for Green Buildings: A Review

Environmental Science

KEYWORDS: Polymer, ZnO, Concrete, PVK, PMMA

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ABSTRACT

Continuous extraction of natural nonrenewable resources such as lime and natural aggregates for the production of concrete is great burden on our environment and sustainability. It is a need of the hour to save our environment and our natural resources. One side we want to reduce the consumption of cement, On the other side the cement concrete of high and ultra high strength is continuously in demand due to multistory, and skyscraper construction.

Here some new composite materials, which are emerging to support conventional concrete industry in some manner, are discussed. These new composites are either improving the properties of conventional cement concrete or replacing a part of it. Nanotechnology is imparting its contribution either by introducing new materials to replace basic constituents or to make concrete of required properties and of high strength.

Introduction

Polymer layered silicate nanocomposites are relatively new class of nanoscale materials, in which at least one dimension of the filler phase is smaller than 100 nm. Stones and timber are the basic materials of oldest industry that is construction industry. Early civilization houses were composites of mud and straw. Before invention of cement, lime and mud were used in masonry work. But after introduction of cement now maximum used material is cement in cement- mortar, cement- concrete in building frames. And construction industry has become concrete industry. Cement-concrete is the only material whose consumption is tremendously increased [1]. In traditional cement concrete, strength and other properties of concrete depend on so many factors, i.e. type of aggregate, ratio of coarse and fine aggregate, cement content, water cement ratio, admixtures, compaction, curing, PVK, PMMA etc. Every factor has its own effect and slight variation in any factor affect the quality and strength of produced concrete. Traditional concrete having more unit weight (24 kN/m3),having good compressive strength but less crack resistant (weak in tension) and heterogeneous in nature. Its strength and durability is limited. Peoples of construction field are creating variety of concrete- composite of varying properties and the results are useful in construction fields. The direction, in which the concrete industry is moving, is discussed here [2] .Nanocomposites with practically all the polymer matrices have been reported with varying degrees of property enhancements. Polar polymers have been generally reported to achieve better filler dispersion owing to better match of the surface polarities of filler and polymers [2,3].

It is an innovation in concrete, which created a new composite material. Because concrete is very weak in tension. Some other problems related to concrete work, is its heterogeneous structure and brittle nature. By adding some chemicals its workability can be increased and by adding some fibers its flexural strength can be increased a little bit. Introduction of fibers improves the crack resistance of the concrete, which is desirable as the cracks propagate and durability of concrete decreases. Some concrete composites with fibers are FRC (fiber reinforced concrete), SIFCON (slurry infiltrated fiber reinforced concrete). GFRC (glass fiber reinforced concrete), FRP (Fiber reinforced Polymer concrete), CFRC (carbon fiber reinforced concrete) etc.

Description:

The polymer binds the reinforcement & particulate together. (Reinforcement material, Glass fibers, Natural fibers, Carbon fibers). Drastic change has been brought in concrete by adding polymers. Polymer mixed composites makes the concrete light weight, durable, flexible, corrosion resistant, low maintenance cost. These light weight composites are strong and stiff. The new materials worldwide are advancing toward high-performance, high-function, intelligent, low dimensional and therefore, these nano-materials, ceramic materials, composite materials have very good prospects in the construction industry.

Recently concrete with fibers have got popularity, some of them are described here .

1. Fibers Reinforced Concrete (FRC), it is a new popular composite material. The weak matrix in concrete when reinforced with steel fibers, uniformly distributed across its entire mass, gets strengthened enormously, thereby rendering the matrix to behave as a composite material with properties significantly different from conventional concrete, Because of the vast improvements achieved by the addition of fibers to concrete. An effective way to improve the performance of plain concrete is by adding a small fraction (0.5%-2% in volume in most cases) of steel fiber to the concrete while mixing with aggregates and cements. The flexural strength of mill-cut steel fiber reinforced concrete is 1.65 to approximately 2.25 times higher than that of normal concrete. The compressive strength of steel fiber reinforced concrete improved with additions of steel fibers at various volume fractions. The strength showed a maximum at 1.5% to 2%. By adding fibers we can get some advantages like (a) improvement in cracking resistance (b) improve ductility (c) improvement in mechanical strength. There are several applications where Fibers Reinforced Concrete (FRC) can be intelligently and beneficially used. These fibers have already been used in construction of industrial floors, pavements, highway-cover-layer, airport pavement, bridges, tunnel etc [1].

2. Self Compaction Concrete.(SCC). self compacting concrete is the demand especially in difficult situation where mechanical compaction is not possible. So to make concrete in such a manner that it should not require any compaction. For concrete mix to be considered as SCC, if the three characteristics for workability are to be satisfied. The three characteristics mandatory for SCC are filling ability, passing ability and resistance to segregation. Dosages of superplasticizer may vary from 3% to 7 %.curing temperature also affects the strength performance.

3. Slurry Infiltrated Fibrous Reinforced Concrete (SIFCON) can be considered as a special type of Steel Fiber Reinforced Concrete (SFRC)is a relatively new high performance and advanced material. The matrix in SIFCON has no coarse aggregates, but a high cementitious content. However, it may contain fine,coarse sand and additives such as fly ash, micro silica and latex emulsions A controlled quantity of high range water reducing admixtures (super plasticizer) may be used for improving flowing, characteristics of SIFCON. SIFCON is unique construction material possessing high strength as well as large ductility and far excellent potential for structural applications when accidental , abnormal loads are encountered during services SIFCON also exhibit new behavioral phenomenon, that of "Fiber lock" which believed to be responsible for its outstanding stress-strain properties. All steel fiber types namely straight, hooked and crimped can be used. The percentage of fibers by volume can be vary from 4 to 20% even though the current practical ranges from 4 to 12%. Proportions of cement and sand generally used for making SIFCON are 1:1, 1:1.5 or 1:2. Generally, fly ash or silica fume equal to 10 to 15% by weight of cement is used in mix. Water cement ratio varies between 0.3 to 0.4. Percentage of super plasticizers varies from 2 to 5% by weight of cement [2] [2(a)].

To reduce the dead weight of structure, light weight concrete walls or concrete blocks have been used in place of bricks, these are made by some agriculture waste or by aerated concrete. Natural product bamboo-fiber is also being used in many places, as a structural member and its fiber as constituent of concrete, at some places light weight polymer concrete is being used as insulating material.

4. Steel fiber reinforced polymer modified concrete(SFRPMC)- acrylic emulsion polymer as a polymeric admixture was applied in lightweight steel fiber reinforced cement concrete. Cement concrete weight is about 24kn/m3, more efforts has been done to reduce the weight of concrete so as to reduce the dead wt. of structural member, in this direction to make light weight concrete, polymers are new additives which can improve bond strength between ingredients.. Inclusion of acrylic emulsion polymer at a certain polymer-cement ratio with steel fibre as reinforcement improves the bonds between the cement matrix and steel fibre due to the acrylic emulsion polymer forms in the cement matrix. In addition, acrylic emulsion polymer modification can significantly improve the flexural strength of the normal steel fiber reinforced concrete. Compared with steel fiber reinforced concrete, the compressive strength of the acrylic emulsion polymer-modified concrete reinforced with steel fiber can increase gradually even after 28 days. The constituent materials used in the laboratory to produce steel fiber reinforced polymer modified cement concrete comprised (i) Ordinary Portland Cement (ii) fine aggregates, with , (iii) coarse aggregates (iv) Silica Fume and (v) free water (vi) acrylic emulsion polymer and (vii) steel fibers.it has some other advantages also,Generally, polymer cement concrete are made with polymer latex, exhibits excellent bonding to steel reinforcement and to old concrete. it shows good ductility, resistance to penetration of water and aqueous salt solutions, and resistance to freeze-thaw damage. Its flexural strength and toughness are usually higher than those of unmodified concrete. The modulus of elasticity may or may not be higher than that of unmodified concrete, The drying shrinkage of polymer cement concrete is generally lower than that of conventional concrete; the amount of shrinkage depends on the water-to-cement ratio, cement content, polymer content and curing conditions. The main application of latex-containing polymer cement concrete is in floor surfacing, as it is non-dusting and relatively cheap. Because of lower shrinkage, good resistance to permeation by various liquids such as water and salt solutions, and good bonding properties to old concrete, it is particularly suitable for thin (25 mm) floor toppings, concrete bridge deck overlays, anti-corrosive overlays, concrete repairs and patching. [3]

5.Smart Concrete:-Concrete mixed with carbon fiber, also called smart concrete, can improve the anti-crack performance of concrete and increase its impermeability.

The impermeability of smart concrete mixed with carbon fiber is better than that of the plain concrete. The differences of carbon fiber contents and the lengths both impact the impermeability of carbon fiber reinforced concrete (CFRC). When carbon fiber volume fraction is 0.2 %, the impermeability of concrete increase 15% compared with plain concrete, and when the carbon fiber content reaches 0.5%, the impermeability of concrete increases 47%. Carbon fibers with the length of 10mm has the best results. It is because the binding capability between fiber and concrete matrix is stronger with the increase of the length of the carbon fiber, and compactness of concrete are all reinforced, and the impermeability is also improved.[4]

Glass fiber reinforced plastics often refers to "GFRP". Because of lowcost and simple technique, GFRP is the most popular materials. GFRP is widely used in bodies and other accessories of car, train and tractor and also can be used in various parts of mechanical industry. GFRP is more and more popular in shipbuilding industry. The ship body made of GFRP may be more corrosion resistant and deeper in water than steel shell . A GFRP garbage truck which has good quality of corrosion-resistant and is easy to clean because of smooth surface. The chair is made of knotting and weaving rope with the special processing treatment. The rope is made of carbonized fiber and "aramid". Before special processing, the rope is the same as the general rope, but after the epoxy treatment, the rope becomes hard and strong Such materials are not only superior to any form of a single material, but also have special properties which a separate component does not have. In order to reduce cost of product, green materials such as bamboo, cane, reed, fibrilia and other fastgrowing plant materials are used to provide new design ideas. Doshisha from Japan and Panasonic jointly designed the speaker, and used bamboo fiber as the vibration plate of the speaker. The bamboo fiber can not only improve sound quality, but also lower the manufacturing cost.[5]

6.Carbon Fibers in rehabilitation/construction:- recently in Civil Structures a new kind of Rehabilitation and New Construction technique has been used with the use of carbon fibers. in which thin flexible fiber reinforced polymer stirrups are externally adhered with thermoset resin. This technique, known as manual lay-up. In the case of reinforced or prestressed concrete structures (externally bonded CFRP laminates,) CFRP laminate bonding involves adhering a thin, flexible fiber sheet to the concrete surface with a thermoset resin. This is used to increase the strength i.e. shear and flexural capacity of beams and slabs and to increase confinement in columns. One another advantages of this, the system does not add significant dead load to the structure, suffers little from corrosion, and may be installed in a relatively short period of time. Second method of rehabilitation of old RCC structures is mounting by CFRP rods. Advantages of using near surface mounted CFRP rods, with respect to externally bonded CFRP laminates, are the possibility of anchoring the rods into adjacent members and minimal installation time. The rods are installed by cutting a groove into the concrete surface and embedding them into the groove with a resin-based paste. Due to their light weight which is about one fifth that of steel, high tensile strength (higher than steel) and good overall environmental durability, carbon fiber based tendons and cables are increasingly being used for reinforcement of concrete structures. The reduction in weight facilitates better handling and easier field installation compared to steel. These elements also cause significantly less sag under their own weight, which increases load capacity while enabling the construction of longer bridge spans.[6].

7.Jute fibers in structural rehabilitation: One of the techniques of strengthening the reinforced concrete structural members is through external confinement by high strength fibre composites which can significantly enhance the strength and JUTE fibre sheets using epoxy resin can be used as retrofit material . The deflection of the beam specimen retrofitted with JUTE fibre sheet reduced the deflection about 69 %.when compared with the deflection of specimen detailed as per code IS 456-2000.[7]

8.FRP composite (fiber reinforced polymer concrete) materials have been recently introduced to the civil engineering community. Three types of fabrics are currently produced commercially. Namely Glass Composites, Carbon Composites and Aramid Composites. These materials are durable, have long fatigue life and have a superior resistant to corrosion and chemical attack. They have high strength-to-weight ratio. Composites are easy to handle in the field and liable enough to configure to the shape of structure under rehabilitation. Composites are versatile and adaptable to almost any shape and size. Furthermore, considering the fact that in repair and strengthening work, labor and operational costs often far outweigh material costs, low weight of FRPs substantially reduces labor costs, which usually attain 80% of the total operational costs. Therefore, it is strongly believed that significant savings could be attained from successful utilization of the new technique of rehabilitation of the infrastructure. Dry fiber properties vary greatly depending on the fiber type, fiber grade, and the actual weight/density of fibers. FRP system properties can vary depending on the manufacturer and on other factors such as volume fraction, fiber properties, resin properties, aerial weight/density of fibers, and type of weave/stitch. One of the most important characteristics of FRP materials is their high tensile strength. The strength is about twice that of prestressing steel strands, and fairly high compared with ordinary steel. The tensile strength of FRP composite system is affected not only by the tensile strength of the fibers, but also by the volume fraction, resin system and the bond performance of fibers and matrix. FRP composites reach their ultimate tensile strength without exhibiting any yielding of the material.[8]

Nanoparticles have unique mechanical, electrical, optical and reactive properties distinct from larger particles. New materials and products based on nanotechnology can be found in building insulation, coatings, and solar technologies. In the building industry, nanotechnology has already brought to market, self-cleaning windows, smog-eating concrete, and many other advances. One of the output of nanotechnology in emerging material is carbon nano tubes. Carbon nanotubes has unique property that it is up to 250 times stronger than steel and 10 times lighter than steel. Nanotechnology promises to make insulation more efficient, less reliant on nonrenewable resources, and less toxic. Some other popular materials from nano technology as nano silica in cement, nano fibers, aerogel, nanogel, Bucky paper etc.

9.Nano-materials in cement:- In problematic soils such as loose soil and marine clay, impact and difficulties of work over them, due to loose and unstable nature. Substantial layer were made up of jet grouting. Large volume of neat cement grouts were pumped under high pressure to stabilize ground. By introducing nano material in to the neat cement grout may substantially decrease the sacrificial layer thickness and quantity of grout material to achieve the increased strength of soil there by increasing the bearing capacity. Nano silica is a nano material of size up to10 to 100 nanometer. Due to Nano scale size of particles and reactivity, Nanoparticles show unique physical and chemical properties.. Nano silica is found very useful in making cement, especially in grouting which is used in repair of cracks. Due to its fineness the fluidity of grout increases and the strength also found increased. This shows that nanotechnology is now useful in cement industry also. Carbon nanotubes also have the potential to effectively hinder crack propagation in cement composites. Reinforcing concrete with nanofibers will produce tougher concretes by interrupting crack formation as soon as it is initiated.

Nanomaterials, ceramic materials, green materials, composite materials and functional materials Functional materials are based on physical properties, have special performances and functions in aspects of electricity, magnetism, sound, light and heat. Functional material is a generic term for engineering materials. Aerogel, A new innovation of nano technology.

10.Aerogels: an ultra-low density solid, a gel in which the liquid component has been replaced with gas. Nicknamed "frozen smoke", aerogel has a content of just 5 percent solid and 95 percent air, and is said to be the lightest weight solid in the world. Despite its lightness, surprisingly, aerogel can support over 2,000 times its own weight. Because nanoporous aerogels it may probably be sensitive to moisture. Presently it is used as non-structural material. it is manufactured and marketed by sandwiching between wall panels that repel moisture. Architectural applications of aerogel include windows, skylights, and translucent wall panels. Nanogel panels provide translucency and insulation.High-insulating Nanogel panels are available with up to 75 percent translucency. Insulating nanocoatings can also be applied as thin films to glass and fabrics. Shade Curtains.

11.Insulating nanocoatings: Drastic changes have been brought by nanotechnology by nanofilms nanocoatings for insulation. Insulation can be painted or sprayed on in the form of a coating. This is a great advantage of nanocoatings over conventional bulk insulators like fiberglass, cellulose, and polystyrene boards, which often require the removal of building envelope components for installation. Various types of nanoparticle coatings are available to achieve a wide variety of other performance characteristics, including: Self-cleaning, Depolluting, Scratch-resistant, Anti-icing and anti-fogging, Antimicrobial, UV protection, Corrosion-resistant, Waterproofing. the versatility of many nanoparticles, surfaces treated with them often exhibit more than one of these properties. In RCC corrosion is the reason behind failure of Reinforcement steel, these steel rods are corrode due to fine cracks in cement concrete. So the scientists continuously trying to find the solution of this problem. for reducing cracks fibers mixing gives positive results, and for steel, there are some corrosion resistant coatings and paints.[20]

some new materials are also emerging which can adjust surrounding environment as per the occupants comfort called smart materials, and such building are called smart or intelligent buildings : for example Humidity adjusting materials and thermal control materials, Radiation absorbing paints, self cleaning coatings, automatic control of sun light by smart glasses etc.

Smart building concept is emerging drastically. it is being called as next generation building concept, in which occupants comfort improved by automatically controlled by sensors, by controlling room temperature, humidity, brightness etc. it is able to turn on and turn off lights according to occupants presence or absence. Room temperature may be adjusted accoding to weather. It saves the energy by automatically controlling all appliances.[9]

12.Self-cleaning nanocoatings :-these coatings can shed dirt through photocatalysis, Self-cleaning surfaces have become a reality. photocatalytic coatings containing titanium dioxide (TiO2) as nanoparticles. These nanoparticles initiate photocatalysis, a process by which dirt is broken down by exposure to the sun's ultraviolet rays and finally washed away by rain. Volatile organic compounds are oxidized into carbon dioxide and water. Today's self-cleaning surfaces are made by applying a thin nanocoating film, painting a nanocoating on, or integrating nanoparticles into the surface layer.

A load-bearing structural material's strength/weight ratio is particularly important because stronger, lighter materials can carry greater loads per unit of material. A higher strength/weight ratio means fewer materials, which in turn means fewer resources and energy consumed in production. While the introduction of nanomaterials into building structural components has begun with the reinforcement of conventional materials like wood, concrete and steel.

New structural materials : Nanotubes, nanofibers and nanosheets (buckypaper) of carbon and similar materials may eventually form the structural skeletons of new buildings.

13.Buckypaper: Buckypaper owes its name to Buckminsterfullerene, or Carbon 60—a type of carbon molecule whose powerful atomic bonds are said to make it twice as hard as diamond. See the miraculous property of Buckypaper. It is 10 times lighter than steel but at the same time it is 250 times stronger than steel. The potential of buckypaper, a material formed by combining carbon nanotubes into larger sheets.Probability is that in future this material can replace the RCC structural members like slab, beam etc.

Networks of embedded sensors with those implanted in building will interact , resulting in "smart environments" that self-adjust to individual needs and preferences. And building components will become smarter by gathering data on temperature, humidity, vibration, , and other factors. This information will be valuable in monitoring and improving building maintenance and safety. Everything could be determined based on invisible, passive correspondence between sensors. Dramatic improvements in energy conservation can be expected as well, as, for instance, environmental control systems recognize patterns of building occupancy and adjust heating and cooling accordingly. Similarly, windows will self-adjust to reflect or let pass solar radiation.

14.Smart Sun Glasses

Applications of systems of networked sensors and micro- and nano-mirror arrays on large areas for light deflection and control can be used in buildings . Mirror arrays are intended for implementation into windows of buildings to improve the functions like daylight guiding into rooms, heat regulation and glare protection. These are generally Placed between the two panes of a window, these mirrors are maintenance-free and not subject to defilement. For using microsystem technology in large area requirement is to use low cost materials and processing technology. . Further applications such as artificial light guiding and light concentration for photovoltaic applications are possible . These applications partly use conventional semiconductor materials but also thinfilm technologies enabling low-cost fabrication on large areas. MEMS are implemented rarely on large areas but these can be used for : (i) display technology using MEMS based shutters , (ii) MEMS based optical filters and (iii) micro mirror arrays for adaptive optics in astronomy using semiconductor materials – not primarily low-cost. Especially MEMS based on thin film technology offer high potential to be produced at low-cost in contrast to semiconductor MEMS[10].

15.Radiation absorbing paints : Oil palm ash is used as radiation absorbing paints . it is called green absorbing material. the ability of oil palm ash paint as a green absorbing material. this paint can reduce the harm on human body associated with radiations

Agriculture's waste such as oil palm ash creates awareness on the green technology. Palm oil ash can be used as a part replacement of cement studies show that up to 30% palm oil ash can be used with cement.[11]

Humidity is one important factor in maintaining indoor environment. It is important factor necessary for peoples physical and mental health. And air conditioning is traditional method for maintaining indoor air quality but it consumes high energy. humidity adjusting material in building has properties of the absorbing and releasing of renewable material to adjust air humidity. It do not consume any artificial energy. it is a kind of natural and ecological control adjustment methods. There are some natural and some synthetic materials which have the properties of adjusting the humidity. Wood is such kind of natural material. Under normal circumstances, when surrounding environment humidity changes, wood itself balance moisture content, can absorb or release moisture to ease the humidity changes of the indoor environment directly. Some synthetic and inorganic materials are capable of humidity adjustment.

16.Silica gel -- silica gel is a kind of amorphous silicon dioxide which is in the micro porous structure, and its chemical component is Si02 . H20,and its diameter generally is l.5-20nm. It can be made by sodium silicate solution which must be treated by inorganic acid, organic organic acid-type salt processing, and then dryed. Silica gel gets all kinds of "activate" treatment, and its effective area is up to 100-1000m2 / g, and adsorption ability to polarity molecular exceeds adsorption ability to nonpolar molecular. It is this character that make the silica gel is mainly used for hygroscopic agent in industry.

17.Montmorillonite is the main component of bentonite (Inorganic mineral material) and a kind of aluminum silicate minerals with layer structure. Montmorillonite of layered structure and its character of absorbing and releasing water vapor, make it become the natural humidity adjusting material, but it's wet capacity is very small. Zeolite is a kind of aluminosilicate mineral of gridlike structure. Natural zeolite grinding into tiny particles, instead part of sand,and mixing with mortar directly makes into mortar clapboard.[12]

18.Humidity controlling blocks :The porous composite humidity adjusting materials of biological and other materials, which is designed based on the structure features, thermal and moist environment of greenhouses, considering the thermal and moist loads from photosynthesis, not only has thermal performance and insulating property, but has the ability to adjust the humidity automatically as well. The additive needed includes water reducer, early strength agent, inorganic antiseptics, fungicide and accessories that can improve humidity-adjusting performance. Humidity controlling blocks of biological and inorganic materials were studied and made to substitute brick for greenhouse wall which utilizes the capacity of the humiditycontrolling materials to raise and lower the humidity to solves the present problems of humidity controlling measures in greenhouse[13].

Industrial wastes depositions/landfills are worldwide big problem. To reduce its burden, researchers are investigating properties of different kind waste if it can be use as cement concrete components. Researchers are continuously trying to search new cementious and construction- material within the industrial waste. This idea has two benefits (a)in reduction of landfills (b)in reducing the quantity of fresh cement and concrete used. Some innovative ideas are to replace at least a part of cement by some industrial waste, like fly ash, silica fume, Ground granulated blast furnace slag (A by- product of steel industry), oil palm ash(agriculture's waste), Waste paper Sludge ash (of paper industry) , Condensed silica fume (by product of semi-conductor industry). Rise husk ash (agricultural waste of rice), etc.

19. Fly ash is a mineral admixture that is mainly a by-product of the coal –fired power plants. It is classified as pozzolanic material. Development of low energy cements will also contribute to increased use of supplementary cementing materials like fly ash and slag while making concrete production more environmentally sustainable. Usually, the use of fly ash as partial replacement of cement has many beneficial effects on the fresh and hardened properties, and the cost of concrete. Fly ash further improves the workability, 20% replacement cement by fly ash as a mineral admixture is determined as the optimum replacement. At the age 90 days, all concrete mixes achieved the cube compressive strength between 72 to 120MPa. Tensile and flexural strength were increased using fly ash using fly ash.[14]

Alternative binder system with fly ash to produce concrete eliminating cement is called "Geopolymer Concrete". Geopolymer concrete can be manufactured by using the low-calcium (ASTM Class F) fly ash obtained from coalburning power stations.[15]

20.Slag concrete :- properties of porous cement concrete prepared by steel slag aggregate.The strength of porous cement concrete was greatly influenced by strength of aggregate itself. Under the premised condition of 10mm/s permeability rate, compressive strength of porous cement concrete prepared by steel slag aggregate was up to 31MPa and strength flexural was about 4.5 MPa Porous concrete pavement is of high strength, good permeability, well absorbing heat and noise, no water and sliding characteristics, etc., which is a new kind of ecological protection concrete pavement meeting modern requirements The surface of modern city is covered with reinforced concrete building and impervious pavement. Compared with natural soil, ordinary concrete pavement is lack of respiration .and ability of absorbing heat and infiltrability. Then a series of environmental problems are brought about.

21.Waste Paper Sludge Ash is a waste material collected from the Paper Industry. Waste Paper Sludge Ash is used as cement replacement in producing mortar and was found satisfactory on its chemical, physical and mechanical properties. The chemical and physical properties of the waste paper sludge ash were determined by comparing it with the Ordinary Portland Cement (OPC). As the result of testing, it shows that Waste Paper Sludge Ash is similar to the chemical properties of OPC. Waste Paper Sludge Ash was used in mortar with different proportions, as cement replacement by volume along with sand and water in fix quantity. Results show that the compressive strength increased with increasing curing age for all concrete mixes and the compressive strength decreases with increasing Waste Paper Sludge Ash in the mortar. The inclusion of 50% Waste Paper Sludge Ash can gain favorable strength mortar at 16.4 MPa. Waste Paper Sludge Ash becomes a new innovation material that can be used as material for masonry to support the green technology due to less presence of sulphate at only 0.57% of the total weight. Carbon dioxide (CO2) and Sulphur dioxide emission also can be reduced since less cement productivity is involved.[16]

22.Rise husk ash (RHA) can be used as a part replacement of cement in making light weight concrete bricks. And Expanded polystyrene (EPS), a by- product of packaging industry can be used as partial aggregate replacement in the mixes. EPS RHA concrete brick giving promising Results in terms of its compressive strength, thermal conductivity. Good thermal and acoustic insulation properties leading it mainly to non-structural applications including precast roof and wall panels and lightweight infill blocks both materials can easily be incorporated in mortar or concrete. with 10% RHA replacement showed the highest compressive strength of 17.51 N/mm2 at 28 days ages under full water.[17]

23.Foamed concrete Block (light weight concrete block): it is made by the waste of alumina oxide production, is a kind of new building material added foaming liquid in the slurry, . It has many properties like light weight, sound insulation, anti-freeze, thermal insulation and other properties. Foam concrete is very effective in saving energy used in thermal insulation. Red mud foamed concrete block is made by the waste of alumina oxide production, It can be use in light wall panels, composite wall panels, roof insulation and so on. The thermal resistance is 5 to 10 times to normal concrete, the block density is between 500 to 900 Kg/m3[18-23].

Conclusion

we can explore more and more new composite materials; these are some of the material which are being used in construction industry except conventional cement concrete. Construction material with natural resources now become limited and causes of air pollution and environmental problems. And the present demand is also to find the substitute of the cement concrete, and to find the solution to reduce its weight, to increase its workability[24-28]. Many other trials have been made to reduce its cement content, aggregate content etc. Many type of Fibers glass fibers, steel fibers, nanofibers are the solution in reducing its brittleness and increasing its flexibility , its homogeneity. Nano technology is contributing in this direction by producing new materials with nano-particles nano tubes, nano coatings. Some industrial wastes and Agro waste are also found useful to replace a part of cement.

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