

Waste glass as fine aggregates



The conversion of solid waste (waste glass) and fibers (bamboo fibers) into construction materials and its capability to fight against chemical weathering will be discussed in this study. Now a day, it is an exciting and innovative technology in the field of engineering. There are many studies had been formulated by researchers on how to minimize or be free in concrete deterioration in an economical way and some are using high-cost materials to defend against deterioration and until now researchers are still searching for the finest and low-cost method yet effective to utilize.

Deterioration due to chemical weathering in concrete structures is one of the major problems in construction that makes concrete weakened, unstable, and even steel within the concrete will be deteriorated and can make serious trouble in the future such as collapse or settlement of particular structures. 1 This research paper involved an evaluation of chemical resistance and strength of concretes for the purpose of establishing performance-based specifications for the durability of concrete.

Concrete is a widely used materials particularly in the field of construction where engineers are responsible of the process or techniques in the mixture so that they can build robust and safety structures. Despite of being thought as a modern material, concrete has been used thousands of years. We inherit it from the Romans where they are the first people who discovered and used it for their construction of temples, aqueducts and other ancient infrastructures.

The word concrete comes from the Latin word *concretus*, which means “mixed together” or compounded with particular materials; it is commonly comprises with coarse aggregates (gravel), fine aggregates (sand), cement,

and water. But usual concrete is not enough to build superior structure that can resist all concrete problems aside of poor manufactured of concrete but considering also the impact of very aggressive environment which is the reason why “ admixture” was invented and until now many researchers and scientist are till finding ways alternative materials which is inexpensive but effective to use in particular concrete difficulty, specially deterioration due to chemical weathering that deeply needs efficient and effective admixtures.

That is why the researcher comes up to an idea on using waste glass and bamboo fiber as composite admixtures to the concrete. 2 Waste glass is a major component of the solid waste stream in many countries. Glass is a 100% recyclable material with high performances and unique aesthetic properties which make it suitable for wide-spread uses.

A type of solid waste that we can actually see everywhere in our daily live which contains silica that makes concrete durable. It can be found in many forms it includes container glass (bottle of soda, milk, liquor etc.), flat glass such as windows, bulb glass and cathode ray tube glass. The specific glass that I actually use as admixture is the Soda-lime glass. This is the most common commercial glass (90% of total production). The chemical and physical properties of soda-lime glass are the basis for its widespread use.

It usually contains 60-75% silica, 12-18% soda, and 5-12% lime. Soda-lime glass is resistant neither to high temperatures nor sudden thermal changes, nor to corrosive chemicals such as sulfates and chloride. However, glass may contain destructive alkali-silica reaction due to its high silica constituent. So it is need to limit the amount of silica in adding to the concrete or using alkali

free glass. One of its significant contributions is to the construction field where the waste glass was reused for value-added concrete production.

Bamboo, on the other hand, are some of the fastest growing plants in the world which belongs to the grass family and can grow to a height of 15 m with diameters varying within the range of 25 to 100 mm. It grows naturally in tropical and sub-tropical regions such as Asian countries. Its fibers are also desirable as woody raw material because of their toughness and elasticity. In addition, bamboo fibers have potential defense of the chloride or sulfate attack, which is the main cause of the deterioration of concrete structures exposed especially to coastal environments.

Bamboo fibers from dried bamboo stems are strong in tension and can be used as reinforcing materials. However, it has inherent weaknesses such as high water capacity, low modulus of elasticity, susceptibility to fungal and insect attack, yet bamboo contains a wide range of carbohydrates such as hemicellulose, starch, sugar, tannins, phenols and lignins, all of which are known to inhibit normal setting and strength development properties of the cement matrix. (Kadir and Sudin, 1989, Suchu and Zakaria, 1992).

Extensive research shows that the combination of low alkali cementitious materials, other chemical admixtures and modern production processes under controlled compaction and temperature conditions can lead to a wide range of concrete composites with excellent durability properties and very satisfactory levels of long term performance under internal and external exposure conditions. (Swamy, 1984, 1985, 1988, 1990, 1992, Kadi And Sudin 1989, Sudin and Zacaria , 1992, Swamy and Barr, 1989, Subarl , 1990, Gran1988, Totido Filho Et Al. , 2003, Savastano Jr. Et Al. 2003).

3. The combination of bamboo fiber and a crushed glass waste particles and other inorganic cementitious binder can produce a new class of building products that can reflect the good characteristics of concrete. The cementitious binder encapsulates the bamboo fibers, glass and aggregates, and the composite can be designed to have high resistance to different chemical weathering or even fire, termites and fungus. The use of glass and bamboo fibers as admixture in concrete has great potential for future high quality concrete development.

The conversion of waste material and bamboo fibers as useful construction material (admixture for concrete) is the main focus of the study; it is being evaluated according to its strength and resistance to chemical reaction through different kinds of methods/tests. The research aimed to evaluate the effectiveness of waste glass and bamboo fibers as additives for concrete in order to develop construction material that is highly effective and economical at the same time good to the environment. This study has good effect to the environment as well as to the people. It would be beneficial to the people to use such material because of its cheaper price and also to the environment for it helps us to minimize the pollution around us.

4. Large quantities of waste materials and by-products are generated from manufacturing processes, service industries and municipal solid wastes, etc. As a result, solid waste management has become one of the major environmental concerns in the world. With the increasing awareness about the environment, scarcity of land-fill space and due to its ever increasing cost, waste materials and by-products utilization has become an attractive alternative to disposal.

High consumption of natural sources, high amount production of industrial wastes and environmental pollution require obtaining new solutions for a sustainable development. Utilization of waste materials and by-products is a partial solution to environmental and ecological problems. Use of these materials not only helps in getting them utilized in cement, concrete, and other construction materials, it helps in reducing the cost of cement and concrete manufacturing, but also has numerous indirect benefits such as reduction in land-fill cost, saving in energy, and protecting the environment from possible pollution effects. Further, their utilization may improve the microstructure, mechanical and durability properties of mortar and concrete, which are difficult to achieve by the use of only ordinary Portland cement. Because of its beneficial characteristic, the study have come up to an idea to formulate additives who in way or the other be useful to the people, environment and in the civil profession.

5. Conceptual Framework

It was illustrated in the diagram shown on how the study is done, how it works, the process on how the desired outcome is produced. Each phase gives and contributes different kinds of data to the production of desired output in the research. The study is focused on the material being used as it is evaluated pertaining to its strength, durability of concrete, and its resistance to chemical weathering. Since these are the basis of the effectiveness/efficacy of the material/additives being used . Each phase has its own characteristic that will help the researcher work out on the study.

The input phase involves the utilization of bamboo fibers and waste glass as admixture. The one of the main focus of the research is the additives

(bamboo fibers and waste glass) used, for it is the one being evaluated pertaining to strength, durability of concrete, resistance to chemical weathering and other factors affecting its functionality. Prior to testing, the study needed the process on how the admixture being extracted and what is the output of the extraction to determine the characteristic of the additives being used for it will affect the functionality of the additives.

Also, the study needed the process of evaluation in achieving the results with regards to the functionality of concrete with the said additives. The testing process wanted data's and methods which are important in evaluating the additives by its functionality. Analyzing the results is the tool used in the final evaluation of the functionality of the additives.

6. The development and innovation of concrete using organic and waste constituents is significant to the following institutional and personnel. The study is significant to the concrete industry for them to be aware that additives such wastes can be effective to utilize in the field of construction and for economic purposes . in this study they will be able to apply the recommendations of the researcher. This study is significant to the engineers and constructors for being an environmental protector they were able to utilize waste materials in designing and constructing structures in an economical manner.

This study is highly significant to human beings and to the environment for it relates to solid waste management. This is helpful to the environment because from waste materials it is converted into a more useful material and proves that waste glass and wood fibers is not just a waste but also a constituents building material. The study is also significant to academic for

this will be use as reference for revision and it will be also use as a guide for other related study.