EUROPEAN ACADEMIC RESEARCH
Vol. V, Issue 9/ December 2017

Impact Factor: 3.4546 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Analysis of the physical-mechanical performance of the portland cement conventional concrete with partial substance of the buriti palm fiber - (Brazil)

ELOADIR AFONSO REIS BRASIL FILHO
Graduation student, Northern University Center UNINORTE (2017)
Manaus - AM
CHARLES RIBEIRO DE BRITO
Master, Federal University of Amazonas UFAM (2015), Manaus, AM
DORIEDSON SOUSA DIAS
Master's student, Federal University of Pará UFPA (2017), Belem, PA, Brazil
MARCO ANTONIO GUERREIRO PRADO FILHO
Master, Federal University of Pará UFPA (2016), Belem, PA, Brazil
JOSÉ CLAÚDIO BENEVIDES
Specialist, University Gama Filho UGF (2006), Manaus, AM
DARLEI DOS ANJOS LAVOR
Laboratory Technician, Northern University Center UNINORTE (2017)
Manaus, AM
ADELANEIDE GOMES LIMA
Master - National Research Institute Amazonia INPA (2006)
Manaus, AM

Abstract:

Cement is one of the most widely used materials in the world. The same one presents good results when submitted to compressive efforts, however, when submitted to tensile stresses, it does not present as satisfactory results and, even with the addition of reinforcement in the concrete to resist these efforts, the concrete still presents small fissures originating of the same does not present good resistance to tensile stresses. In this sense, the present study aims to analyze the results obtained with the incorporation of the organic fibers from the buriti palm (Mauritia Vinífera Martius) to the conventional concrete traces, with partial replacement of the Portland cement, observing its physical-mechanical behavior and influences (Portland cement): 0.8 *(sand): 1.14 (Brita Powder): 1.14 (Brita Powder): 0.8 (sand): 1.14 (Brita Powder): 2.34 (Brita 0): 0.55 (Water). From this reference trait were produced the other mixtures, prioritizing the substitution of fiber contents. Fiber contents of 0% were adopted; 0.3%; 0.5% and 1%, respectively. The results show that the mixture TR2-CP03 and TR3-05, with a content of 0.3% and 0.5% of buriti fibers presents better behavior, with lower rate of water absorption versus resistance to compression. The TR4-CP-1F blend, with 1.0% buriti fibers, showed a good increase in resistance to 0.3% and 0.5% thereof, the 1.0% fibers presented better mechanical behavior at 28 days, with an increase of (----%) in the compressive strength compared to the resistance of the reference trace.*

Key words: Buriti Fibers, Replacement, Concrete, Portland Cement.

1 INTRODUCTION

Civil construction is a reference for the evolution of research, especially in the area of new materials used in buildings that suggest visibility in relation to sustainability, social and economic, as well as, through innovation and technology applied to the development of new materials that can be used for the construction of buildings, present satisfactory results in relation to the performance and cost reduction that, for the good development of the civil construction industry and, consequently, a marked importance for the national economy. This quest for improvements within the field of civil engineering research today is untiring with regard to the materials used, especially the materials that make up the concrete. However, cement and water remain the most consumed materials worldwide.

Adding short and discontinuous fibers to concrete matrices, whether steel, glass, polypropylene or vegetable fibers, result in a composite. The so-called fiber-reinforced concrete has been called [1].

Technological advances are directly related to the growing development of new materials. In this context, composite materials arise to fill an existing gap when only traditional materials (metals, ceramics and polymers) are considered. This is because, when combining two different materials, a third, which presents new properties. Thus, high performance materials are designed, through manipulation between possible constituents and the optimization of the arrangement in which these constituents are available [1].

The palm of buriti is in abundance and is very used in the north region. Their straws are used in the making of numerous types of handicrafts; of its fruits, a red blood-red oil is extracted for the treatment of burns, which has analgesic and healing effects. However, this fruit is edible and provides, on a large scale, vitamin A contents.

The object of study of this research are the cementitious composites partially replaced with Buriti palm fiber (Mauritia vinifera Martius), which present excellent results to combat the efforts of traction not supported by the concrete due to the low mechanical resistance of the same in its conventional composition, that is, without addition of any reinforcing compound thereto.

2 BIBLIOGRAPHICAL REVIEW

The addition of organic fibers (vegetable) in concrete has gradually gained space as an alternative material for addition and / or substitution, since it is a material that presents low cost compared to the various types available in the market and that produce an excellent flexibility and mechanical resistance to concrete dies. In recent years, the research has been very advanced in relation to the addition of new compounds to the concrete in order to improve the mechanical strength of the concrete and one of the materials that perform very well this requirement are the fibers.

In relation to the mechanical strength of the fibers [2] states: The fibers are materials with mechanical properties of great relevance such as high strength and stiffness, in addition to large slender and small sections as geometric characteristics of relevance.

The increase of tenacity is influenced by the fiber concentration and the resistance of the fibers to the pulling which in turn are governed by the aspect ratio (length / diameter) of the fiber and by other factors such as shape or surface texture. Currently, fiber-reinforced concretes (CRF) that have been used for various purposes due to their properties have been highlighted [2].

This material is used as reinforcement from the Neolithic period from 14600 to 4500 BC, a time known as the clay era, where the constructions were of reinforced clay with vegetable residues such as straw cut or grams, in order to facilitate the drying and better distribute the cracks formed, to date has not been confirmed if it was intentional.

The reality is that these constructions presented characteristics superior to the houses of taipa, still in use mainly in the northeast Brazilian. Asbestos cement was the first asbestos cement to be produced on a large scale in the early 20th century, where it was widely used in the manufacture of tiles and water tanks, but its use today is banned in several countries due to the proven health damages in the use of asbestos. The incorporation of the fibers into fragile matrices such as the cementitious ones modifies their characteristics, increases their ductility, tenacity, tensile strength and impacts [4].

Currently in the market there exists a large scale of fibers for such purposes, the most used are: steel, polypropylene, polyester and glass. In contrast to the use of synthetic fibers, more and more studies are taking place on the basis of recycled and vegetable fibers. There is research on cementitious composites reinforced with fibers from pet bottles, rubber and steel fibers from tires and vegetable fibers such as bamboo, curauá, coconut, eucalyptus, jute, sisal and others. The main advantage of these is the cost, due to come from reuse and renewable sources. This leads to a low cost final product compared to conventional products [5].

The vegetal fibers, treated in this research, began to be used in the matrix of cementitious composites in Brazil in 1980 and, based on studies carried out by researchers from the Center for Research and Development (CEPED) in Camaçari, Bahia [6]. Since then its use has been quite widespread, especially the Amazonian fibers due to the large scale of production in the region.

Composite materials of fiber-reinforced polymer matrix, widely used in structural applications, stand out for their excellent mechanical properties, also associated with a lower density than their traditional alternatives. Composite material consists of the macroscopic combination of two or more different materials. The first constituent is called the matrix. It unites, shapes and protects an arrangement of a more resistant material, called reinforcement [1].

According to the studies of [7], at the age of 28 days a very satisfactory result of mechanical resistance was obtained in relation to the 7 days, which must have occurred because it was a longer term and the fiber achieved an acceptable reaction in the cementitious composite and can be applied to reinforce mortar.

The mechanical properties of a composite material can be evaluated from two different points of view. Micromechanics is an analysis of the interaction between constituents at a microscopic level, through which the properties of the constituents are estimated from the properties of a blade. Macromechanics analyzes a composite material on a macroscopic scale, inserting the configuration of the blade arrangement in determining the mechanical behavior of the material [1].

In view of these analyzes, the insertion of buriti palm fibers was used as a partial replacement material for the cement, in relation to the reference concrete (mixture) of the concrete, with influence in the physical-mechanical behavior of properties such as water absorption versus resistance to compression, where the value found was sufficient to conform to the technical standards of the Brazilian Association of Technical Standards (ABNT) and exceeded the expectations of the reference trait.

3 MATERIALS AND METHODS

The methods of analysis of this research were laboratory tests for each stage of characterization of the concrete constituent materials, as well as the experimental dosage of the traits produced and physical-mechanical behavior analysis. However, the initial step of this study was the accomplishment of a bibliographical research about the main subjects discussed here, such as the use of fibers in cementitious matrixes, characterization of materials and concrete dosage methods in scientific literature, articles, monographs, theses and dissertations, engineering books, electronic journals, technical standards, and others.

3.1 PHYSICAL CHARACTERIZATION OF FIBERS

3.1.1 FIBER COLLECTION AND PREPARATION

The buriti fibers were collected in the municipality of Oriximiná-Pá, with distance approximately 482 km from the capital of the state of Amazonas (AM). As they were collected in their natural state, they were on the ground the clasps of the buriti palm, in order to obtain the desired fibers. From the total volume of fibers collected, two fasteners were used in order to obtain the largest amount of fibers for the study. The removal of the buriti fibers was done manually, with the need to pre-wash the fasteners to eliminate the residues that could affect the preparation of the concrete (Figure 1).

Figure 1: Fibers without wash. Source: The Authors, (2017).

After removal, the fibers underwent a natural drying process. The subsequent step consisted of a pre-treatment of the fasteners, [8] where the fibers were immersed in boiling water for a time interval of thirty minutes and then placed in sieves to drain the liquid waste generated in the process. And by purpose, they were dried naturally by exposure to the sun for a period of ten hours (Figure 2).

Figure 2: Fibers after the wash. Source: The Authors, (2017).

3.1.2 DETERMINATION OF SPECIFIC MASS

For the accomplishment of this work, it was necessary to determine the specific mass for the fibers in question. And according to [9], the specific mass of the fibers was obtained by the volume of ethyl alcohol displaced in a beaker with the addition of a certain quantity of fibers.

The choice of ethyl alcohol was due to its low density in order to avoid that the fibers floated, because the fiber density was unknown [10].

For the test three samples of 1g of fibers were measured on a digital scale. The samples were placed in a beaker containing 50 ml of ethyl alcohol and then the volume variations were recorded. The remainder of the samples were processed in the same manner (Figure 3).

Figure 3: Determination of the specific mass of the fibers. Source: The Authors, (2017).

3.2 CHARACTERIZATION OF CEMENT AND AGGREGATES

The characterization tests of the constituent materials of the concrete were elaborated in the laboratory of constructive techniques and materials of construction of the University Center of the North (UNINORTE).

3.2.1 CEMENT

The word cement comes from the Latin caementu, which designates in the old Rome a kind of natural stone of rocks and not squared. The origin of the cement goes back some 4,500 years. The monuments of ancient Egypt already used a garter consisting of a mixture of calcined gypsum. The great Greek and Roman works, such as the Pantheon and the Colosseum, were built using the soils of volcanic origin on the Greek island of Santorini or in the vicinity of the Italian city of Pozzuoli, which had water-hardening properties [11].].

Portland cement is one of the most important building materials and highly employed by mankind. It is characterized as a fine powder with agglomerating properties, binders or binders, which hardens under the action of water. After hardening, even if it is again subjected to the action of water, portland cement does not decompose anymore [12].

Cement composite portland with addition of carbonaceous material (CP II-F) is added with carbonyl filler. This material consists of ground rocks where they contain calcium carbonate (example: limestone). This addition makes concretes and mortars easier to work because their particles have appropriate dimensions to fit the particles of the other cement components [13].

Its use is recommended for floors and bricks of soil-cement (material obtained by mixing soil, cement and water), and can be used in the preparation of mortars for laying, coating, reinforced mortar, simple concrete, reinforced, prestressed, designed (concrete that requires the control of heat of hydration of the cement to avoid the appearance of cracks that damage the structure), precast elements, artifacts, floors and concrete pavements, among others [13] .

In this research the cement used was the CP I-S-40, branded Cemex (Figure 4). The option for this type of cement containing up to 5% of pozzolan additions is justified because it is the only one with availability in the city of Manaus of cements without additions, types CP I or CP V, it was considered the cement used as the most suitable for the research.

Figure 4: Cement selected for research. Source: The Authors, (2017).

For cement quality analysis, the following procedures were used:

a) Determination of specific mass; NBR NM 023 - Portland cement and other powdered materials - Determination of specific mass, 2001;

b) Determination of fineness; NBR 11579 / MB 3432 Determination of fineness by means of the 75 µm sieve (No. 200), 1991;

c) determination of the paste of normal consistency; according to the NBR norm NM 43 - Determination of the paste of normal consistency of the cement, of 2003;

d) Determination of take-up times; according to the NBR norm NM 65 - Determination of cement picking time, 2003;

e) Determination of the compressive strength; procedure performed according to norm NBR 7215 - Portland Cement: Determination of compressive strength, 1996.

3.2.2 AGGREGATED SMALL (MIÚDO) AND LARGE (GRAÚDO)

Concrete is a composite material consisting of cement, water, small aggregate (sand) and aggregate (stone or gravel), and air. It may also contain additives (fly ash, pozzolans, active silica, etc.) and chemical additives with the purpose of improving or modifying their basic properties [14].

Schematically it can be indicated that the paste is cement mixed with water, the mortar is the paste mixed with the sand, and the concrete is the mortar mixed with the stone or gravel, also called simple concrete (concrete without reinforcements). Figure 5 to 11 show photographs of the cement, the small aggregates, the cement paste, the mortar composing the concrete [14].

Figure 5: Cement. Source: [14], (2006).

Aggregates can be defined as granular and inert materials that come in the composition of mortars and concretes. They are very important in concrete because about 70% of their composition is made up of aggregates, and are the least cost materials of concretes. Aggregates are classified as originating in natural and artificial. The natural aggregates are those found in nature, such as river sands (Figure 6) and gravel, also called gravel or pebble. Figure 11. Artificial aggregates are those that have undergone some process to obtain the final characteristics, such as brittle grinding of rocks [14].

Figure 6: Small Aggregated (natural sand). Source: [14], (2006).

Figure 7: Large Aggregated (rock). Source: [14], (2006).

Figure 8: Cement and water paste. Source: [14], (2006).

Figure 9: Grout. Source: [14], (2006).

Figure 10: Simple Concrete. Source: [14], (2006).

Figure 11: Rolled pebble. Source: [14], (2006).

In the classification as to the dimensions the aggregates are called kid, like sands, and large, like stones or britas. The small aggregate has a maximum diameter of 4.8 mm or less, and the large aggregate has a maximum diameter greater than 4.8 mm. The large aggregates (brittle) have the following numbering and maximum dimensions according to Figure 12 to 15 [14].

Figure 12: Rock 0 (4,8mm a 9,5 mm). Source: [14], (2006).

Figure 13: Rock 1 (9,5mm a 19,0 mm). Source: [14], (2006).

Figure 14: Rock 2 (19,0 mm a 38,0 mm). Source: [14], (2006).

Figure 15: Rock 2 (38,0 mm a 76,0 mm). Source: [14], (2006).

The procedures for quality testing and characterization of aggregates are determined by the ABNT NBR 7211/05 standard, where it makes references on the following specifications: as the blocking process to reduce sampling, the weight of the materials to perform each test method , storage type, and so on. The following is a list of procedures performed according to technical standards.

a) NBR NM 046; Determination of the fine material passing through the No. 200 sieve by washing, 2003;
b) NBR 7251; Aggregate in loose state, 1982;
c) NBR NM 248; Determination of the granulometric composition, 2003;
d) NBR 9776; Aggregates - Determination of the specific mass of small aggregates by means of the Chapman vial, 1987.

4 RESULTS AND DISCUSSIONS

4.1 FIBERS

The fiber content has great importance in the performance because this parameter defines the number of fibers in the section of rupture that will work as bridge of transference of tension. The higher the content, the greater the probability that the cracks will intercept a larger number of fibers. The fiber content influences the concept of critical fiber volume. The critical fiber volume is that for which the composite maintains a post-crack residual resistance equal to the matrix strength [15].

4.1.1 SPECIFIC MASS

In this work, the results obtained for the test of determination of the specific mass of the fibers in question are in table 1.

Determination	Mass (g)	Reading 1 (cm^3)	Reading 2 (cm^3)	Específic Mass (g/cm^3)
Sample 01	1,00	50,00	51,00	1,00
Sample 02	1,00	50,00	51,00	1,00
Sample 03	1,00	50,00	51,00	1,00
Average (g/cm^3)				1,00
Average(Kg/m^3)				1000,00

Table 1. Fibers specific mass. Source: The Authors, (2017).

4.1.2 THERMAL ANALYSIS

As well as, the thermal analysis tests for buriti palm fibers were also carried out, the study focus of this work, which presented the results according to the thermogravimetric curve of Figure 16.

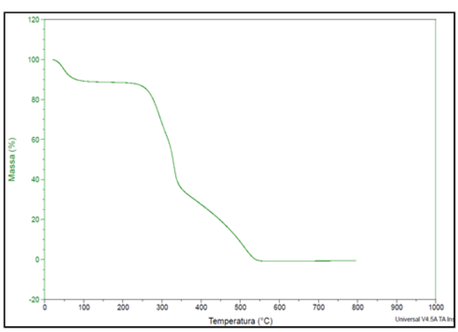

Figure 16. Thermogravimetric curve for buriti palm fiber.Source: The Authors, (2017).

The fibers had a specific mass (Table 1) similar to that obtained by authors previously with a value of 1.1 g / cm^3, similar to the specific mass of the water [9]. According to the thermogravimetric curve of the fibers, it includes degradation processes of elements such as cellulose, hemicellulose, lignin, pectin and other materials. It can be observed (Figure 16) that the fibers present a higher degradation rate from 300ºC, a fact that proves the thermal resistance of the fibers until their total degradation, at about 800ºC. These results resemble those obtained in the thermal analysis of açaí seed fibers.

4.2 FIBERS

4.2.1 COMPRESSION RESISTENCE

The values of compressive strength of the Portland cement had a satisfactory result. Table 2 shows the values Obtained for the axial compressive strength of the cement.

Trace	Burst load (Kgf)		Compressive strength (MPa)		Average (MPa)
	7 days	28 days	7 days	28 days	7 days
1:3:0,48	5046,0	8056,5	25,70	41,03	25,57
	5013,0	7993,6	25,53	40,71	**28 days**
	5001,6	7980,6	25,47	40,64	40,80

Table 2. Resistance to axial compression of cement.
Source: The Authors, (2017).

The results of the characterization tests of the cement used were compared to those obtained in studies [16] for the same type of cement (CP I S 40) and the same manufacturer. The value obtained for specific cement mass was lower, but with little variation in relation to the comparative value (3190 Kg / m^3) and with the characteristic value of 3150 Kg / m^3. This property is of great importance for the calculations of material consumption in the produced mixtures [17]. The fineness index of the binder was lower than the maximum limit established by NBR 5732/1991 (item 5.5, table 3) of 10% and the value compared to 2.96%, and can be applied for these purposes [10].

The fineness of the cement regulates the velocities of the hydration reaction of this, the increase of this factor contributes to the improvement of properties such as the resistance, especially in the early ages, reduction of the exudation and other types of segregation, which results in a concrete with greater impermeability, workability and cohesion [18]. In contrast, there is greater release of heat and retraction, which can proceed in concrete more susceptible to cracking.

Another important reason for the characterization of the cement is its picking time, this phenomenon concerns the evolution of the mechanical properties of the paste at the beginning of the hardening process of the same, such characterization is determined by two different times, the start time and end of handle [17]. From a practical point of view, the handle start time can be considered as the useful period of application of the concrete [16].

For the CP-I S of the Cemex brand, handle and start values were obtained from 1h45min and 2h45min, respectively and 1h30min and 2h40min, according to the manufacturer's data [19]; the results obtained in the tests were 1h30min for the beginning of the handle, that is, in accordance with the results used as parameters and with the minimum limit established by NBR 5732 NBR 5732/1991 (item 5.5, table 3) of 1h, and 3h10min for the end of handle, a value higher than the established guidelines, but much lower than the maximum limit according to NBR 5732/1991 (item 5.5, table 3) of 10h**.**

4.3 CONCRETE DOSAGE

Concrete is considered as a composite material, in this way it is of paramount importance to the characterization of the materials that constitute it, since it presents a heterogeneous and quite complex structure. The knowledge of the properties of each constituent allows a better control over its final properties, since it is known that these are born in its internal structure [2].

For the aggregate (sand / gravel powder) the results obtained through the particle size analysis showed that the sand / Crude powder used is considered medium because its fineness modulus is equal to 2.2 and it is in the optimal zone of use which ranges from 2.20 to 2.90, described in NBR 7211/2009 (item 5.1.1, table 2) and in the range of 2.7 and 3.0 recommended for concretes with good resistance [20].

From the granulometric analysis of the large aggregate a maximum characteristic size of 9.5 mm was obtained.

4.3.1 CALCULATION OF THE TRACE

The following information was required for the dosing of the concrete (Table 3):

Concrete	
Fck (MPa)	25
Sd (MPa)	4
Cement	
Normal resistance at 28 days (MPa)	40
Especific mass (Kg/m³)	3100,96
Added small	
Modulus of fineness	2,51
Specific gravity of the sand (Kg/m³)	2620,0
Unit mass of sand (Kg/m³)	1560,0
Specific mass of gravel powde (Kg/m³)	2620,0
Unit mass of gravel powder(Kg/m³)	1580,0
Heavy aggregate	
Maximum characteristic dimension (mm)	9,5
Especific mass (Kg/m³)	2770,0
Unit mass(Kg/m³)	1580,0

Table 3. Preliminary dosing information. Source: The Authors, (2017).

The dosage of the concrete was found according to the method of the Brazilian Association of Portland Cement (ABCP, 2009); resulted in a reference trace equal to 1: 0.8: 1.14: 2.34: 0.55. From this, three more traces were elaborated for analysis with different levels of fiber substitution.

4.3.2 ABSORPTION OF WATER BY IMMERSION OF THE BODIES OF PROOF

Table 4 and figure 17 present results for the absorption of water to the trace, through these it can be observed that the mixture containing only the substitution of 0.5% of fibers obtained the highest rate of absorption with 0.75% while the mixtures 0.5% and 1.0% obtained very close values of 0.70% and with the content of 0.3% of fibers obtained the lowest rate, with 0.35%. It can also be noticed that only the substitution of 0.3% had a low absorption, because they presented lower value of absorption when compared the mixtures with reference trait.
The use of pozzolans in the concretes can bring innumerable advantages, among them the decrease of the permeability of the concrete, because the insertion of fines fills more adequately the present voids of the mixture, of this occurs a greater difficulty in the transport of the particles of water. Such behavior is evidenced in the mixture produced, which can be confirmed through the obtained results [21]

Mixture	Dry mass (g)	Saturated mass (g)	Absorption (%)	Average (%)
TR1-CP-0F	3692,2	3720,4	0,76%	0,70%
	3668,3	3692,0	0,65%	
TR2-CP-03F	3708,0	3718,6	0,29%	0,35%
	3654,4	3669,7	0,42%	
TR3-CP05F	3706,0	3743,1	1,00%	0,74%
	3649,7	3667,0	0,47%	
TR1-CP-1F	3665,1	3690,8	0,70%	0,71%
	3676,4	3702,7	0,72%	

Table 4: Absorption of the water mixture. Source: The Authors, (2017).

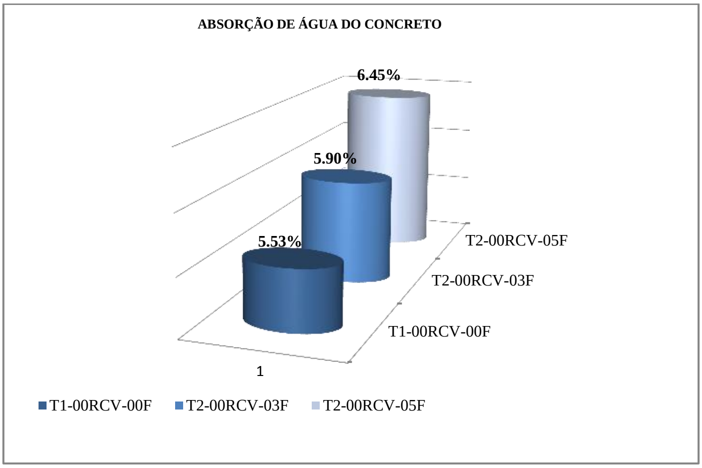

Figure 17: Graph of water absorption of the produced mixtures. Source: The Authors, (2017).

4.3.3 AXIAL COMPRESSION RESISTANCE

Table 5 and figure 18 present the results for the axial compressive strength of the composite, it can be observed that all the traces produced have increasing values to the reference trait, besides presenting the minimum resistance for concrete of structural use according to the NBR 6118/2014 (item 8.2.1).

The traces TR4-CP-1F with substitution of 1.0% fiber content presented better results at 28 days compared to the others, in addition it can be observed that the mixtures containing 0.5% of the same was soon after, because the partial replacement of this content by the cement of the T3-CP-05F trait showed an increase of (---%) and the partial substitution of TR2-CP-03F with 0.3% %) in relation to the reference line TR1-CP-0F, which allows to affirm its viability as partial replacement of the cementitious matrix with the concrete trace.

For the reference concrete dosage, a *fck* of 25 Mpa was used as the parameter, the mechanical resistance was obtained successfully by the concrete produced. Although in its production all the necessary care has been taken for the basis of the specimens to be as uniform as possible.

Mixture	**Bursting load (Kgf)**		**Compressive strength (MPa)**		**Average at 28 days (MPa)**
	7 days	**28 days**	**7 days**	**28 days**	
TR1-CP-0F	18100,0	19780,0	23,05	25,18	26,43
	19000,0	21730,0	24,19	27,67	
TR2-CP-03F	20890,0	21240,0	26,60	27,04	28,00
	20950,0	22750,0	26,67	28,97	
TR3-CP-05F	20700,0	20520,0	26,36	26,13	28,66
	20760,0	24500,0	26,43	31,19	
TR4-CP-1F	20240,0	28000,0	25,77	35,65	36,35
	20250,0	29100,0	25,78	37,05	

Table 5: compression resistance of the water mixture. Source: The Authors, (2017).

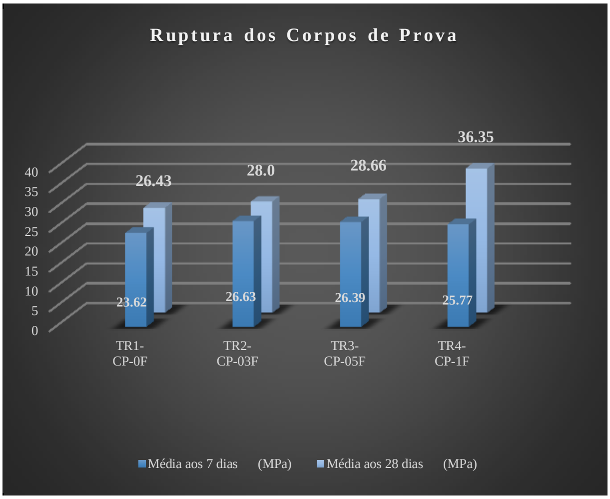

Figure 18: Graph of the axial resistance samples. Source: The Authors, (2017).

5 CONCLUSION

Based on the results presented in this work, it is concluded that the results obtained for the fibers used were similar to the values of studies related to the same theme, with characteristics that allow its use as partial replacement of cementitious matrices.

As well as, the cement used according to the obtained values and compared to the existing studies and normative values confirms the viability of its use for the production of conventional concrete;

Also, for the small aggregate, 40% of medium sand and 60% of Brita Powder were used for the construction of the trace, so the results obtained have characteristics that allow the production of a concrete of great resistance by Brita Powder increase resistance. With the loss of consistency of the trace in relation to it, the A / C was increased to 0.55, and with this we obtained a satisfactory result. Since its modulus of fineness allows to classify it as a medium sand, that is, neither so thick to produce rough concretes and with less workability and nor so fine so that it influences the consumption of cement and consequently there is reduction of the resistance of the cementitious composite . In view of this, it is considered the same as good quality for the development of the analysis;

Also, based on the results presented, it was concluded that the characterization tests of the large aggregate allowed to evaluate its quality for use in concrete, it has a maximum characteristic size of 12.5 mm, where a dimension of 9.5 mm for best results which is considered to be a good quality diameter so that high strength and non-cracking concrete can be obtained between the transition zone of the aggregate with the slurry, moreover such granulometric characteristic is in the ideal range for concrete use with a low cement consumption share, one of the factors of this study. The other physical indices pertinent to this aggregate were in agreement with the normative requirements of the tests carried out in the same ones, which proves the viability of its use for confection of the mixtures;

And, from the data obtained for the concrete materials of the concrete, the choice of the 1: 0.8: 1.14: 2.34: 0.55 trace according to the ABCP method allowed the objective of the concrete that showed a good mortar-aggregate ratio during the making of the trace. This reference trait made possible the production of the other mixtures with the distinct contents of partial replacement of the fibers with the cement;

Also, for the tests of resistance to axial compression Buriti (Mauritia Vinífera Martius) palm fibers had an optimum performance in the tract (mixture) TR4-CP-1F at 28 days, where it obtained a resistance increase of -%) to the reference line TR1-CP-0F, but the concretes produced with the same presented better behavior in the cracking, in relation to the concretes without addition;

Therefore, it is necessary to analyze new partial replacements of the Buriti (Mauritia Vinífera Martius) fibers for future researches and for a better physicochemical performance, it is necessary to increase the partial substitution of the fibers with respect to the reference trait so that it can know how far the resistance will reach with the replacement.

6 SPECIAL THANKS

UFPA and UNINORTE Laureate International Universities.

7 BIBLIOGRAPHIC REFERENCES

[1] GALLI, C.A. **Caracterização das Propriedades Mecânicas de Compósitos de Matriz de Epóxi com Fibras de Carbono Unidirecionais.** Universidade Federal do Rio de Janeiro Escola Politécnica, 2016. Disponível em: <http://monografias.poli.ufrj.br/monografias/monopoli10016041.pdf>. Acesso em 04/dezembro/2017.

[2] MEHTA, P.K.; MONTEIRO, P.J.M. **Concreto: Estrutura, Propriedades e Materiais.** 1 ed. São Paulo: PINI, 1994. 581 p.

[3] NAVARRO, R. F. **A Evolução dos Materiais, Parte 1: da pré-história ao início da era moderna.** Revista Eletrônica de Materiais e Processos, 2006.

[4] CALLISTER, William D. Jr. **Ciência e engenharia de materiais: uma introdução.** 5ªedição. Rio de Janeiro: LTC, 2000.

[5] CORÓ, Angela Ghisleni. I**nvestigação das propriedades mecânicas de concretos reforçados com fibras pet.** 2002. 64 f. TCC (Graduação) - Curso de Engenharia Civil, Universidade Regional do Noroeste do Estado do Rio Grande do Su, Ijuí, 2002. Disponível em: <http://www.projetos.unijui.edu.br/petegc/wp-content/uploads/2010/03/TCC-Angela-Ghisleni-Cor.pdf>. Acesso em: 25 ago. 2016.

[6] SAVASTANO JÚNIOR, Holmer. **Materiais à base de cimento reforçados com fibra vegetal: reciclagem de resíduos para a construção de baixo custo.** 2000. 152 f. Tese (Doutorado) - Curso de Livre Docência, Universidade de São Paulo, São Paulo, 2000. Disponível em: <http://www.usp.br/constrambi/producao_arquivos/materiais_a_base_de_cimento.pdf>. Acesso em: 24 ago. 2016.

[7] LEITE, Josiane dos Santos. **Estudo da visibilidade da fibra de buriti como reforço de compósitos cimentícios.** Manaus, 2016.

[8] SARMIENTO, Cecilia Ramirez. **Argamassa de cimento reforçada com fibras de bagaço de cana-de-açucar e sua utilização como material de construção.** 1996. 120 f. Dissertação (Mestrado) - Curso de Pós-graduação em Engenharia Agrícola, Universidade Estadual de Campinas, Campinas, 1996. Disponível em:

<http://www.bibliotecadigital.unicamp.br/document/?code=vtls000116367&fd=y>. Acesso em: 12 set. 2016.

[9] BARBOSA, Eduarda Pereira. **Análise de comportamento físico-mecânico do concreto de cimento Portland com adição de fibras de semente de açaí e resíduo cerâmico**. Amazonas, 2017.

[10] LIMA JÚNIOR, Ubirajara Marques. **Fibras da semente do açaizeiro (Euterpe Oleracea Mart.): avaliação quanto ao uso como reforço de compósitos fibrocimentícios.** 2007. 145 f. Dissertação (Mestrado) - Curso de Pós-graduação em Engenharia e Tecnologia de Materiais, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, 2007. Disponível em: <http://repositorio.pucrs.br/dspace/handle/10923/3384>. Acesso em: 17 ago. 2016.

[11] SINDICATO NACIONAL DA INDÚSTRIA DO CIMENTO (SNIC). SNIC 50 Anos. Rio de Janeiro 2006b Acesso em www.snic.org.br, 04/12/2017.

[12] ASSOCIAÇÃO BRASILEIRA DE CIMENTO PORTLAND. **Guia básico de utilização do cimento Portland.** 7.ed. São Paulo, 2002. 28p. (BT-106).

[13] PEREIRA, A.C; et al. **Cimento Portland.** Universidade do Estado do Mato Grosso Campus Universitário de SINOP. Sinop, 2013. Disponível em: <http://sinop.unemat.br/site_antigo/prof/foto_p_downloads/fot_7092cimento_pobtland_pdf.pdf>. Acesso em: xx xxx.2017.

[14] BASTOS, P. S.; SANTOS, D. Fundamentos do concreto armado. **UNIVERSIDADE ESTADUAL PAULISTA UNESP - Campus de Bauru/SP FACULDADE DE ENGENHARIA Departamento de Engenharia Civil Disciplina:**, n. wwwp.feb.unesp.br/pbastos, 2006.

[15] LO, F. et al. Fibras para concreto e argamassa Acabamento do concreto Concreto pré-moldado Compatibilidade e resistência Resistência a impacto e estilhaçamento Laudo Técnico *. [s.d.].

[16] Associação Brasileira de Normas Técnicas – ABNT NBR 5732 - Cimento Portland Comum. Rio de Janeiro, 1991.

[17] BAUER, L.A.F. **Materiais de construção.** 5. ed. Rio de Janeiro: Livros Técnicos e Científicos (LTC), 1994. 435 p.

[18] HELENE, Paulo; Terzian, Paulo**. Manual de dosagem e controle do concreto.** São Paulo: PINI, 1992. 349p.

[19] OLIVEIRA, Mesaque Silva de. **Desenvolvimento e caracterização de telhas cimentícias reforçadas com tecido de fibras vegetais da amazônia.** 2017. 118 f. Dissertação (Mestrado) - Curso de Pós-graduação em Engenharia Civil, Universidade Federal do Amazonas, Manaus, 2017.

[20] AÏTCIN, P.C. **Concreto de Alto Desempenho.** São Paulo: Pini, 2000.

[21] OLIVEIRA, Marília Pereira de et al. **Estudo do caulim calcinado como material de substituição parcial do cimento portland.** In: CONFERÊNCIA BRASILEIRA DE MATERIAIS E TECNOLOGIA NÃO-CONVENCIONAIS: HABITAÇÕES E INFRA-ESTRUTURA DE INTERESSE SOCIAL BRASIL-NOCMAT 2004, 1., 2004, Pirassununga. **Anais.** Pirassununga: Conferência Brasileira de Materiais e Tecnologia Não-convencionais: Habitações e Infra-estrutura de Interesse Social, 2004. p. 1 - 10. Disponível em: <http://www.usp.br/constrambi/producao_arquivos/estudo_de_caulim.pdf>. Acesso em: 18 ago. 2016.