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Literature Review on Multiwalled Carbon Nanotube in Cement Paste on Mechanical characteristics

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***Abstract*- This research paper discusses with the literature study of Multiwalled Carbon Nanotube (MWCNT) from different research papers which are incorporating MWCNT from 0.15 to 2.5% on mechanical characteristics of the cement concrete. Sonication was done by mixing of MWCNT and surfactants by cement's weight/water which is attained from the different researchers enlightens techniques (like ultrasonic dispersion) were taken up for dissolving it homogeneously. Compressive, flexural and tensile strength tests were carried out on concrete specimens. This literature review paper represents the introduction and methodologies with various experimental research papers. In addition, this paper was thrashed out based on to develop the above-mentioned properties.**

I. INTRODUCTION

Cement paste is the composite construction material and prepared with suitable proportion of fine aggregate, water and binding materials. It is mostly used to prepare for plastering and mortar and even entire buildings. The cement paste is the mainly and widely utilized in building material. In addition to that, it is made up of mixing cement, water and fine aggregate. In recent construction trends, advanced admixtures were required to change and enhance the properties of cement paste, which means to avoid creep, cracks and shrinkage in the concrete. The research papers on nanotechnologies and nanomaterials were emphasized the possible making usage of current materials in the fields like energy, medicine, telecommunication, construction and informatics. This is because of specific characteristics of nano materials. Construction materials area may one among largest beneficiary of nano materials and with current applications which may develop properties of concrete, glass and steel materials. Enhancing the resistances and durability will minimize the pollution of environment and subsequently reducing carbon footprint of the structures. Nano particles may be known as physical substances with minimum dimension.

Nanotechnology stands for the learning of phenomena and the handling of nano particles in nanoscale. In addition to that, it is the addition of the general sciences in nanoscale. Nano-sciences may be further defined as the planning, designing, characterizing, production of nano particles or systems that scheming size and shape at the level of nanoscale. Nano-science needs most advanced image processing techniques for evaluating, performing, studying and developing the nano-material characteristics and for producing tiny powders or solids or liquids form of nanomaterials with the size within 100 nm which is called nanomaterials (Gogotsi, 2006). At present, the application of nanoparticles in building construction is minimized mainly because of less knowledge on the right or suitable nanomaterials and its behavior for constructions; the deficiency in precise standards for production and construction of building construction materials by using

nanoproducts. Nanoproducts consist of four types that may be used for concrete (i) carbon nano-tube, (ii) Nano silica, (iii) carbon fiber, (iv) titanium Offered nanoproducts are very less due to the lack of detailed report on these types of nano particles content; costs; health risks related with it. In addition to making use of nanoproducts in building construction at wide range, it is mandatory to conduct researches on: the choosing of nanoparticles with specific usage in building industry and the literature review its behavior, the properties study of the construction building elements which contains nanoparticles subjected to different types of loads; the improvement of specific standards, design and production of nanomaterials. This current paper is part of the literature review with respect to the research already done by many researchers and emphasis a mixture of nanoparticles properly to be utilized in construction.

II. MATERIALS AND DISCUSSION

Cement is used as main component in major construction material for last ten decades in civil engineering field. Moreover, cement is the major component of cement concrete along with coarse and fine aggregates. The improvement of newly developed nano fibers, such as carbon nanotube (MWCNT) or Multiwalled carbon nanotube (MWCNT), opened a field of reinforcement using nano-sized fibers in Reinforced cement concrete. MWCNT is strongest product and also which is believed to be perfect reinforcement for cement concrete [1].

The MWCNTs may be known as structures with tubular section which is manufactured with graphite layers. The Graphite is thin and flat layer which is made up of sheets of carbon atoms which is in hexagonal mold. There are "N" number of CNTs, which are single-walled Carbon Nanotubes and multiwalled carbon nanotubes. Single-walled carbon nanotubes is consisting of diameter from 1nm to 3 nm. But the multiwalled carbon nanotubes is diameter ranging from 10nm to 100 nm. SWCNT and MWCNT's length will varies from 0.50lm to 50 lm. Multiwalled Carbon nanotubes has high range of aspect ratios i.e., 1000:1 to 2500000:1, which may be distributed densely and widely [1].

Properties of CNT may be used to connect the gap in cement particles, and which avoid them from propagation of cracks, mainly material without crack [2,3].

Siddique & Mehta have stated that multiwalled carbon nanotubes can capable of filling the cracks voids which may produce in normal conventional concrete, thereby decreasing the propagation of cracking [4].

In the recent study, Salvetat et al. presented that the young's modulus of CNT is 100 times more than that of normal TMT steel which is around 1 Tpa [5]. Although, CNT is the strongest product, CNT have some significance flexibility. Due of CNT's strongest, larger aspect ratio and more flexibility in nature, it is supposed to have considerable usage in building industry as reinforcing products.

Makar and Groert mentioned that major difficulties in utilizing MWCNT in building products. CNT donot dispersed in concrete uniformly due to Vander waal's effect. Individual carbon nanotubes will attract each other because of this effect. When the cement concrete is applied with external load, individual carbon nano tube will pull out and produces insufficient bonding. [6, 7]. SEM analysis also stated that the carbon nanotubes will help in bridging the gaps and cracks between cement particles like calcium silicate and ettringite.

Nochaiya & Chaipanich mentioned and studied that the SEM analysis and its properties of cement particles with carbon nanotubes. They stated that the better interaction between calcium silicate products and multiwalled carbon nanotubes (MWCNTs), in which MWCNT will helps to fill the gap and makes in denser that the normal conventional concrete and stronger than it [12].

Wansom et al. investigate the major impact of AC-impedance reaction of cement with multi walled carbon nanotubes materials [13].

Li et al. studied that the pressure-sensitive properties and SEM analysis of cement paste with multiwalled carbon nanotubes products. The results showed that the 0.13 percentage of CNT will provide better bonding and better dispersion. They also studied the Sonication (ultrasonic) by utilizing a generator with a flat beater [14].

III. CONCLUSION

- In SEM analysis, hydration products may be easily identified by its ettringite like needle like pattern with calcium silicate particles. Hydrates products of Cement looks like petals of flowers.
- Although it is practically investigated that different patterns or structures are present inside the cement particles, the cracks or gaps still present in the products.
- Thereby, carbon nano tubes are utilized to fill the gap and crack and arrest the propagation cracks future in large scale. In addition to it's the mechanical properties of cement products can be increased.
- The present literature review to list out the previous studies which are carried out by different researchers in worldwide and thereby increasing the properties of cement concrete by using CNT and MWCNT.
- By which, the impact of carbon nanotubes in cement products is wrapped up by the results that arrived from casting, testing and analysis of concrete specimens for various mechanical properties test conducted at laboratory.
- The incorporation of very tiny amounts (0.5 % wt) of multiwalled carbon nanotubes have the capacity of increasing the mechanical characteristics of cement concrete in tremendously

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