Seaweed as an Internal Curing Agent & Strengthening in Concrete –A Review

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Abstract

Increase in the developmental activities world over the demand for construction materials is increasing exponentially. India is also aiming at a high developmental rate compared to other nations in Asia there is a heavy demand for building materials in the domestic market day by day. Now a days the main focus is on sustainable development. Green construction materials take an important role in sustainable development. Seaweed is pure natural material that offers numerous advantages such as, Excellent heat insulation and heat capacity characteristics as well full Bio-degradability and strong carbon-dioxide fixation. Studies have been done on seaweed since 20 years in different areas such as Food, Cosmetic, construction industry (Concrete, Unfired Clay bricks, Roofs, Novel Biofiller)…etc Studies done on concrete were mostly focusing on increasing the strength of concrete but no researcher has focused on how seaweed can increase the strength of the concrete and use of seaweed as an internal curing agent. In this paper, we just want to review the literature and the importance of seaweed and its uses in concrete, a different test like Compressive, Split Tensile, Flexure and Chemical composition is carried out.

Keywords:-*Seaweed, Novel Biofiller, Carbon-dioxide Fixation, Roofs, Unfired Clay Bricks, Bio-degradability, internal curing.*

I. INTRODUCTION

"Seaweed" is a colloquial term and lacks a formal definition. A seaweed may belong to one of the several groups of multi cellular algae: the red algae, green algae, and brown algae. As these three groups do not have a common multi cellular ancestor, the seaweed is in a polyphyletic group.

Seaweed has many uses; as an edible, as an ingredient in toothpaste, cosmetics, and paints. In addition to edible and other direct uses, marine algae provide a rich and diverse source of raw material for the manufacture of seaweed gums, a group of natural compounds characterized by their thickening and gelling properties. E.G:- MacFarlane Nova(1966), Neville, A.M. (1995), Trono G (1998) 8) ,Plank J (2005).

Concrete based on Portland cement is most widely used construction material in the world, and its production follows a trend of growth. About 15% of the total concrete production contains chemical admixtures, which are chemicals added to concrete, mortar or grout at the time of mixing to modify their properties , either in the fresh or hardened state.

Internal curing admixture provides an internal source of water necessary to replace that consumed by chemical shrinkage during hydration. As the cement hydrates, this water is drawn from the pores in the admixture's water reservoirs and absorbed into the pores of the cement paste. This process can minimize the development of drying shrinkage, help in avoiding early-age cracking, and improve strength. Because of its internal bonding, the compressive strength also can be increased ultimately. In the production of cement, chemical pathways include the manufacture of carbon negative elements; which can be used to make concrete that draws carbon-dioxide into its structure as it matures. Seaweed farming with sequestration of carbon-dioxide in offshore sediment offers great potential but is at a very early stage of development. Mehta, P.K. (1999), Narasimha Rao, (2008), Dr. S. K. Chinta (2012): R. Praveena(2016).

"The purpose of this Research is to investigate the use of alginate a natural and renewable bio-Polymer obtained from seaweed as an admixture for internal curing & Strengthening in concrete"

II. REVIEW OF LITERATURE

A. International:-

Addition of cactus mucilage and seaweed extract to concrete produced distinct effects on the mechanical properties and durability depending on the water to cement ratio. In the case of a low water/cement ratio, the permeable porosity decreased because of the water holding capacity of the polymers, which provided additional moisture for further cement hydration. In concrete with high water/cement ratio, the additional water did not improve hydration because there was already enough water for hydration, and the porosity increased as a result of the retardation effect on cement hydration and the subsequent drying. Those changes in porosity marginally affected compressive strength, being the most noticeable in concrete with a water/cement ratio of 0.60 and 0 days moist-cured, where the combination of cactus mucilage and seaweed extract

increased the strength at 120 days by 20% with respect to the control.

Regarding durability, the capillary water absorption and the rapid chloride permeability were marginally influenced by the permeable porosity produced by the use of the admixtures, being lower in concrete with a low water/cement ratio and higher in concrete with a high water/cement ratio, compared to the control mixes. The chloride ion diffusion coefficients were clearly reduced by the use of the cactus mucilage and seaweed extract in both water/cement ratios and curing types compared to the control mix. Combinations of the lower porosity and changes in the properties of the pore solution (viscosity) could explain these results. The carbonation depth was decreased in concrete containing cactus mucilage compared to the control mixes as a result of the decreased permeable porosity and increased viscosity was carried by (E.F. Hernández March 2016) Seaweed residue and polypropylene composite can improve the interfacial interaction. (Carmen Albano:2009) Seaweed and Polypropylene with different matrix in the ratio of 10:90,20:80,30:70,40:60& 50:50 (Wt% of seaweed: Wt% of Polypropylene) by compounding and injection molding. The tensile, bending and impact properties of composite were investigated. The 30:70 matrix gave best overall mechanical performance of the composite prepared. Interfacial adhesive and bonding between the fibers and polypropylene matrix were investigated by Scanning Electrn Microscopy (SEM).(M.Masudal Hassan:2008:Germany) Seaweed can also be used to prepare unfired clay bricks; (A.Dove:2016:U.K)

At least 221 species of seaweed were used, with145 species for food and 101 species for phycocolloid production. 2,005,459 ton dry weight was produced, with 90% coming from China, France, UK, Korea, Japan and Chile. 1,033,650 t dry weight was cultured with 90% coming from China, Korea and Japan. Just four genera made up 93% of the cultured seaweed: Laminaria (682,581 ton dry wt), Porphyra (130,614 ton dry wt), Undaria (101,708 ton dry wt) and Gracilaria (50,165 t dry wt). The value of the harvest was in excess of US $ 6.2 billion. Since 1984 the production of seaweeds worldwide has grown by 119%. World seaweed utilization by W. Lindsey Zemke-White July 1999

Keywords:- *Concrete; (PP)Polypropylene, Composits, Injection moulding, Organic admixtures; Compressive strength; Chloride; Durability, seaweed, phycocolloid, alginate, carrageenan.*

B. National:-

Study on marine algae was performed which concluded that the chemical reaction with the cement makes the environment free from pollution. Since algae are environmental friendly, this makes the concrete more economic and, at the same time, there is a reduction of the problem on waste. In this study, marine brown algae were used as additive material to concrete. With a fixed water to cement ratio (W/C = 0.5), marine brown algae is added at 2%, 5%, 8% and 10% from the cement content in producing M25 grade concrete. Harden tests were performed at 3, 7 and 14 days. The results showed that the various strength properties of concrete increased or decreased with addition of marine algae. The compressive strength tends to decrease for more addition of marine algae. Deflection characteristics test showed that the ultimate load carrying capacity of optimum mix concrete beam was higher than conventional concrete beam. This study shows that 8% addition of marine algae to concrete showed an increase in strength properties and when the addition increased to 10% the properties started to decrease was carried by R. Ramasubramani (2016)

Now a day's the main focus on sustainable construction are increased, green construction material takes important role in sustainable development. Concrete has become the most popular construction material in the world, sustainable concrete determines the sustainability of a structure. Several efforts have been done to achieve the sustainable concrete. Those efforts make the concrete technology innovation 'green', less energy, and less carbon emission. Seaweed is a pure natural material that offers numerous advantages, such as excellent heat insulation and heat capacity characteristics as well as full biodegradability and strong carbon dioxide fixation. In this paper, utilization of seaweed in construction industry for various applications is critically reviewed by Dr.A. Muthadhi(2016)

Keywords:- *Seaweed; construction industries; seaweed resource in India; natural polymer; viscosity modifying admixture; filler material*

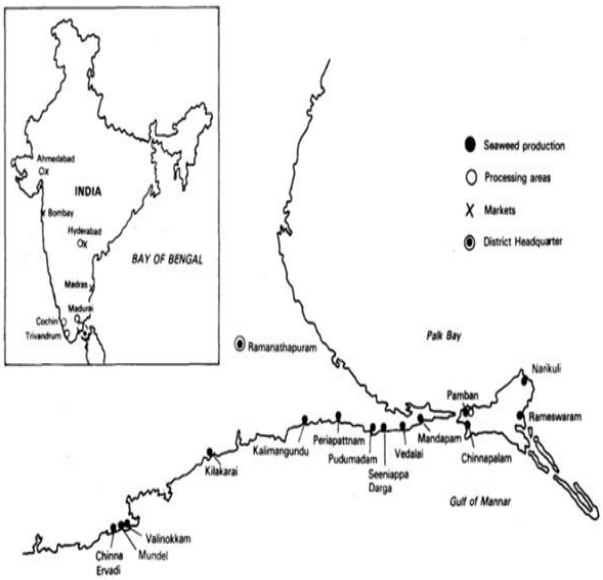
III. OBJECTIVES OF THE CURRENT PROJECT

a. In this project, seaweed is used in concrete as the self curing agent.
b. Seaweed usage as an admixture can help in the CO_2 fixation from cement.
c. Utilization of seaweed as a source of construction, industrial & food products will increase.
d. It will become an additional economic activity to provide more employment in countries that are only starting to initiate research and development of seaweeds.
e. Manpower for research and development will be upgraded.
f. More countries will be involved in the culture of seaweeds rather than in uncontrolled exploitation of natural resources

IV. SPECIFIC LOCATION TO BE HIGHLIGHTED

- SEAWEED COLLECTION IN INDIA
- Location

Although processing takes place in several states, commercial harvesting of seaweed, all from natural sources, is limited to the southern portion of the Tamil Nadu coastline, from Kanyakumari (CapeComorin) in the south, northwards to the peninsula that forms the Gulf of Mannar, a total distance of almost 300 km. Collection is particularly concentrated in that part of the 'seaweed belt' that runs along the coast of Ramanathapuram District and includes the villages of Mundel, Valinokkam, Chinna Ervadi, Kilakarãi, Kalimangundu, Periapattnam, Pudumadam, Seeniappa Darga, Vedalai,Pamban, Chinnapalam and Rameswaram. Here, the seaweed is collected both from the walersoff the mainland coast and those surrounding the chain of off-shore islands



Current research is specific location based in Ramanathapuram district of Tamilnadu

V. CONCLUSION

Increase in the developmental activities world over the demand for construction materials is increasing exponentially .India is also aiming at a high developmental rate compared to other nations in Asia there is a heavy demand for building materials in the domestic market day by day.

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Seaweed as an internal curing agent & Strengthening in concrete" is a completely new study/research in the field of Green construction material.

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