National Conference on 'Advances in Engineering, Technology and Applied Sciences' - NCAETAS-2019
© 2019 IJSRSET | Volume 5 | Issue 6 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099

Study of Glass Fibre Reinforced Concrete and Aramid Composites

Snehal Sonkusare [1], Harshal Mahalle [1], Pranay Bhujade[1], Nandkishor Nirmalkar[1], Smohit Dhoble[1], Vikas Satpute[1], Ms. Neha Arukia[2]

[1]Student of Civil Engineering Department, DBACER, Nagpur, Maharashtra, India

[2]Professor of Civil Engineering Department, DBACER, Nagpur, Maharashtra, India

ABSTRACT

Plain concrete has two deficiencies, low tensile strength and low strain at fracture. The present trend in concrete technology is towards increasing the strength and durability of concrete to meet the demand of the modern construction, and for that we add fibres in concrete. Fibres such as steel fibre, glass fibre, synthetic fibre, natural fibre and organic fibre when added in certain percentage in concrete it improves the strain properties as well as crack resistance, ductility, flexural strength and toughness. If we add glass fibre content of 0.33%, 0.67% and 1% in concrete it is observed that percentage increase in flexural strength after 28 days is 7.31 N/mm2 ,7.59 N/mm2, 7.07 N /mm2 respectively without reinforcement. The aramid, ones being the most effective, the first organic fibre having high tensile modulus and strength. It has 5-10% higher mechanical properties than other synthetic fibres. Hence, an attempt has made in the present investigation to study the flexural strength of aramid fibre in concrete.

Keywords: Glass Fibres, Aramid Fibres, Eco-Friendly, Flexural Strength, Admixture.

I. INTRODUCTION

Concrete is one of the most widely used construction material in the world. Plain concrete has some deficiencies such as low tensile strength, low post cracking capacity, limited ductility, highly porous, susceptible to chemical and environmental attack. This shortcoming is generally overcome by providing deformed steel bars in concrete. The fibres are a good quality manufactured product that can be reused or used as an admixture to improve some properties of plain concrete. Fibres include steel fibre, glass fibre, aramid fibre, synthetic fibre and natural fibres etc. In recent times glass fibre are also available and which are free from corrosion problems associated with steel fibres. Addition of fibres can increase strength of concrete and also reduce plastic shrinkage and drying shrinkage by arresting the propagations of cracks.

Glass fibre is one of the most versatile building materials that is making the significant contribution to the economics, technology and aesthetic of the construction industry worldwide for over 40 years. Glass fibre has high tensile strength (2-4 GPa), elastic modulus (70-80 GPa) and fire resistance properties thus reducing the loss of damage during fire accidents GFRC has advantage of being lightweight, high compressive strength and flexural strength.

The aramid ones being the most effective, the first man made organic fibre having high tensile strength, less wear and tear, less abrasive etc. It has 5-10 % higher mechanical properties than other synthetic fibre. Aramid has excellent heat and fire resistance therefore it neither melts nor ignites in normal level of oxygen. It is also a light weight material and the aramid fibre will cover Kevlar, Nomex, Technora, Teijinconex, Twaron etc. Aramid fibre has better mechanical properties than steel and glass fibre on

same weight basis. According to the study of synthetic fibres compared to natural organic fibres are eco-friendly, economical and production cost is also low. The aim of the work is to study the engineering properties such as flexural strength of aramid fibre as compared with glass fibres in the concrete for different proportions.

II. MATERIALS

Glass Fibre is a material consisting of numerous extremely fine fibres of glass. Due to the relatively inexpensive cost glass fibres are the most commonly used reinforcement.

Types of Glass: -

- A glass- Soda lime silicate glasses used where the strength, durability and good electrical resistivity of E glass are not required.
- C Glass- Calcium borosilicate glasses used for their chemical stability in corrosive acid environments.
- E Glass- Alumina-calcium-borosilicate glasses with a maximum alkali content of 2 wt% used as general-purpose fibres where strength and high electrical resistivity are required.
- S Glass- Magnesium aluminosilicate glasses used for textile substrates or reinforcement in composite structural application which require high strength, modulus, and stability under extreme temperature and corrosive environments.

The most commonly used glass is E-glass. This is the most popular because of its cost.

Table 1

Fibre Type	Density(g/cm^3)	Modulus GPa
C-glass	2.56	69
D-glass	2.11	55
E-glass	2.54	72
ECR-glass	2.72	80

Properties of Glass Fibers: -

- Incombustibility.
- Corrosion resistance.
- High strength at low densities.
- Good thermal.
- Sound insulation.
- Special electrical properties

Aramid: -

Aramid fibre is a man-made organic polymer (an aromatic polyamide) produced by spinning a solid fibre from a liquid chemical blend. Aramid fibers are a class of heat-resistant and strong synthetic fibers.

Aramid Fibre characteristics

- Aramids share a high degree of orientation with other fibers such as ultra-high-molecular-weight polyethylene, a characteristic that dominates their properties.
- Good resistance to abrasion.
- Good resistance to organic solvents.
- Nonconductive.
- No melting point.

Types of Fibre

Para-Aramid: -

- Kevlar: - Kevlar is a heat-resistant and strong synthetic fibre, related to other aramids such as Nomex and Technora.
- Technora: - Technora is an aramid that is useful for a variety of applications that require high strength or chemical resistance.
- Twaron: - Twaron is a para-aramid. It is a heat-resistant and strong synthetic fibre.
- Heracron: - Have hyper tenacity high heat and chemical resistant, low weight.

Meta-Aramid: -

- Nomex: -Nomex is a flame-resistant meta-aramid.
- Teijinconex: -Teijinconex is a meta-aramid that offers excellent resistance to heat, flame and chemicals.

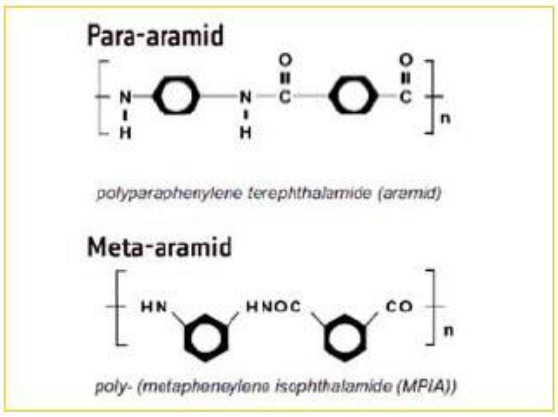

Figure 1

Properties of Aramid Fibre: -

There are many properties of aramid yarns as follows:

- High tensile strength: It has high tensile property rather than steel. This makes them very suitable for weight-sensitive application, such as in the aerospace industry.
- High stiffness: It has high stiffness. When load is applied on its product, then it has less elongation. Therefore, it has high load bearing.
- Low density: It has low density; therefore, it takes less distance and save the space.
- Low creep: The creep of aramid fiber is generally considered to be a logarithmic function of time; creep rate is low when compared with other synthetic fibers such as nylon or polyester and they approach that of steel.
- Stress rupture: When some materials are subjected to permanently applied loads they eventually creep to failure. This phenomenon is generally referred to as stress rupture. Considerable attention has been paid to the stress-rupture behaviour of Kevlar yarns. In all cases it was found that Kevlar yarns would support a large proportion of their nominal short-term ultimate loading for long period of time, but there was considerable variability in the stress rupture life times for any given load level.

Comparison Between Glass fiber And Aramid Fiber

- Tensile Strength.

Table 2

Material	Fibre Strength	Laminated Strength
E Glass	3450	1500
Kevlar	2757	1430

- Density and strength to weight ratio.

Table 3

Materials	**Fibre Strength**	**Laminated Strength**	**Density of laminate grams/cc**	**Strength to weight ratio**
E Glass	3450	1500	2.66	564
Kevlar	2757	1430	1.44	993

- Modulus of Elasticity

Table 4

Materials	**Young modulus**
E Glass	30-40
Kevlar	70.5-112.4

Benefits of Aramid Fibre

- Aramid fibre resist elevated temperature therefore for making of protective clotting and fibric used near fire.
- Aramid fiber has non-conductive properties therefore it used like insulator for safety purpose.
- Kevlar has more resistance to fatigue.
- Aramid fibre is a light weight material.

Applications of Aramid Fibre

- Flame resistance clothing, helmets.
- It is used in composite materials.
- It is used in tyres for resisting wear and tear because of their high strength properties.
- It is used for making sporting goods.
- It is used in many civil structure, mechanical structure.

III. CONCLUSION

- The application of glass fibre reinforced concrete has reduced shrinkage, cracking, post cracking capacity and increased durability, tensile strength, flexural strength as compared to plain cement concrete.
- Aramid fiber is great composite material for heat resistance.

IV. REFERENCES

[1]. Yuji Nakayama et al, bond behaviour between deformed aramid fiber-reinforced plastic reinforcement and concrete The 14th world Conference on Earthquake Engineering October 12-17,2008, Beijing, china.

[2]. A. Ciferri and I. M. Ward: "Ultra-high modulus polymers";1979, Barking, Applied Science.

[3]. Blasct v. Fiber textile cu destinatii special si inalt performante. Vol.1, Edit. Tehnopress, lasi, 85(2000).

[4]. M jassala et al., Aramid fibres-An overview, Indian journal of Fiber & textile Research Vol. 27, September 2002, pp, 290-306.

[5]. Chio, t.t., Wells, j.e., Moore R.L.and Hmstad. stress rupture behaviour of strands of an organic fibre/epoxy matris", composite materials: testing and design (3rd conference), astm stp 546, American society of testing and materials. pp. 209-224(1974).