Application Of Hybrid Fibre Concrete As Advanced Material For Concrete Water Tank Construction

M A Azizan¹, N Z Noriman², N Ishak³ and H Desa²

¹Faculty of Civil Engineering Technology, Universiti Malaysia Perlis, UnicitiAlum, Sg Chuchuh, 02600, Perlis.
²Centre of Excellence for Unmanned Aerial System (COEUAS), Universiti Malaysia Perlis, 01000 Kangar, Perlis.
³Braintree Scientific & Engineering, Blok E, Pusat Perniagaan Pengkalan Jaya, 01000 Kangar, Perlis

Email: aziziazizan@unimap.edu.my

Abstract. The challenge of construction and the complexity of civil engineering systems, especially in the construction of water tanks, are catching people's attention around the world. Concrete, which is a priority feature and a mandatory used material, must have a very high strength and an acceptable degree of workability and properties. Efforts are being made in the field of concrete production to create and expand these mixtures of unusual characteristics and behaviors. The used of the hybrid fibre concrete in the concrete wall can reduce the costing factor in terms of constructions and maintenances beside that the quality assurance is highlighted. In addition, the sustainability in the water tank construction in Malaysia can be achieved using the advanced material in the construction.

1. Introduction

As shown by the latest or modernized architecture used in the implementation of some schemes, the Malaysian construction industry has recently undergone numerous innovative renovations. The use of the Industrialized Building System (IBS), new technology, optimal civil works factory, and modern high-tech construction equipment in excellent conditions will assist in improving the practicality and changing the existing approach's norm and model [1,4,5]. Researchers are attempting to achieve the best concrete quality by using the fibre component and other mixtures in concrete to some extent. Glass, biomass, polypropylene, and aramid fibres improve tensile strength, fatigue behaviour, durability, shrinkage characteristics, cavities, corrosion resistance, and serviceability of concrete, which is critical given global sustainability trends [1,2]. Solid waste should be stored and treated in concrete pits, with just a few exceptions. Petroleum products, such as oil, diesel, and other products, can spill through concrete walls, necessitating the use of special diaphragms. The word "reservoir" refers to underground or above-ground liquid storage systems. Below-ground reservoirs are typically used to hold vast volumes of water, while elevated reservoirs are commonly delivered directly by gravity flow and have a limited volume [3,7]. The rate of development and construction in Malaysia has fuelled demand for efficient, cost-effective, and quick-service buildings including substations and water tanks. The supply of water tanks is also insufficient to meet the demand. Another issue that necessitates study into the economic and structural application of new materials and building practises in this age of rising construction materials and labour costs is the cost of materials and labour. There is a certain parameter with regards to the building materials used in a large amount of expenditure.
2. Materials and methods

2.1 Material Preparation
The substance used in this study is the fibre of the Nylon, Steel and Polypropylene also known as the hard vibe fiber. In the meantime, the material preparations of the microfiller such as silica and it is important to wash the fibre with the different percentage and all the unnecessary sections will be removed as well. This is because this research can use only pure and straight fibre [5].

2.2 Mold
In order to shape the appropriate size of the specimen, a mould was required. A mould made of aluminium was manufactured in a workshop at the Faculty of Civil Engineering Technology, UniMAP. The scale of the mould used was 450 mm x 300 mm and was 3 mm thick. Since the normal thickness for running the flexural test was around 3 mm, the thickness must be in the 3 mm range.

2.3 Specimen
The procedure used to generate the composite sample is the hand-lay-up method. The fibre (nylon, steel and polypropylene), binder and microfiller are the active ingredients that will be used. For the microfiller, the ratio of combining all solutions was 5:1, where 5 times the amount of water is needed for the example was for each gramme of binder. The required quantity for this research was 75 grammes for the binder [6]. This mixture was described as a matrix that was used as a distributor of loads and as glue. Both will be mixed after measuring the microfiller and the binder. Then, after a certain moment, it will be stirred, where both have been blended properly to ensure. In order to ensure that there were no trap bubbles, the stir procedure needed to impact the specimen.

2.4 Mixture Design
The very first step of this study includes the creation of an initial mixing model based on the conventional formulation of a concrete mixture that compensates for the predicted behavior (increased water demand, reduced aggregate size, etc.) [3,4,6]. Make changes out of this base combination to maximize capacity. The shape of the substance used in the matrix and the proportion of mixture are influences. The mixture is calculated on the basis of its compressive force determined using a 3000 KN load test power ELE (Engineering Laboratory Equipment) measuring device as per BS1881: Section 116: 1983. On the basis of rheological properties, a qualitative appraisal of the mixture has also been carried out.

3. Results and discussion

3.1 Compression Test
To evaluate its compressive power, each of the mixture discussed above was measured. The compressive strength was tested so the potency of the fibre was better shown. Figure 4.1 summarizes the findings of any initial mixture evaluated in compliance with BS1881: Part 116: 1983. The graph demonstrates the configuration of each initial mixture to endure 28 days of pressure. The compressive strength is substantially increased after each modification of the mixture. The rise is due to the increase in the concrete slurry's bonding power itself. In order to form cement slurry by a hydration process, the water is combined with cement materials. The cement paste ties together the aggregates, fills the aggregates with voids, and allows the aggregates to move more freely. Less water will create harder, more stable concrete in the grout; more water will induce a higher slump in the free-flowing concrete.

As it reflects the consistency of concrete as a whole, the compressive force of concrete is considered to be the most significant characteristic of hardened concrete. Ordinary concrete 100-100-100 mm failed immediately under the full load in the compression test and broke into pieces when the first crack appeared. Failure is a very vulnerable one.
3.2 Modulus of Rupture (MOR)
In this analysis, the inclusion of hybrid fibres did not find an exact improvement in compressive power, however, under two-point bending, the MOR of the material changed significantly. In comparison to the relevant rule, the MOR of the blended mixture is compared in Figure 2. The rupture modulus of mixture hybrid fibre concrete has been shown to increase dramatically.

3.3 Splitting Tensile Test
Uniaxial tensile concrete direct testing is more difficult than steel or timber. Since concrete is a fragile substance, it is difficult to understand and match. The indirect cylindrical break tensile measure is then used to assess the tensile strength of the concrete. In the split tensile test, the axis of the concrete cylinder used for the compression test is horizontally located between the pressure plates of the test system and the strain is raised before the indirect tensile force in the form of indirect fracturing induces failure in vertical diameter. The failed study as seen in Figure 3, and Figure 4 shows that applying various percentages of fibre material to concrete will increase the splitting tensile strength considerably.
4. Conclusions

The study administered by this technique aims at the creation, apart from concrete construction material, of hybrid fiber-enriched composite materials with the desired freshness and hardening properties. The fibre material used in the fibre ferroconcrete plays a critical role in the ferroconcrete's strength efficiency, according to the findings. Hybrid fibre ferroconcrete improves the strength of concrete by combining two complementary fibres. The mixed fiber of nylon steel and polypropylene steel concrete is employed to boost the engineering performance in hybrid fibre concrete, there's a positive interaction between the fibers, therefore the ensuing compounding performance exceeds the general performance of standard concrete. The results show that the performance of mixed nylon steel fiber ferroconcrete is
better than that of mixed polypropene steel fiber ferroconcrete. The research team is currently investigating the possibility of expanding the experimental tasks for water flow simulation studies using proper software and weathering processes to refine the processing conditions and compare the efficiency with which this material is made eligible for construction of water tank material.

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