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COMPARISON OF CHITOSAN SULFATION METHODS FOR CU² ADSORPTION[+]

COMPARAÇÃO DE MÉTODOS DE SULFATAÇÃO DA QUITOSANA PARA ADSORÇÃO DE CU²⁺

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ABSTRACT[1]
Chitosan is a polysaccharide that has free amine and hydroxyl groups, which is considered a good adsorbent material for heavy metals in contaminated water. In order to improve this property, some necessary modifications have been proposed in order to increase the adsorptive capacity of this polysaccharide. The objective of this work was to modify the structure of chitosan and carboxymethyl chitosan by sulfation, to characterize the materials synthesized through yield, by FT-IR and to analyze elementary and evaluate an adsorbent capacity of the materials against copper ions. The results attenuated that the reaction yield of the materials varied from 58% to 91%, and it was possible to identify through FT-IR the required groups C-O-S and S = O regarding the insertion of the sultate groups, identifying the presence of the sulfate groups in the structure. In adsorption tests, as sulphates sulphated over a percentage of adsorption above 90% copper, a performance superior to pure chitosan (%). The adsorptive capacity of 63 mg / g, in relation to the results found in the literature. Thus, it was observed that sulfation is a viable modification route for adsorption of metals.

KEYWORDS*: Adsorption. Sulfation. Copper.*

RESUMO
A quitosana é um polissacarídeo que possui grupamentos amina e hidroxila livre, sendo essa considerada um bom material adsorvente de metais pesados em águas contaminadas. Afim de melhorar essa propriedade algumas modificações estruturais têm sido propostas a fim de aumentar a capacidade adsortiva deste polissacarídeo. O objetivo deste trabalho foi modificar por sulfatação a estrutura da quitosana e da carboximetilquitosana, caracterizar os materiais sintetizados através de rendimento, por FT-IR e análise elementar e avaliar a capacidade adsorvente dos materiais frente a íons cobre. Os resultados mostraram que o rendimento reacional dos materiais variou de 58% a 91%, e foi possível identificar

[1]Article from the Annals of the I Symposium on Environment and Energy (I SiMAE) – Fortaleza, CE

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através de FT-IR os grupos funcionais C-O-S e S=O referentes à inserção dos grupos sulfatos, identificando a presença dos grupos sulfato na estrutura. Nos ensaios de adsorção, as amostras sulfatadas apresentaram um percentual de adsorção acima de 90% de cobre, um desempenho superior à quitosana pura (%).A capacidade adsortiva foi de 63 mg/g, comparado aos resultados presentes na literatura. Desta forma, observou-se que a sulfatação é uma rota viável de modificação para a adsorção de metais.

PALAVRAS-CHAVE: Adsorção. Sulfatação. Cobre.

1. INTRODUCTION

Water is one of the most essential resources for life on earth, where studies and research on sustainable methods to increase freshwater quality through the decontamination of water beds have been reported (DESBRIERES; GUIBAL, 2018). Adsorption is one of the proposals that has several advantages, as it manages to remove both organic and inorganic pollutants and in addition to producing a low amount of waste (SPINELLI *et al.,* 2005). Among the adsorbent materials, polysaccharides have stood out, because in addition to having a high efficiency, they are also economically viable, biocompatible , biodegradable and non-toxic materials. (ARAMWIT; YAMDECH; AMPAWONG, 2016). Chitosan is a polysaccharide derived from chitin, found in great abundance in nature in crustacean shells that have good adsorptive potential (JIANG et *al.* , 2014). In recent years, modifications have been proposed in the structure of chitosan in order to increase its adsorptive capacity , as it has free amine and hydroxyl groups , which facilitates the entry of new groups (VAKILI *et al.* , 2014). Sulfation is a modification used that makes the structure of polysaccharides with a negative surface charge, which facilitates their adsorbing action through a complexation mechanism with metal ions that have a positive surface charge (SILVA, 2012). Copper is a heavy metal widely used in the electroplating industry due to its high conductivity and one of the components of some fungicides. Due to its applicability, due to improper handling or disposal, it can be found as a pollutant in high concentrations in soil and water (ANDREAZZA *et al.* , 2010). Thus, the objective of this work was to develop sulfated functional derivatives from chitosan and carboxymethylchitosan , in order to test their adsorptive capacity against copper.

2. Materials and methods

2.1 - Materials

Chitosan (Polymar), acetic acid (dynamic), monochloroacetic acid (dynamic), sodium hydroxide (cromoline), isopropyl alcohol (neon), methyl alcohol (neon), sodium bisulfite (synth), sodium (synth) and sodium sulfate (vetec .

2.2 Synthesis of sulfated chitosan

Two types of sulfation reaction were carried out on the original chitosan and on the chitosan carboxymethylated ; The carboxymethyl chitosan was synthesized in a previous work according to the methodology described in ABREU, 2008. In the first sulfation method, a sulfating agent was used where 10 mL of a 3.1% m/v $NaHSO_3$ solution was added to a solution of 3.1% m/v. The mixture, which acts as a surfactant,

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was stirred for 90 min at 60°C. The pH of the solution was corrected to 9.0 with NaOH or HCl . Then , 0.5 g of pure QT or carboxymethyl chitosan was added to the sulfating agent , leaving it under magnetic stirring for 4 h at 40°C. Finally, the supernatant was centrifuged and discarded and the precipitate was washed with distilled water and dried at 60°C in an oven. in the second method of sulfation sodium sulfate was used. 3 g of chitosan or carboxymethyl chitosan were added to 100 ml of 3% acetic acid and allowed to stir until homogenized. 100mL of 4 % sodium sulfate was added to the solution under stirring for 90 min. The precipitate was then centrifuged at 4000 RPM, washed and lyophilized.

2.3 - Characterizations

Four types of bioadsorbent materials were synthesized and these functional derivatives were characterized by infrared spectroscopy (Thermo Scientific with KBr tablets) to evaluate functional groups, as well as to indicate the synthesis reaction, an elemental analysis was also carried out to prove the presence of sulfur in the modified polysaccharide structure and to calculate the degree of substitution through the equation 1. (PAIVA JUNIOR, 2020)

$$GS = \frac{\left(\frac{S\%}{massa\ atômica\ do\ S}\right)}{\left(\frac{C\%}{massa\ atômica\ do\ C}\right)6} \qquad (1)$$

To calculate the yield where the initial mass of chitosan and the mass after the reactions were weighed, it was possible to observe the reaction yield

2.4 - Adsorption tests

For the adsorption studies, approximately 0.3 g of samples were weighed each and immersed in 40 mL of 0.3 mol/L copper sulfate solution. After 24 h, an aliquot was taken and the remaining copper was determined using EDTA - 0.01001 Mol/L. The remaining Cu +2 ion concentration was calculated by the equation below:

$$q = (ni - nf) / m \qquad (2)$$

Where q is the adsorptive capacity , ni is the initial number of moles, nf the final number of moles in the mass of sample used.

3. Results and discussion

Two sulfated derivatives of chitosan were produced , chitosan sulfated with sulfating agent (QTS) and sulfated with sodium sulfate (QTSNa). Sulfated derivatives of carboxymethyl-chitosan were also produced , carboxymethyl chitosan sulfated with sulfating agent (QTCS) and sulfated with sodium sulfate (QTCSNa). The percentage yield by mass of the functional derivatives was determined in order to analyze the feasibility of each process and its cost-benefit ratio, whose values are shown in table 2. It is observed that the direct derivatives of chitosan obtained a higher yield in relation to the derivatives of carboxymethylchitosan , in which QTS and QTSNa had a yield greater than 89%, indicating that they are viable processes and that they have an excellent cost-benefit ratio, as it is a process carried out in fewer steps, therefore with lower cost and high yield . The sulfated derivatives of carboxymethylchitosan obtained yields of 68% for QTCS and 58% for QTCSNa , where losses occur due to the process

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involving several steps, susceptible to more losses in each washing and purification step.

3.1 Infrared Spectroscopy

In the QT spectrum, it is possible to observe the characteristic peaks of chitosan , where a broad band is observed in the region of 3426 cm-1 referring to the OH stretch and in the same region the peak referring to the NH stretch is superimposed, there are also peaks in the region of 1656 cm-1 referring to the C=O bond and in 1080 referring to the CO stretch. In the sulphated derivatives of chitosan and carboxymethylchitosan , it is possible to observe the characteristic peaks of chitosan , it is also possible to observe the existence of bands referring to the entrance of the sulphate groups, where they are present in all derivatives at approximately 617 cm $^{-1}$, referring to for the COS stretch and in the QTCS and QTCSNa , there is a peak in the region of approximately 1254 cm $^{-1}$ referring to the S=O stretch, whereas in the QTS and QTSNa it was not possible to observe it due to the overlapping of bands. It is possible to observe the peaks of all the samples in Fig 1. Thus, it was confirmed that the sulfate groups were successfully inserted into the chitosan structure .

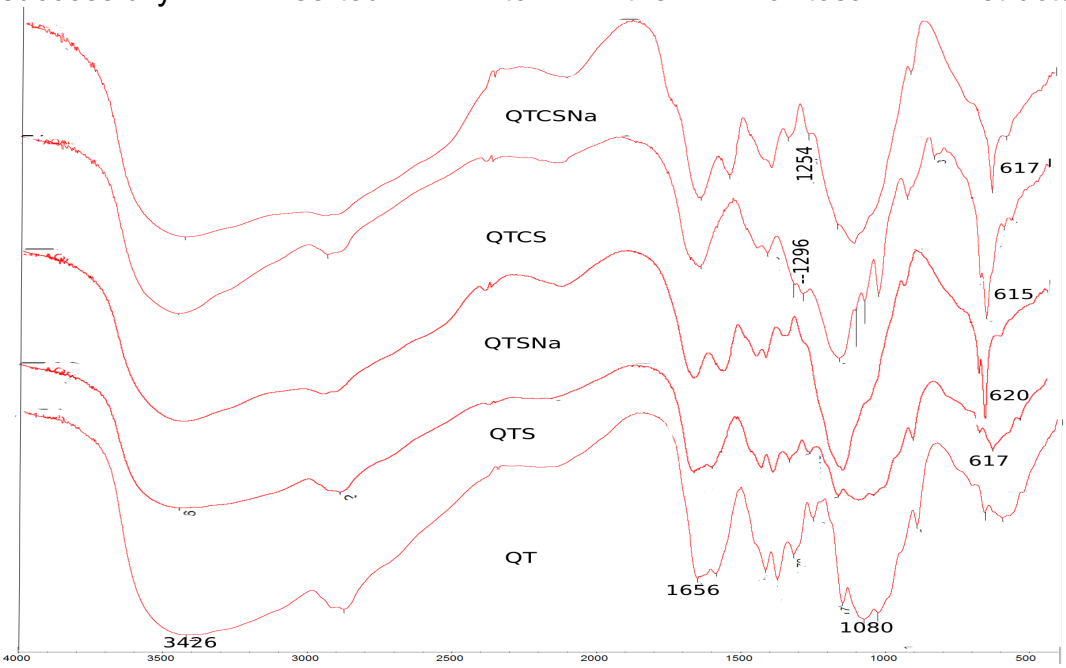

Figure 1: FTIR spectrum of chitosan (QT), sulphating agent sulphated chitosan (QTS), sodium sulphate sulphated chitosan (QTSNa), sulphating agent sulphated carboxymethyl chitosan (QTCS) and sodium sulphate sulphated carboxymethyl chitosan (QTCSNa) .
Source: Prepared by the author.

3.2 Elementary Analysis

Elemental analysis was performed only of pure chitosan (QT) and sulphated chitosan with surfactant agent (QTS) since it obtained a high reaction yield and was also one of the ones that had a higher percentage of adsorption. Thus, it is possible to observe in table 1, that there was an insertion of sulfate groups through the percentage of sulfur present in the structure of the same, which was 7.79%. By calculating the degree of substitution, it was possible to observe that the sulfated chitosan with sulfating agent has a degree of substitution of 1.96%, which in comparison with other

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works has a much higher substitution result. Moura Neto and collaborators (2011) made the sulfation of cashew tree gum, it was observed that it obtained a substitution of at most 0.88%. In comparison with the modification of chitosan by sulfation made by Moraes (2016), QTS also obtained a superior result, since in the work done by Moraes the degree of substitution was at most 1.37%. Thus, it was possible to observe that the method used to modify chitosan using the sulfating agent was successful, having a high degree of substitution.

Table 1: Elementary analysis of QT and QTS.

Sample	%Ç	%H	%N	%S	Degree of replacement (%)
QT	39.58	6.63	9.47	2.37	0.37
QTS	24.83	4.19	6.69	7.79	1.96

Source: Prepared by the author.

3.3 Adsorption study

The insertion of sulfate groups in the chemical structure of QT causes the material surface to have a high density of negative charge, thus favoring the adsorption of metals since they have a positive charge (MORAES, 2016). In this study, all analyzed samples obtained a removal percentage greater than 90%, as can be seen in table 2. Sulfated chitosan obtained a superior result than pure chitosan due to its insolubility at all pHs and it remained at 24 h without lose their proper properties, they become a more promising material for removing metals from industrial effluents.

In table 2 it is also possible to observe the adsorptive capacity of the materials where all obtained a similar capacity and above 60 mg/g in relation to copper, thus showing a high efficiency against this material. Among the 5 analyzed samples, it was possible to observe that the pure chitosan had an adsorptive capacity similar to the modified ones, however, due to its solubility in acid pH, it cannot be used in industrial effluents, which often have a certain acidity. The sulfated chitosans had a high adsorptive capacity and

In addition, they only have one type of modification, different from sulfation against carboxymethyl chitosan . In an article by Futalan *et al.* (2011), where chitosan immobilized with bentonite was used, obtained a capacity of 26 mg/g of copper much lower than the sulfated chitosan . Thus, there are two more promising products, QTS and QTCS, because the QTS is made with only one reaction, it becomes a lower cost product, in addition to a methodology having a high degree of substitution compared to methodologies already carried out in other countries. articles, so it can be considered the most viable product for this purpose, although the others also obtained positive results in relation to the adsorption of metals.

Table 2: Yield and adsorption study

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Sample	Performance (%)	Adsorptive capacity (mg/g)	adsorption percentage (%)
(QT)	-----	64.98 ± 0.009403	97.83 ±0.0014
(QTS)	91.4	64.08 ± 0.2079	98.17 ±0.3185
(QTSNa)	89	64.42 ± 0.02339	97.47 ±0.0352
(QTCS)	68.4	64.15 ± 0.05068	98.53 ±0.0778
(QTCSNa)	57.4	63.76 ± 0.067344	97.16 ±0.1026

Caption: Pure Chitosan (QT); Sulfated chitosan with sulfating agent (QTS); Chitosan sulfated with sodium sulfate (QTSNa); Sulfated carboxymethyl chitosan with sulfating agent (QTCS); Carboxymethyl chitosan sulfated with sodium sulfate (QTSNa).
Source: Prepared by the author.

4. CONCLUSIONS

We sought to modify the structure of chitosan through two sulfation methods in order to expand some of its properties. Thus synthesizing 4 different materials, QTS, QTCS, QTSNa and QTCSNa . Where all of them obtained a similar copper adsorption potential, greater than 90% and with an adsorptive capacity greater than 60 mg/g of copper, the QTS obtained a high degree of substitution and stood out in terms of yield and adsorption percentage , being the product with a high potential for adsorption of metals. Thus, it is possible to use the modification by sulfation for large-scale use in a potential use in the decontamination of industrial effluents contaminated with copper and new tests can be carried out in relation to the adsorption capacity of this material against other heavy metals.

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STABILITY STUDY OF GALACTOMANAN BIOHYDROGEL ASSOCIATED WITH SHA BUTTER[1]

ESTUDO DE ESTABILIDADE DE BIOHIDROGEL DE GALACTOMANANA ASSOCIADO A MANTEIGA DE KARITÉ

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ABSTRACT

This study shows the development of a biohydrogel from galactomannan from the species Delonix regia associated with emulsified shea butter. Due to characteristics such as atoxity, biocompatibility and mainly its use as a vehicle of active principle, biohydrogels have aroused the interest of large industries for natural hydrogels. Shea butter was chosen in the composition of the biohydrogel, because it is used as an emollient, with moisturizing power and has a protective action, has antioxidant properties capable of protecting against free radicals and

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UV rays. The biohydrogels obtained were submitted to organoleptic and physical-chemical evaluation, followed by preliminary stability tests. In view of the analyzes, it was observed that samples remained stable in the organoleptic evaluation and also showed physical-chemical characteristics that can serve the biohydrogel industry, however, when subjected to higher temperatures, they lost water, showing that hydrogels are quite susceptible to changes due to heat exposure. However, even with the loss of water, these formulations have a great potential to become a product for hair and body use.

KEYWORDS: Karite butter. Galactomannan. Biohydrogel.

RESUMO

Este estudo mostra o desenvolvimento de um biohidrogel a partir da galactomanana advinda da espécie Delonix regia associada à manteiga de karité emulsionada. Devido características como atoxidade, biocompatibilidade e principalmente sua utilização como veículo de princípio ativo, biohidrogéis têm despertado o interesse das grandes indústrias por hidrogéis naturais. A manteiga de karité foi escolhida na composição do biohidrogel, por ser utilizada como emoliente, com poder hidratante e possuir uma ação protetora, apresenta propriedades antioxidantes capazes de proteger contra os radicais livres e raios UV. Os biohidrogéis obtidos foram submetidos a avaliação organoléptica e físico-química, seguidos de testes de estabilidade preliminares. Diante das análises, observou-se que as amostras se mantiveram estáveis na avaliação organoléptica e apresentaram também características físico-químicas que podem atender a indústria de biohidrogéis, porém, quando submetidas a temperaturas mais elevadas perderam água, evidenciando que os hidrogéis são bastante suscetíveis a alterações devido a exposição ao calor. Entretanto, mesmo com a perda da água, estas formulações apresentam um grande potencial de se tornarem um produto para uso capilar e corporal.

PALAVRAS-CHAVE: *Manteiga de Karité. Galactomanana. Biohidrogel.*

1. INTRODUCTION

The cosmetics sector, in particular the hair and body products market, has followed a new trend according to the demands of its consumers, betting on products free of petrolatum , sulfates, parabens and silicones, replacing these products with ingredients from from nature.

In this sense, biohydrogels have aroused the interest of large industries for presenting characteristics such as biocompatibility, and the ability to become gels due to their high degree of swelling, resembling living tissue. In addition, they act as a controlled release system of active principles, being a good candidate to replace synthetic polymers (AOUADA, 2009; MOURA, 2005; SABADINI, 2015). Therefore, the use of natural polymers, obtained from renewable sources, such as plants, algae and microbial cultures, especially yeasts and fungi, has a great industrial application because they present low-cost products, are biocompatible , non-toxic, biodegradable and are abundant. in nature (SABADINI, 2015).

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Shea butter is made up of fatty acids and vitamins, having a great importance in the cosmetics area (BAREL; PAYE; MAIBACH, 2009; MARANZ; WIESMAN, 2004; MAANIKUU; PEKER, 2017; SEMMLER, 2011).

In this context, this work presents the development of a biohydrogel from a natural polymer associated with emulsified shea butter. The formulations obtained were evaluated in order to ensure the reliability of the product for possible studies and later applications.

2. MATERIALS AND METHODS

Galactomannan was provided by the Chemical Technology Laboratory of the State University of Ceará. Shea butter was supplied by the company Mapric ® Products Pharmaceuticals .

2.1 *Preparation of the emulsion*

The emulsion was prepared using distilled water, shea butter and fatty acid diethanolamide (DEA) as a surfactant. Initially, distilled water was placed in a 100 mL beaker , followed by the addition of diethanolamide , until the mixture was homogenized; finally, the shea butter was added , heating it for 10 minutes at a temperature of around 50°C until complete homogenization. The emulsions were left to rest for 48 hours and after this period, the emulsion's pH, appearance, color and visual stability were evaluated.

2.2 *Incorporation of emulsified shea butter in galactomannan biohydrogel*

After obtaining the shea butter emulsions and forming the galactomannan biohydrogel , 5% of the shea butter emulsions were reserved for 5 grams of the biohydrogel , in which the emulsion proportions varied by 6.8615g (Formulation A) and 11 .9037g (Formulation B). Then, the formulations were placed in an ultrasound for agitation promoted by ultrasonic energy, for 10 minutes. Then, the samples were placed at rest in the refrigerator for 48 hours to later be analyzed for their organoleptic characteristics and physicochemical properties.

2.3 *Organoleptic and physicochemical parameters*

2.3.1 pH Assessment

The determination of the pH of the prepared samples was carried out at room temperature for 4 weeks using a MACHEREY-NAGEL pH indicator strip.

2.3.2 Density

To analyze the density of the samples, a 25 mL pycnometer was used . Initially, the empty pycnometer was weighed, then it was weighed with water that was used as a standard, and finally the pycnometer containing the ready-made formulations was weighed.

2.3 .3 Organoleptic Properties

The analyzes involved macroscopic aspects such as odor, color and homogeneity, in order to verify some type of instability.

2.4 *Preliminary stability tests*

From the physical-chemical and organoleptic parameters, the stable samples were submitted to preliminary stability tests (ANVISA, 2004).

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2.4.1 Centrifugation

falcon centrifuge test tube , the samples were subjected to cycles of 1000, 2000 and 3500 rpm for 15 minutes each cycle. And then the samples were analyzed macroscopically in relation to their appearance, color, odor, phase separations and pH determination.

2.4.2 Thermal Stress

The samples were submitted to heating in a water bath, in the temperature range of 40 to 80°C. Increasing the temperature by 5°C and remaining for 30 minutes at each temperature. These samples were then subjected to organoleptic tests and pH determination.

2.4.3 Freeze-thaw cycle

The formulations were subjected to different temperature conditions. First, the samples were conditioned in the refrigerator for 24 hours with a temperature range of around 4°C, then the samples were removed and placed in the oven for another 24 hours with a temperature range of 45°C, ending the first cycle. Finally, a total of 6 cycles were carried out, that is, in a period of 12 days with alternation between the refrigerator and the oven. Then, they were analyzed in relation to organoleptic aspects and pH determination.

3. RESULTS AND DISCUSSION

3.1 *Physico - chemical and organoleptic parameters*

3.1.1 pH Assessment

According to Gomes (1999), the pH of the hydrolipidic layer that protects the hair should be slightly acidic, between 4 and 6 on the pH scale. When using products that are too acidic or too alkaline, hair damages, presenting an opaque and dry appearance. The formulations had a pH around 7 and this pH was maintained, as it would not damage the skin or hair.

3.1.2 Density

Analyzing the formulations, it can be seen that there was no significant change since the formulations have different amounts of emulsion.

Table 2 - Determination of the relative densities of formulations A and B

Determination of relative density (25°C)			
SAMPLE **(A)** (g)	mH_2O (g)	ρH_2O (g/mL)	SAMPLE **(A)** (g/mL)
25.1196	26.3246	≅ 1.00	≅ 0.9542
SAMPLE **(B)** (g)	mH_2O (g)	ρH_2O (g/mL)	SAMPLE **(B)** (g/mL)
24.6968	26.7392	≅ 1.00	≅ 0.9269

Source: Prepared fur author .
Where ρ= density .

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3.1.3 Organoleptic Properties

For the formulations obtained, no changes were observed in relation to their organoleptic properties as shown in Table 3. These could then proceed to the stability test.

Table 3 - Organoleptic parameters of the formulations

Formulations	Coloring	Odor	Aspect	pH
THE	whitish	characteristic	Gel	7.0
B	whitish	characteristic	Gel	7.0

Source: Prepared fur author .

3.2 Evaluation of preliminary stability tests

The stability study is very important for these biohydrogel samples , as it will provide information about their behavior under different environmental conditions, such as humidity and temperature, evaluating the extent to which these formulations can remain unchanged (ANVISA, 2004).

3.2.1 Centrifugation

According to Anvisa (2004), the first test that must be performed is the centrifugation test, which is related to the gravitational force in order to verify the increase in the movement of the particles, thus causing a stress in the sample and anticipating possible processes of instability. When centrifuged, the biohydrogels remained stable, maintaining the appearance of a gel, without changes in color or odor, without the formation of phases and changes in pH.

3.2.1 Thermal Stress

In the temperature range of 40-65 ºC , the formulations behaved similarly, even with differences in the amount of water and surfactant. From 65 ºC , there were changes in its characteristics. Regarding their color, they became yellowish, and in their aspects, they became slightly dry due to loss of mass, that is, which is possibly due to the loss of water during the cycle.

3.2 .3 Freeze-Defrost Cycle

During the first, second and third cycles, the samples did not undergo any changes in characteristics such as: gelatinous appearance and whitish color, in addition to maintaining neutrality in the pH value. During the fourth cycle, samples A and B began to undergo changes, showing yellowish colors and the gelatinous aspect was dry, due to the evaporation of water. On the other hand, the odor and the pH value remained the same. Similar results were found by Moura (2005), who, when performing tests with hydrogels , involving temperature, observed a decrease in their volume with increasing temperature, evidencing that they are quite susceptible to changes when exposed to heat. Biohydrogels are also quite susceptible to changes in their appearance due to temperature (DRESSLER , 2008),

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a fact demonstrated in this work, where the samples had the appearance of a plastic film.

4. CONCLUSIONS

The association of emulsified shea butter with galactomannan biohydrogel provided a stable formulation. In the results obtained by the preliminary stability tests, it was observed that after a certain temperature and a repetition of cycles, mass loss occurred, probably due to water evaporation, since the biohydrogel is composed of a high amount of water due to swelling. Regarding the parameters adopted by ANVISA, regarding storage for long periods of time on the shelf, the samples behaved well, maintaining their organoleptic properties and pH, which is an advantage for the product for commercialization purposes. Thus, the formulations need further studies in future evaluations in order to obtain more detailed information about this biohydrogel .

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CHARACTERIZATION OF SODIUM ALGINATE NANOEMULSIONS WITH *EUCALYPTUS CITRIODORA ESSENTIAL OIL*[1]

CARACTERIZAÇÕES DE NANOEMULSÕES DE ALGINATO DE SÓDIO COM ÓLEO ESSENCIAL DE EUCALYPTUS CITRIODORA

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ABSTRACT
The stability properties of nanoemulsions are influenced by emulsification conditions and the composition of formulations. Polymer nano-emulsions were prepared with the help of a mechanical homogenizer, in which five formulations of different concentrations were obtained in order to evaluate the stability with subsequent applications in controlled release systems. Viscosity, Particle Size and Encapsulation Efficiency were evaluated in order to obtain a stable emulsion. The N2 and N4 formulations, which were produced with 2:1 (N2) 1:2 (N4) oil and surfactant ratio and 1:1 (N2) 2:1 (N4) alginate and surfactant, stood out for having smaller Particle Size and more homogeneous size distribution. The N2 formulation obtained higher Encapsulation Efficiency, with a value of 68.2 ± 0.09%. It is assumed that the N2 nanoemulsion is the most favorable, because its formulation has a greater amount of surfactant making the interaction between the oil and the gum greater, thus having a better encapsulation capacity.

KEYWORDS: Alginate. Encapsulation. Essential oil.

RESUMO
As propriedades de estabilidade das nanoemulsões são influenciadas pelas condições de emulsificação e pela composição das formulações. Nanoemulsões poliméricas foram preparadas com auxílio de um homogeneizador mecânico, no qual foram obtidas cinco formulações de diferentes concentrações, no intuito de avaliar a estabilidade com posteriores aplicações em sistemas de liberação controlada. Foi avaliada a Viscosidade, o Tamanho de Partícula e a Eficiência de Encapsulamento visando obter uma emulsão

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estável. As formulações N2 e N4, que foram produzidas com 2:1 (N2) 1:2 (N4) razão óleo e surfactante e 1:1 (N2) 2:1 (N4) alginato e surfactante, se destacaram por apresentar menor Tamanho de Partícula e distribuição de tamanho mais homogêneo. A formulação N2 obteve maior Eficiência de Encapsulamento, com valor de 68,2 ± 0,09%. Supõe-se que a nanoemulsão N2 é a mais favorável, pois sua formulação possui uma maior quantidade de tensoativo fazendo com que a interação entre o óleo e a goma seja maior, assim tendo uma melhor capacidade de encapsulamento.

***PALAVRAS-CHAVE**: Alginato. Encapsulamento. Óleo Essencial.*

1. INTRODUCTION

Nanoemulsions (NE) are composed of mixtures of oils with surfactants that form emulsions with micellar size of 10-1000 nm, reflecting in their translucent aspect. As a result of their reduced size, they suffer less gravity, which gives them greater stability, and they present Brownian motion (DONS, FERRARI, 2016). NE are composed of three phases: aqueous phase and oil phase, often with the presence of an emulsifying agent acting at the interface, sometimes called surfactants or surfactants (CAPEK, 2004). structure of a nanoemulsion. Polymeric nanoemulsions have stood out due to their hydrophilic character, high water permeability, biocompatibility and tensile strength (BRUXEL, FERNANDA *et al.,* 2012). Natural polymers based on polysaccharides have been proposed as matrices for the formation of nanoemulsions, in order to improve the biocompatibility and biodegradability of the systems and improve the stability of nanoemulsions.

Some of these molecules, such as alginates, are able to interact with surfactant chains arranged around the oil droplets. (SALVIA-TRUJILLO, 2015). Eucalyptus is a plant belonging to the Myrtaceae family cultivated in all regions of Brazil, with about 800 known species. The species Eucalyptus citriodora has already been reported by several authors regarding its antimicrobial action (ELAISSI, *et al.*, 2011). The encapsulation of essential oils at the nanoscale represents a viable and efficient approach to increase the physical stability of bioactive compounds (WEISS *et al.,* 2009). EN appear as systems capable of effectively encapsulating, protecting and releasing these compounds (SALVIA-TRUJILLO and McCLEMENTS, 2016). The present work seeks an effective nanoemulsion in encapsulation for essential oil protection for application in controlled release systems.

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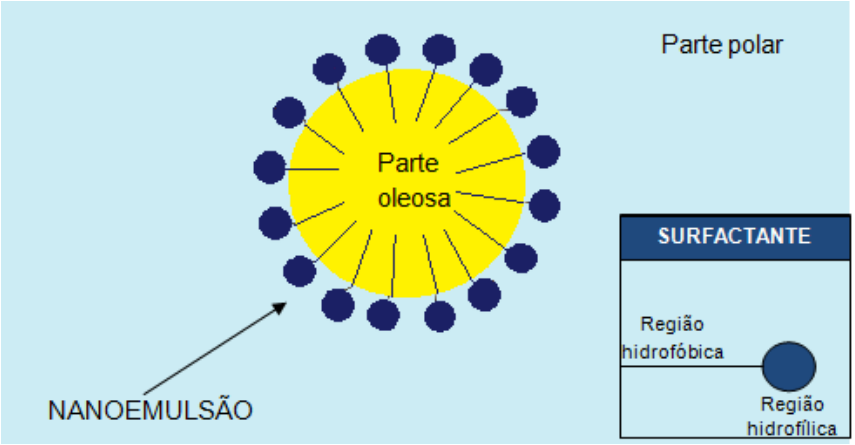
Figure 1- Structure of a nanoemulsion (SOURCE: Author's own)



2. Materials and methods

materials

Sodium Alginate (DINÂMICA), essential oil of Eucalyptus citriodora (FERQUIMA) was used, the surfactant used was Tween 80 ®. Water bath (CIENTEC), hot plates (QUIMIS), a high energy mechanical stirrer, the Ultra-stirrer (10,000-29,000 rpm) were used.

Preparation of nanoemulsions

Three types of sodium alginate solutions were prepared with different concentrations 2%, 1% and 0.5%. The nanoemulsions were prepared following the method of Fernandez *et al.,* (2004) with adaptations. The aqueous and oily phases were heated separately at a temperature of 75 ± 1°C, in a water bath (CIENTEC), then the oily phase was slowly poured into the aqueous with the aid of a syringe under variable agitation from 12,000 to 15,000 rpm. with the aid of a high energy mechanical stirrer (Ultra-stirrer) until the entire oily phase was reversed over the aqueous one, after this process the stirring continued at 22,000 rpm for 5 minutes, after this period of time the solution was taken to a magnetic stirrer until reaching room temperature (25 ± 5°C). Next, in Table 1, there are the relative formulations of the nanoemulsions.

Table 1 - relative composition of alginate nanoemulsions and citriodora eucalyptus essential oil and surfactant

Experimental Condition	sodium alginate	Surfactant	Oil	Surfactant and Oil	Alginate and Surfactant
N1	(2%) 100 mg	75 mg	75 mg	1:1	1.33:1
N2	(1%) 100 mg	100 mg	50 mg	2:1	1:1
N3	(1%) 100 mg	75 mg	75 mg	1:1	1.33:1
N4	(1%) 100 mg	50 mg	100 mg	1:2	2:1
N5	(0.5%) 100 mg	75 mg	75 mg	1:1	1.33:1

Characterizations of emulsions

The viscosity of the emulsions was evaluated in triplicate, through solutions with dilutions of 50%, 30%, 20%, 15% and 10%. The viscosity was measured by depositing the solution in an Otwald Viscometer, where the flow time was timed.

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The particle size of the emulsions was evaluated using the Zetasizer/Nanoseries 590 (MALVERN) device, with measurements in triplicate. The samples were diluted at a ratio of 1:100 and left under agitation for 24 hours before analysis.

The encapsulation efficiency of the emulsions was measured according to a modified methodology from Sebaaly *et al* ., (2015). Emulsion solutions were prepared in 1:4 ethyl alcohol, then the solutions were left to rest for 24 hours, there was a phase separation where the colorless part that represented the mixture of oil and alcohol was analyzed. The Encapsulation Efficiency (EE) was calculated from Eq. 1:

$$\frac{EE(\%)=M\ x100}{Mo} \quad (1)$$

The determination was carried out by measuring the free concentration in the NE. It was determined by absorption spectroscopy in the UV-Vis region at a wavelength of 214 nm. A standard curve of Eucalyptus citriodora was prepared, so that it was possible to determine the concentration of oil in the medium through a calibration curve, represented by Eq. two:

$Y=0.0024x + 0.0615$ $R^2=0.998$ (2)

For the microscopic analysis, an optical microscope of the brand Olympus CX-31 was used, to observe the homogeneity and morphology of the dispersion. One drop of each formulation was placed on a glass slide for microscopy and covered with a coverslip. The slides were analyzed in 40x, 100x and 1000x objectives.

3. Results and discussion

Characterizations of Viscosity, Particle Size, Encapsulation Efficiency and Optical Microscopy were performed. It is expected that the lower the viscosity, the smaller the corresponding particle diameter and that the nanoemulsion has a greater oil retention. Figure 2 shows the flow time of the five samples that increase with the concentration. It can be noted that the nanoemulsions N2, N3 and N1 respectively have higher viscosity values, the higher the viscosity, the greater the stability and lifetime of the sample, so N2 has a better Viscosity profile. N2 containing a ratio of 2:1 surfactant and oil and 1:1 alginate and surfactant. Sample N5 has a lower viscosity value, which gives it instability. According to the literature, low-mass surfactants have high mobility at the interface, thus readily adsorbing to droplet surfaces, reducing the surface or interfacial tension between them (ARTIGA-ARTIGAS *et al.,* 2018).

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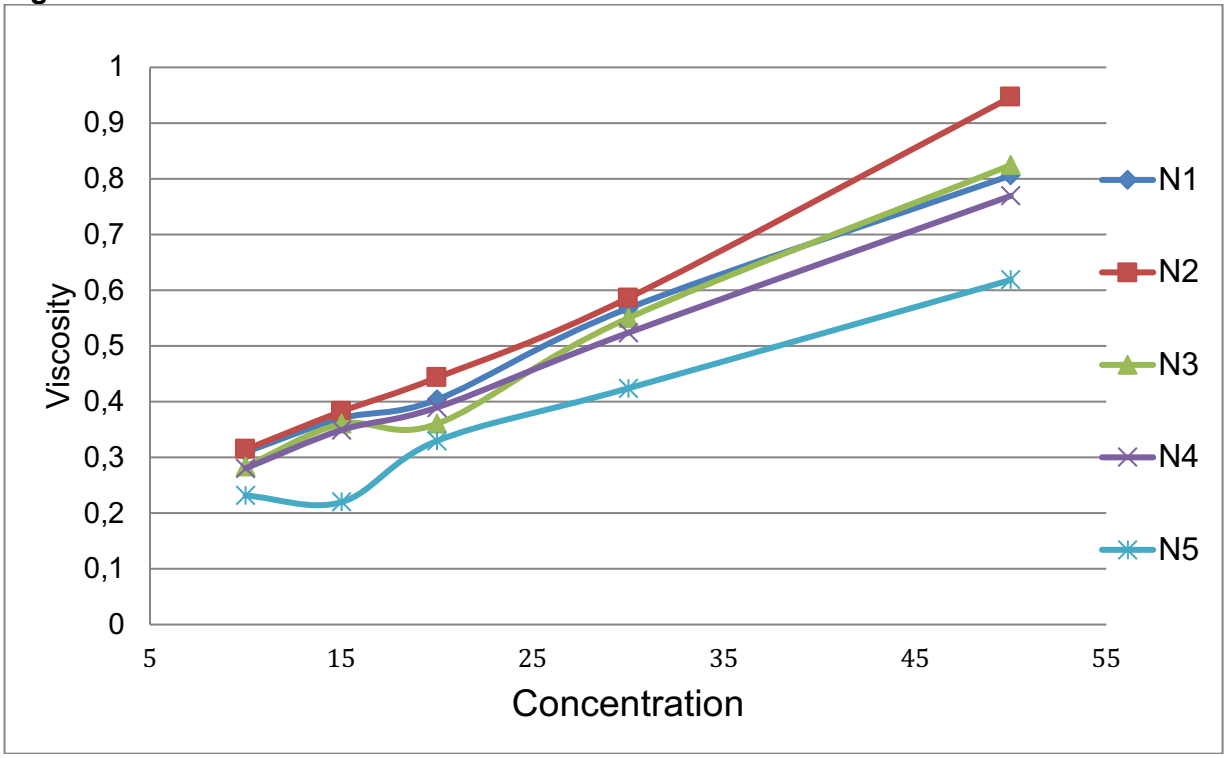
Figure 2- Flow time of nanoemulsions at different concentrations.



Optical microscopy testing was performed 8 weeks after sample preparation.

The analysis by optical microscopy allowed visualizing the morphology of the micelles, as shown in Figure 3. It is observed that among the systems studied, the systems (N1, N2, N3, N4, N5.) exhibited some homogeneity, it was possible to detect the micelles formed in different emulsification reactions and the presence of Brownian motion. Tween 80, due to its larger nonpolar chain, is able to make the stabilization interface between the oil and Alginate in a more successful way. (ABREU *et al* ., 2020).

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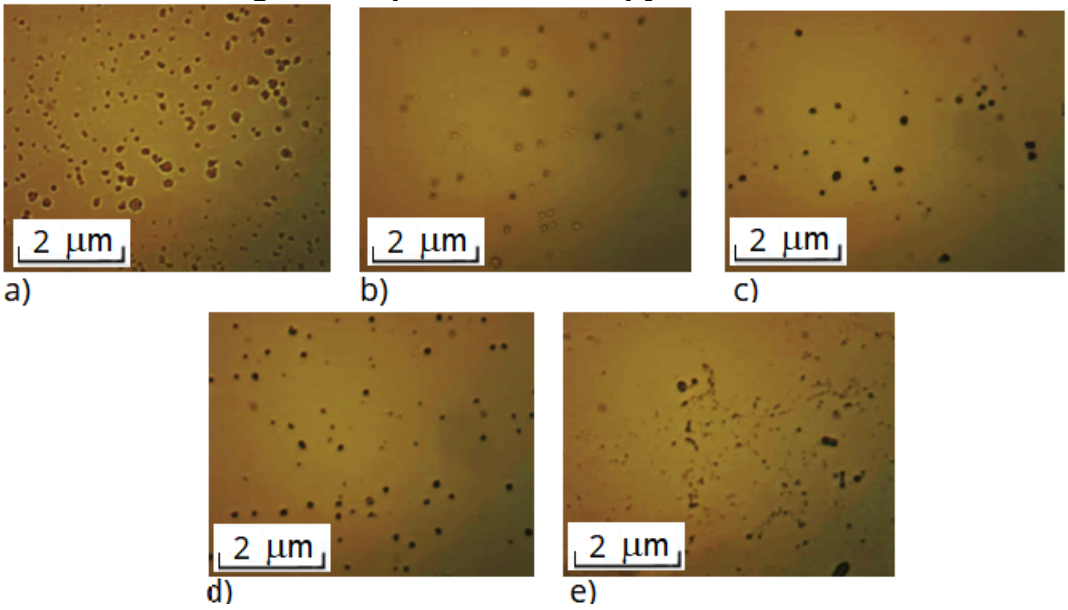
Figure 3: Optical Microscopy of Emulsions



a) N1 (1:1 Surfactant and Oil, 1.33:1 Alginate and Surfactant), b) N2 (2:1 Surfactant and Oil, 1:1 Alginate and Surfactant), c) N3 (1:1 Surfactant and Oil 1.33:1 Alginate and Surfactant), d) N4 (1:2 Surfactant and Oil, 2:1 Alginate and Surfactant), e) 1:1 N5 Surfactant and Oil. Alginate and Surfactant 1.33:1)

Regarding the particle size results, taking into account the experimental conditions and the proportion of each formulation, the following data shown in Table 2 was obtained .

Table 2 - Relationship between particle size, reaction conditions and proportion of oil, surfactant and gum.

Experimental Condition	Surfactant and Oil	Alginate and Surfactant	Particle Size (nm)	AND IS%
N2	2:1	1:1	313 (94.8%); 88.15 (5.2%)	68.2±0.09
N4	1:2	2:1	309.8 (100%)	41.0±0.1
N5	1:1	1.33:1	371 (80.8%); 5362 (19.2%)	54.6±0.07

As can be seen, the nanoemulsions showed a droplet diameter between 88.15 and 5362 nm, in agreement with the evaluated formulations. Table 2 shows the mean values of the peaks for the NE of the experimental conditions N2, N4 and N5. The NE N2 and N5 showed a bimodal distribution, with two peaks representing a portion of particles with different average size, with a small fraction of 88.15 nm (5.2%) and with a majority profile of 313 nm (94.8%). for N2. For N5, a fraction of 5362 nm (19.2%) and with a predominant profile of 371 nm (80.8%). NE N4, on the other hand, showed a smaller overall size in a unimodal distribution with an average particle size fraction of 309.8 nm.

The smallest droplet sizes were obtained in formulations N2 and N4 where it is observed that the surfactant Tween 80 was used in both. When Tween 80 is used, smaller particle sizes are obtained, which means that there was less coalescence or

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a lower degree of Ostwald maturation. The degree of encapsulation was calculated as a function of the oil content added in the emulsion and is shown in Table 1. The NE2 and NE5 samples stand out with values of 68.2 ± 0.09 and 54.6 ±0.07, respectively. These formulations have the highest amount of surfactant, which makes the interaction of the aqueous and oil phase greater than the other formulations, providing greater stability.

4. CONCLUSIONS

The sample that achieved the best results in the physicochemical tests was the NE2 nanoemulsion, as it has stable viscosity values, Particle Size between 88.15 and 313 nm and an Encapsulation Efficiency value greater than 68.0% as already discussed due to the higher amount of surfactant. Sodium alginate nanoemulsion with *Eucalyptus citriodora* essential oil proved to be a good alternative for encapsulation and for essential oil protection for use in delivery systems, providing stable nanoemulsions.

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THERMOGRAVIMETRIC ANALYSIS OF PEQUI OIL MICROPARTICLES (*CARYOCAR CORIACEUM* WITTM.) IN A POLYMERIC MATRIX OF ALGINATE AND CHITOSAN[1]

ANÁLISE TERMOGRAVIMÉTRICA DE MICROPARTÍCULAS DE ÓLEO DE PEQUI (CARYOCAR CORIACEUM WITTM.) EM MATRIZ POLIMÉRICA DE ALGINATO E QUITOSANA

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ABSTRACT
Pequi oil has high level of antioxidant substances, phenolic compounds, vitamin A and E, substances that are sensitive to the presence of light and oxygen. In order to provide greater stability to these compounds, microencapsulation techniques have been applied. Microparticles have different characteristics depending on the matrix, the microencapsulation technique and the drying method used. Thermal stability of the resulting microparticles is always important for industrial applications. The objective of this work was to perform thermogravimetric analysis (TGA) of pequi oil microparticles (OP) with chitosan (QT) / alginate (AG) and alginate matrixes submitted to oven drying and freeze drying. The percentage weight loss was calculated over time. The QT/ AG/OP microcapsules showed a higher temperature and enthalpy of degradation than AG/OP, thus the electrolytic complexation of QT/AG resulted in better thermal stability. Regardless of the drying method applied, the QT/ AG/OP particles showed the first degradation peak at 375 ° C, thus this matrix was suitable for oil protection in terms of thermal resistance.

KEYWORDS: Encapsulation. Ionic Gelation. Thermal degradation.

RESUMO
Óleo de pequi apresenta em sua constituição altos teores de substâncias antioxidantes, compostos fenólicos, vitamina A e E, substâncias essas sensíveis a presença de luz e oxigênio. A fim de proporcionar maior estabilidade a esses compostos, as técnicas de microencapsulação vêm sendo aplicadas. Micropartículas apresentam diferentes características a depender da matriz, da técnica de microencapsulação e do método de secagem utilizados. Estabilidade térmica das micropartículas resultantes é sempre importante para aplicações a nível industrial. O objetivo desse trabalho foi realizar análise termogravimétrica (TGA) de micropartículas de óleo de pequi (OP) com matrizes de quitosana (QT)/ alginato (AG) e de alginato submetidas as secagens em estufa e por liofilização. A perda de massa percentual foi calculada em relação ao tempo. As microcápsulas de QT/AG/OP apresentaram maior temperatura e entalpia de degradação do que AG/OP, podendo inferir assim que a complexação eletrolítica de QT/AG resultou em melhor estabilidade térmica. Independentemente do método de secagem aplicado, as partículas de QT/AG/OP apresentaram o primeiro pico de degradação em 375 °C, sendo esta matriz de polissacarídeo adequada para a proteção do óleo em termos de resistência térmica.

PALAVRAS-CHAVE: *Encapsulamento. Gelificação iônica. Degradação Térmica.*

INTRODUCTION

The pequi tree (*Caryocar coriaceum* Wittm) is a tree species native to the Brazilian Cerrado belonging to the Caryocaraceae family (ASCARI; TAKAHASHI; BOAVENTURA, 2013). The species is considered of high economic importance, since there are several ways of using it, serving the food, medicinal and cosmetic sectors

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(EMERENCIANDO, 2017). The pequi pulp oil consists mainly of palmitic (35.17%) and oleic (55.87%) fatty acids, with a total of 37.97% saturated and 61.35% unsaturated, with 0.68 % not identified (DE LIMA *et al* ., 2007). These characteristics related to unsaturated fatty acids are very important, since the consumption of unsaturated fatty acids has been reported to be beneficial to health (ASCHERIO *et al* ., 1996). Pequi oil due to its chemical composition has gained prominence in scientific research, and encapsulation may favor the preservation of the characteristics of the bioactive compounds present for a longer time.

Ionic gelling is a microencapsulation method that has the advantage of employing mild conditions, since it does not use high temperatures, vigorous agitation or organic solvents, being suitable for the encapsulation of substances that would degrade under such conditions (COLAK *et al* ., 2016). Sodium alginate is a polysaccharide extracted from brown algae or bacteria widely used in ionic gelation studies. It is composed of residues of β -D -mannuronic acid (M) joined by type bonds (1→4) and residues of its epimer, α-L- guluronic acid (G), in various proportions. These residues are arranged in the form of blocks of mannuronic (M) or guluronic (G) acids, linked so that the sequence of these residues in the molecule is alternated (HELGERUD *et al* ., 2012). Chitosan is an amino polysaccharide, derived from the deacetylation process of chitin (DAMIAN *et al* ., 2005) .

polyelectrolytic complex between chitosan and alginate, allows that several properties of both polymers are maintained, such compounds present even greater stability to variations in pH and greater efficiency in the controlled release of active principles (YAN *et al* ., 2000). Chitosan is used to reinforce the microparticle in order to favor the encapsulation of the active agent (RIBEIRO et *al* ., 2005) and prevent the rapid erosion of the alginate gel (TØNNESEN AND KARLSEN, 2002). Another important factor is that alginate has a tendency to acquire pores in its structure, thus, the formation of a chitosan membrane on the surface of the microparticle tends to decrease the rate of release of the substance present in its interior (BHATTARAI *et al* ., 2011).

Several drying methods can be used in order to favor the storage of microparticles obtained by ionic gelation . Drying is the process in which a heat source is applied under controlled conditions to remove volatile substance (not exclusively water) present in the material using the evaporation process, producing solid products (MONTEIRO; AZEREDO, 2012). The main objective for drying a food or product is to extend the shelf life and protection, so the absence of water in the material inhibits microbial growth and enzymatic activity.

Thermogravimetric analysis (TGA) is used to investigate processes related to thermal stability and decomposition, dehydration and oxidation, measuring the mass variations of a sample as a function of temperature and time during heating (TENGKU-ROZAINA, BIRCH, 2019; XIAO *et al* ., 2014), being a way to assess the thermal resistance of encapsulated particles. The objective of this study was to perform a thermogravimetric analysis of pequi oil microparticles, produced by ionic gelation , in alginate polymer matrix and electrolytic complexation with chitosan, subjected to two drying methods: oven drying and lyophilization.

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MATERIALS AND METHODS

Material

In this work, the following material was used: medium viscosity sodium alginate salt from Dinâmica®, with a purity of 90%, low molecular weight chitosan (75-85% deacetylation) from Sigma- Aldrich , calcium chloride of Dynamics, Span 80 and Tween 80 Surfactants (Chemical Dynamics).

The pequi (*C. coriaceum*) was purchased directly from producers in Barbalha-CE, and the oil was extracted from the fruit pulp at the Laboratory of Agroindustrial Processes (EMBRAPA) using the cold extraction method according to Lima *et al* . (2019). The pulp was submitted to a temperature ≤ 45ºC in an industrial stove and centrifuged at 4500 rpm for 15 min to separate the oil, and stored in glass vials at 5ºC.

Formation of microparticles

For the preparation of the emulsion to be microencapsulated with pequi oil and sodium alginate, 1.2% (m/v) alginate was prepared in distilled water (100 mL) and left under stirring for 24 h at room temperature (25 °C).). Tween 80 (0.55%) was added to the alginate solution and homogenized in Ultra-Turrax ® (T-25 digital, IKA®), being stirred at 12,000 rpm for 2 min. Sodium alginate solution was mixed with pequi oil (2 g) and surfactant Span 80 (0.45%). At the end, the emulsion was homogenized in Ultra-Turrax ®, being stirred at 12,000 rpm for 5 min. The emulsion was dropped into a solution of calcium chloride 1.3% (m/v) and chitosan 1.2% (m/v). In the treatment for the formation of microparticles with alginate matrix, only 1.3% (m/v) calcium chloride solution was used. For the formation of particles by ionic gelation, the extrusion technique was used, using the Encapsulator equipment Büchi B-395 (Büchi , Essen, Germany). A drip nozzle with a diameter of 120 µm, frequency of 120 Hz, voltage of 300 v and 80% agitation was used. At the end, the spheres were submitted to drying: a) in a heating oven at 50 ºC for 2h30 min and b) dried in a lyophilizer (CHRIST, model 1-8 LSCbasic) after previous freezing in an ultrafreezer .

Thermal analysis

For the thermal characterization of pequi oil microparticles by thermogravimetric analysis (TGA), the STA 6000 equipment (PerkinElmer) was used. Approximately 10 mg of the samples were weighed and investigated in the temperature ranges from 25 to 750 °C with a heating rate of 10 °C/min and nitrogen gas flow rate of 20 mL /min.

RESULTS AND DISCUSSION

Thermogravimetric analysis (TGA) is a technique in which changes in the mass of a sample are measured as a function of time and temperature, as it is subjected to a controlled temperature program in a controlled atmosphere (CAI *et al* ., 2018).). However, TGA alone is not sufficient to interpret the weight loss of the sample. Thus, derived thermogravimetry (DTG) is used because, when we apply the derivation operations to raw thermograms, it provides an improvement in the information contained in the thermogram (RAMBO *et al* ., 2015). Figure 1 shows the DTG curves for pequi oil (OP), Alginate microparticles (AG), Chitosan microparticles, Alginate and

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pequi oil (QT/AG/OP) and AG/OP microparticles, observing the influence of drying method (oven and lyophilization) on thermal degradation.

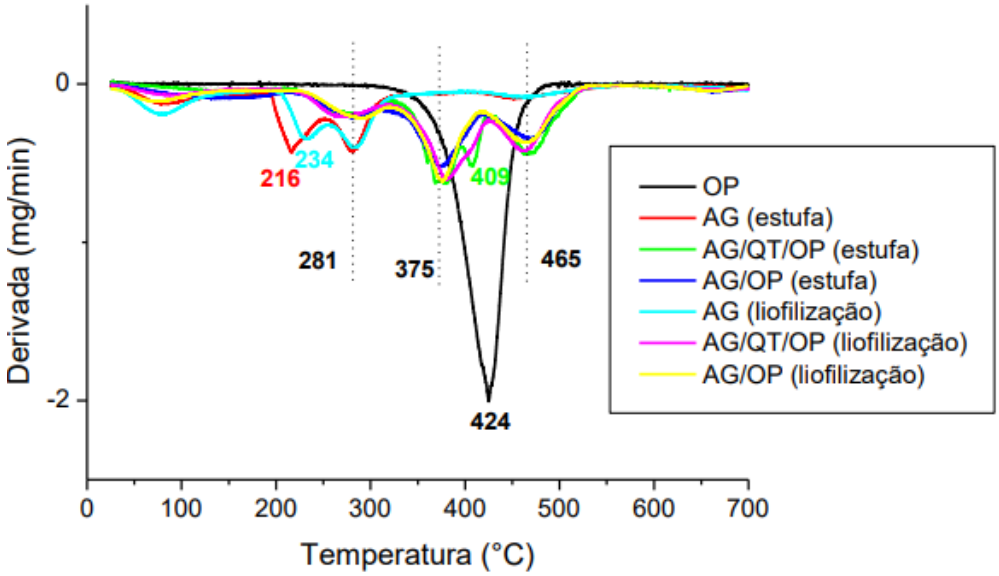

Figure 1 – Thermogravimetric analysis of pequi oil microparticles.

The OP had its degradation at approximately 424 ºC. All microparticles showed an initial degradation event at approximately 100 ºC, referring to water loss (Da Silva; De Paula; Feitosa, 2007). AG (greenhouse) and AG (lyophilization) particles showed a second polymeric degradation event at approximately 215 ºC. The AG/QT/OP microparticles, regardless of the drying method applied, showed the second degradation peak at 375 °C, indicating better stability due to the affinity of the electrostatic interactions of the polymers (CHANG *et al* ., 2016). The AG/OP microparticles were also not influenced by the thermal degradation in terms of the drying method, with similar events starting at 281 ºC.

In Alouh 's studies *et al* . (2019) alginate/chitosan hybrid microparticles exhibited four stages of thermal degradation. The first occurred in the range of 25 to 240 °C corresponding to water molecules trapped in the network (GOPALAKANNAN *et al* ., 2016). The second and third peak observed between 240 and 370°C occurred due to the decomposition of the biopolymers . The last stage of thermal degradation of the granules took place between 370 and 525 °C. Popa *et al* . (2008) found that the chitosan/alginate complex modifies the degradation mechanism of the resulting particles, introducing new events compared to the crude polymers. These results corroborate with those found in this work.

CONCLUSIONS

The pequi oil microparticles obtained by ionic gelation in a polymer matrix of alginate and chitosan showed better thermal stability results, regardless of the drying method. Results like these are important when looking for a commercial application in

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the food area, and it is necessary to define the best condition for drying the particles based on temperature and enthalpy of degradation.

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CHARACTERISTICS AND INDICATORS OF FINANCIAL IMPACT OF SOCIAL ENTREPRENEURS

CARACTERÍSTICAS E INDICADORES DE IMPACTO FINANCEIRO DOS EMPREENDEDORES SOCIAIS

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RESUME
The theme of the work is the financial management of social entrepreneurship, and the broad business market that it covers. The social entrepreneur has different characteristics from other types of entrepreneurs in the application of financial resources, their results, impacts and considerations both nationally and internationally. The general objective is to show these characteristics in the context of financial investments, and to show its performance in society and in the contemporary economy. The results show the dynamic concepts, linked to new ways of undertaking and how businesses are developed, in the new forms of sustainable development, which is typical of this type of entrepreneurs.

KEYWORDS: Entrepreneurship. Social entrepreneur. Financial management

RESUMO
O tema do trabalho é a gestão financeira do empreendedorismo social, e o amplo mercado de negócios que ele abrange. O empreendedor social tem características diferenciadas dos outros tipos de empreendedor em aplicações de recursos financeiros, seus resultados, impactos e considerações tanto nacionalmente como internacionalmente. O objetivo geral é mostrar esta características no âmbito de aplicações financeiras, e mostrar sua atuação na sociedade e na economia

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contemporanea. Os resultados mostram os conceitos dinâmicos, ligados as novas formas de empreender e como se desenvolvem os negócios, nas novas formas de desenvolvimento sustentável, que é típico deste tipo de empreendedores.

PALAVRAS-CHAVE: *Empreendedorismo. Empreendedor social. Gestão financeira*

INTRODUCTION

In the United States and Europe, the first experiences of social entrepreneurship emerged in the 1960s, with the pioneering initiatives of civil society organizations in search of financial sustainability. In Brazil, the first initiatives emerged in the 1980s, but a large part of the enterprises currently in operation emerged in the 1990s, such as Associação Saú de Criança and the Committee for the Democratization of Informatics, both in Rio de Janeiro, and the Palmas Bank, in Fortaleza.

The work is guided by the reflection on the sources of financing and the financial results of social enterprises and the category of impact investments. The financing of the social entrepreneur, following a concept that differentiates the social entrepreneur from the Civil Society Organization - CSO and in general from a Third Sector organization, according to the current legal framework, has different characteristics from the classic entrepreneur who finances himself with his profits and from the Third Sector that has government funding or donations. Thus, the objective of the work is to explain these characteristics.

This bibliographic research is justified by the discussion, not always clear in the literature, about social impacts, or high social impact ventures in which the social entrepreneur is included as the main agent. In particular, the use, in Brazil, of the term social impacts as a synonym for any activity that fits into social responsibility activities, corporate citizenship, should be more careful, instead of evaluating activities and market agents when impacts occur. A solidary or citizenship activity is not the same thing and an activity whose impacts are relevant to the market and society at the same time.

In another article, the authors clarified the concept of social entrepreneur and its impacts (MARTINS and AVENI 2020). In particular, the processes and agents of social impacts were clarified, showing how there is an often hybrid chain that can be polarized and idealized without motivation, conferring the seal of social impacts only on social activities and organizations such as CSOs, movements and associations that operate in and out of the market. In this second work, the financial management of a social entrepreneur is explained, completing the subject previously discussed.

The work initially addresses the topic of what is a social entrepreneur and what are his financial sources and financial management. A discussion of the relevant aspects follows to show the results achieved. At the end there is a conclusion that closes the job.

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SOCIAL ENTREPRENEURSHIP AND SOCIAL BUSINESS

Social entrepreneurship is a field of socio-environmental action and of doing business, which aims to achieve two goals considered irreconcilable: generation of social impact and economic value. Currently, there is a debate on the definition of this field of action, involving the role of social entrepreneurs in the economy and their interaction with civil society and public policies, one of the pioneers in this field, defined social entrepreneurs as; individuals who act as agents of change, develop new solutions to social problems, implement these solutions on a large scale and contribute to transforming society.

In the practice of social entrepreneurship, aspects of innovation and social vision are emphasized, that is, innovation in the business model and in the form of operation, as well as the construction of a shared vision of how to meet social demands and solve problems. environment, as in the following definition:

> "a process that involves an innovative combination of resources to explore opportunities that meet social needs and catalyze social change". Mair and Marti (2006 page 22):

On this topic, Comini (2011) presented the different definitions used in national and international literature to identify social enterprises. According to the author, social enterprise, inclusive business (including business) and social business (social business) are some of the terms used to identify organizations that "aim to solve social problems with efficiency and financial sustainability through market mechanisms".

Naigeborim (2011) explains that using market mechanisms means that "these businesses must operate under the same commercial rules as any other business, that is, operate by the law of market supply and demand". According to the author, these projects are planned in order to generate enough resources to cover all their operations and also contribute to their growth. However, in these businesses "profit is not an end in itself, but a means to develop solutions that help reduce poverty, social inequality and environmental degradation".

In a more specific approach, Yunus (2008) defines social business as an enterprise with the following characteristics:

a) its mission is to meet the demands of low-income and more vulnerable population segments;
b) develops and sells products and services adjusted to these social demands;
c) generates sufficient income to cover its own expenses;
d) reinvests a part of the economic surplus in the expansion of the business, while the other part is kept as a reserve to cover unexpected expenses;
e) has investors who do not receive profits in the form of dividends, but can receive the investment back after a period.

In 1976, Yunus created the first social business operating with these characteristics, Grameen Bank, which offers microcredit to the population at the base of the economic pyramid in Bangladesh. Reading Yunus's story and explanations, his concept of a social entrepreneur becomes clear.

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Faced with the problems faced by communities in his country, he had the vision that access to capital, even on a small scale, can transform people's lives. From this vision, the entrepreneur created an innovative business model, as he describes:

> "I helped launch a global movement called microcredit, which helps the poor by offering them small loans without collateral. The value of these loans is very low - 30 or 40 U$ dollars - and these people can use the money to start small businesses. Credit is provided to women and about 94% of the bank's shares are in the hands of the borrowers themselves. "(Yunus, 2008).

In Yunus' conception, those individuals who conduct social businesses are considered social entrepreneurs, but not all of them undertake activities of this nature, as is the case with civil society organizations that depend on philanthropy. For Yunus, the social entrepreneur must lead a change in culture and work so that this change can change the market in a way that favors everyone, especially the excluded, in business and makes the market more sustainable. In Yunus' conception, the social entrepreneur is not an NGO or a charitable company, much less an ideological political social movement.

Another approach, which proposes the eradication of poverty through entrepreneurial initiatives of a social nature, was presented by Prahalad and Hart (2002) in the article The fortune at the bottom of the pyramid. Unlike Yunus, the authors defended the proposal to create businesses that reduce costs and improve the quality of products and services offered to families located at the base of the economic pyramid. The difference with Yunus lies in the proposal to reduce prices possible with new and better technologies and not in supporting market participation with new sources of income.

The underlying assumptions are twofold: the first is that this population represents a large-scale profitable market, decreasing the value of the margin but increasing the number of sales, for companies; the second is that the consumption of more accessible and adequate products and services increases the quality of life of these families. In other words, it triggers a positive spiral that benefits everyone.

The base of the pyramid population was defined as four billion people in the world who have a per capita income of less than US$ 1,500 per year, that is, a purchasing power parity of less than US$ 2 per day.

Thus, Yunus et. al. (2010), when considering that these business strategies, aimed at the population at the base of the economic pyramid, do not believe they are a social business strategy insofar as they prioritize the objective of generating profit and the social impacts are not direct. London (2009), one of the authors of the bottom of the pyramid (BoP) approach, recognized the difficulty in assessing the social impact of these strategies in terms of eradicating poverty and increasing the population's quality of life. These are indirect impacts.

Based on the criticisms, Hart and Simanis (2008) reformulated this approach, calling it BoP 2.0, based on the premise that communities located at the base of the economic pyramid are entrepreneurial and have valuable skills and knowledge. Therefore, entrepreneurs who wish to do business with these communities must

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enter the informal economy in which they operate and build a network of organizations connected by mutual trust.

The business model is co-created with the involvement and partnership of the set of local actors, who are the stakeholders benefited by the business. The authors cite as an example the Grameen Phone venture, formed by Telenor, a Norwegian company, and Grameen Telecom, a non-profit organization, aiming to provide cellular telephony services to communities at the base of the economic pyramid (BoP) in Bangladesh. Thus, the authors approach their proposal to Yunus's conception of social business, emphasizing the creation of innovative business models based on the social entrepreneur's immersion in the reality of vulnerable and low-income communities.

In parallel with the discussion on the concept of social entrepreneurship, several initiatives are being developed to give legitimacy and recognition to these enterprises. In the United States, the B-Lab organization created the B-corp or Benefit Corporation certification, based on standards of socio-environmental impact and transparency. To receive this certification, the social entrepreneur answers a questionnaire for each sector of his business, in addition to having audited his production process.

The organizations that make up the B-corporations network aim to redefine the concept of business success through an innovative legal framework, with new laws to regulate the way of doing business based on the values of social justice, equity, transparency and sustainability. New legislation on B-corporations already exists in nineteen US states. By 2012, six hundred enterprises had been certified in fifteen countries (B-Lab, 2012).

This movement of social entrepreneurs is present in Brazil, coordinated by CDI Lan, a certified B-corp based in São Paulo. In summary, studies on social entrepreneurship indicate that the field is expanding worldwide, as well as its potential and dynamism are based on the diversity of organizations and actors involved, whether civil society organizations or entrepreneurs who create businesses aimed at socio-environmental impact and the distribution of profits simultaneously. In the plurality and heterogeneity of social entrepreneurs, there is a common intention to bring about changes in the living conditions of the most vulnerable and low-income population segments, based on innovative business models.

In the 1990s, other American academic institutions began to work in the field, such as the Fuqua School of Business at Duke University, which created a teaching and research center (Center for the Advancement of Social Entrepreneurship). Organizations that support social entrepreneurs emerged, such as the Nonprofit Enterprise Self-Sustainability Team (NESsT) and the Social Enterprise Alliance in 1997, and the Institute for Social Entrepreneurs in 1999. In addition, numerous academic publications debate the field, such as the Journal of Social 7 Entrepreneurship, the International Journal of Social Entrepreneurship and Innovation, the Social Enterprise Journal and the Stanford Social Innovation Review.

In England, social entrepreneurship was spread in the 1990s by academics such as Charles Leadbeater, author of The Rise of the Social Entrepreneur, and

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Michael Young, founder of the School for Social Entrepreneurs. In universities, research and teaching centers such as the Skoll Center for Social Entrepreneurship at Said Business School were opened. Currently, there are independent organizations, such as Social Enterprise UK, a network that aggregates more than fifteen thousand social enterprises in the United Kingdom and seeks to influence public policies for the sector.

In Brazil, the first initiatives in the field of social entrepreneurship emerged in the 1980s, "in the face of growing social problematization, the reduction of public investments in the social field, the growth of third sector organizations and the participation of companies in investment and social", according to Oliveira (2004).

The initiatives of Brazilian social entrepreneurs are aimed at the population groups covered by the government programs “Brasil Sem Miséria” and “Bolsa Família”, as well as the lower income group of the middle class, defined in a report by the Secretariat of Strategic Affairs (2012) with based on April 2012 values, namely:

- The extremely poor are those with a per capita family income of up to R $81;
- The poor, with a per capita family income between R$81 and R$162;
- The vulnerable , who have a per capita family income between R$162 and R$291;
- The lower class m is dia, with a per capita family income between R$ 291 and R$ 441; am is day class m is day, with per capita family income between R$441 and R$641.

DISCUSSION _

As financing a business is a strategic decision of the entrepreneur, since the mobilization of resources is strongly related to its potential for success in the short and medium terms, choosing the source of financing for the business is an important step in building the capacity to generate social, environmental and financial value. The social entrepreneur should consider using resources derived from donations or past earnings to finance social impact activities, more than the classic entrepreneur. It can also resort to financing from banks for current activities, waiting for discounts and active participation from financial institutions.

One of the biggest challenges for social entrepreneurs is gaining access to other financing and attracting investors, especially in the early stages of the business cycle. In order to meet the growing demand for capital mobilization to finance social entrepreneurs, since the late 1990s the investment ecosystem has been developing, which brings together private foundations, fund managers, equity investors, financial institutions and accelerator organizations, which share the intention of generating socio-environmental impact in addition to financial returns.

Investment market in impact companies

It is estimated that in 2011, investments for social impact activities directed US$ 4.4 billion to 2,200 projects worldwide, more than half of them in the USA. and Canada and the rest in business in India, Russia, China and countries in Latin

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America and Africa. The preferred sectors are education, health, credit and basic services such as clean water and housing. (ASSISI, 2012)

In this scenario, an aspect to be considered is that social enterprises, as hybrid organizations, seek greater autonomy of action and governance models that include different stakeholders, to ensure that their social mission is effectively carried out. Thus, these organizations avoid accepting the traditional venture capital contribution, known as venture capital, which generally implies greater strategic-operational control by the shareholders.

In a survey carried out in the USA, Haigh and Hoffman (2012) report that 60% of hybrid organizations seek long-term investments known as "patient capital", while 12% prefer loans or investment funds with an expected return lower than market rate.

Thus, the segment that has been showing a growth trend worldwide for financing social entrepreneurs is impact investing funds, which are organizations responsible for raising funds from private investors and directing these resources to loans or equity participation in businesses. social projects, aiming at financial return and social impact simultaneously. Currently, impact investment funds are focused on emerging or developing countries (CREMONEZZI ET AL., 2013).

To perform a global estimate of impact investing, the bank JP Morgan (2013) surveyed 99 investors and revealed that in 2013, funds were expected to invest up to US$9 billion in impact businesses, 12, 5% more than in 2012. Of those who intended to invest in developing markets such as Brazil, 47% cited education as an area of interest, second only to food and agriculture (63%), financial services and microfinance (59%) and health (51%).

In Brazil, seed capital funds allocate investments between BRL 500,000 and BRL 2 million in startups and small companies seeking investment to structure and grow their business. Venture capital funds, which is the venture capital that an investor applies in a new business, invest between R$2 million and R$10 million in companies that already have a structured business model and are prepared to grow. Private equity funds invest in mergers and sales between large companies, which normally involve amounts above R$10 million.

Another form that is growing in importance is venture capital. This investment in emerging companies represents a lower amount invested than the private equity contributions. On the other hand, due to the high risk of investments in emerging companies, venture capital funds have a greater number of companies in the portfolio in order to diversify risks. (BRAZILIAN AGENCY FOR INDUSTRIAL DEVELOPMENT - ABDI, 2011)

A survey conducted by the Aspen Network of Development Entrepreneurs (2012) in Brazil identified fourteen impact investing companies, 86% of which are in the Southeast region of the country. These investors include civil society associations (36%), private companies (29%), international or multilateral organizations (14%) and foundations, public companies and investment companies with their own resources (7% each type). The data also indicated that 14% of investors expect a 20% to 30% return on investment after five years, while 86% of them aim for between 50% and 60% return.

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Among the impact investment funds in the country, which invest risk capital in social businesses, are Vox Capital, FIRST and MOV Investimentos, among others, which focus mainly on businesses in the areas of health, housing, education and microfinance aimed at the base of the pyramid and with return potential. Whether through equity interest or convertible debt, investment in early-stage businesses (seed, early-stage, startup) is an investor strategy to enable growth with gains in scale, financial returns and positive social impact.

The development of the field of impact investing is still emerging in the country and in the world and its development requires not only a change in the mindset of the various stakeholders, but the construction and dissemination of new standards of metrics and impact assessment methodologies, as well as public policies and new legislation that encourage the development of these businesses. According to Bugg-Levine, et al. (2012), investments in social enterprises will remain chronically insufficient and inefficient if transparent methods of measuring and monitoring the socio-environmental impact generated are not implemented.

According to Aveni (2019) in addition to the classic forms of financing: financial institutions and public financing, which was integrated into institutionalized microcredit systems, today there are specialized networks and funds as well as angel investors and Crowdfunding systems that allow raising funds and financing. directly on the capital market.

The form of cooperation with Associations and companies specialized in startup and acceleration of the social enterprise is a novelty that should not be underestimated because to have access to forms of cooperation. These investors provide a means to improve the company's human capital, as they intend to expand and maintain a network. The phenomenon of network collaboration is a key element to understand why there are many new forms of funding, this stems from the current increase in the development and use of social networks; (AVENI 2019)

Financial impact indicators

The management of resources obtained to finance activities must generate results linked to the objective of generating socio-environmental impact, that is, improving the living conditions of low-income populations in a state of social vulnerability, as well as guaranteeing the preservation of the environment.

To this end, they seek indicators of short, medium and long-term changes in the communities in which they operate. According to Barki and Torres (2013), there are three dimensions of change in the socioeconomic conditions of low-income families:

- the reduction of transaction costs ;
- the reduction of social vulnerability and
- the increase in individual and family assets .

Transaction costs involve expenses incurred by families as a result of the difficulty in accessing quality public services and consumer products suited to their needs and purchasing power. Reducing social vulnerability refers to access to products and services that reduce the exposure of this population to the risk of

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disease, unemployment, death, extreme poverty, violence, drugs and environmental contamination. And the increase in family assets goes beyond generating income and jobs, including access to quality housing, health services and education.

One of the conceptual references used is the field of public policy evaluation, in which evaluation is considered essential for the development of forms and instruments of public action. The approach used is the logical matrix model, whose modalities identify three evaluation orders: goals, processes and impact. The evaluation of goals seeks to measure the most immediate results of the activities carried out, such as the number of people treated in health centers or the number of hospital beds, among others. Process evaluation aims to monitor and evaluate program implementation procedures, as well as identify intervening barriers and obstacles.

Impact assessment consists of measuring the effects produced on society and, therefore, beyond the direct beneficiaries of public intervention, under the motivation of measuring its social effectiveness. According to Trevisan and Bellen (2008), this objective assessment makes the diagnosis of the changes that actually occurred and to what extent they occurred in the desired direction. In this way, we seek to evaluate the medium and long term results in order to establish the cause-effect relationship between the actions of a program and the results obtained.

The logic matrix is one of the methods of evaluation guided by the theory of the program (theorybased program evaluation), also known as the theory of change, which proposes an impact evaluation based on a conceptual model of how a program generates the expected impacts (outcomes). This method includes the chain of connections between the theories of the program (process and impact). Process theory includes the program's input, activity, and output phases. Impact theory, in turn, includes short, medium and long-term outcomes. (Coryn et al. 2011).

Currently, initiatives are being developed to create conceptual models and social impact assessment methods. These include the Impact Reporting and Investment Standards (IRIS), a dictionary with standardized definitions of social, environmental and financial impact metrics; organized into five areas: description of the organization; Product Description; financial performance; operational impact; and product impact. This taxonomy of metrics aims to contribute to the measurement of the socio-environmental and financial impact of social enterprises and impact investments. This tool was developed in 2009 by the Global Impact Investment Network (GIIN), a network of investors and philanthropists promoted by the Rockefeller Foundation, aiming to build a conceptual reference for the analysis of the impact of investments (GIIN, 2013).

Another way to assess impacts from a financial goals and indicators point of view is the Global Impact Investing Rating System (GIIRS), in turn, is an impact investment rating system developed by B-Lab, which considers four assessment areas - governance, employees, communities and the environment - and compares the impact generated by areas such as education, job creation for young people, or alternative energies. Both the GIIRS and the IRIS are conceptual and methodological

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references to measure the results (outputs) of a business, but not the dimension of the impacts (outcomes) (GIIRS, 2013).

The Social Return on Investment (SROI), another approach to impact assessment, is a set of guidelines to financially measure the impact of social investment. The objective is to calculate the social cash flow based on the net present value, to arrive at the return on investment. This method was developed by an American foundation, The Roberts Enterprise Development Fund, whose objective is to quantify the economic value created with social investment.

In Brazil, the implementation of socio-environmental impact assessment approaches and methodologies by entrepreneurs and investors is still emerging and challenging. Among the difficulties are both the costs involved, the scarcity of reliable and consistent databases, as well as the lack of experience and knowledge about evaluation techniques, among other issues. Thus, the development of the field of social entrepreneurship involves the challenge of elaborating and measuring metrics of social and financial returns on investments, in order to plan strategic changes, improve business models and attract investors.

RESULTS

The current final synthesis summarizes the various types of financing, and impact indicators by the scope of social businesses and intended social impacts. Civil society organizations that do not generate their own income, nor traditional profitable companies, are not considered social businesses or enterprises. The scope includes the following types of social businesses: civil society organization with own income generation; civil society organization associated with a social business; social business that reinvests its profits; production or commercialization cooperatives, whose members are part of the vulnerable segments of the population; social enterprise that reinvests part of its profits and distributes dividends; company that seeks profits and that includes social businesses in its value chain. Social businesses and enterprises can be financed by own resources, loans or venture capital funds.

Business impact includes three categories: social impact, financial return and mixed return (social and financial). The indicators derive from management and projects. Using the Logical Matrix, targets and target indicators are defined. The logic matrix defines these goals for the activities to be developed to solve a problem. This problem derives from a cause-effect analysis defining a social impact. Another indicator system is the Impact Reporting and Investment Standards (IRIS) organized into five areas: description of the organization; Product Description; financial performance; operational impact; and product impact. Another is the Global Impact Investing Rating System (GIIRS), which is a rating system for impact investments developed by B-Lab, which considers four assessment areas - governance, employees, communities and the environment. Another system is the Social Return on Investment (SROI), another approach to impact assessment, which is configured as a set of guidelines to financially measure the impact of social investment. Finally, in view of the need to quantify outcomes, the experimental randomized controlled trial

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(RCT) method is considered the most appropriate to identify causal relationships, being used in clinical trials in the health area.

This synthesis must be coordinated in the accounting, in the sense that for each impact activity, or intended impact, the resources used must be shown in order to make an assessment of the feasibility and future sustainability of social activities.

Table 1 - Summary of results

FUNDING of impact activities
• Own revenue generation via donations or transfers per project • Re-investment of profits from business activity • Empr is esteem • investment funds • Venture Capital • crowdfunding
IMPACT INDICATORS impact indicator systems
• a logical matrix • Impact Reporting and Investment Standards (IRIS) • Global Impact Investing Rating System (GIIRS), • Social Return on Investment (SROI) • Randomized controlled trial (RCT)

The social entrepreneur can thus take advantage of resources available in the market that are not the traditional resources of startups and technological innovators. On the other hand, it must carefully maintain a system of impact indicators that justify the application of the financial resources used in its activities.

FINAL CONSIDERATIONS

Despite having evaluated financial results, the most significant result, the social and cultural impact, that social entrepreneurs will be able to achieve in the short term is revealed in the change of mentality, in the sense of coming to believe that the most difficult problems in the world can be resolved with a mix of capitalism and non-profit activities.

In the current work, the characteristics of a financial management of the social entrepreneur were shown, starting from the sources of financing and methods of financing and showing systems of analysis of the social impacts generated.

Together, these analyzes can clarify for each company its social impact by segregating financing and projects, that is, listing the financing and resources involved by each intended impact activity. In this way, the social impact and its financial management become clearer, in addition to the discourse and reports that serve as communication and improvement of the organizations image.

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ASTREINTES: THE OVERVIEW OF CHANGES DEVELOPED PRIOR TO THE 2015 CIVIL PROCEDURE CODE REFORM

ASTREINTES: O PANORAMA DE ALTERAÇÕES DESENVOLVIDAS ANTERIORES À REFORMA DO CÓDIGO DE PROCESSO CIVIL DE 2015

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ABSTRACT

The theme of this article is: Astreintes, the panorama of changes developed prior to the reform of the civil procedure code of 2015. The following problem was investigated: Due to the change of the CIvil code from 1973 to 2015 and expressly its interpretations, as it has been originating the proper fixation of astreintes? The following hypothesis was considered: What has been the criterion adopted by the legislator for the establishment of Astreintes. The general objective is to discuss the real change brought about by the new code in the face of the uneasiness linked to the Astreintes. The specific objectives are: To understand the characteristics; the legal nature; The historic; the origins and the fundamental role of astreintes in the civil enforcement process over time. This work is important for the society and the operator of the Law, because it addresses the reflexes resulting from an institute that is little talked about academically today and is legally relevant. This is a qualitative theoretical research lasting five months. As a result of the research carried out, it is concluded that there is, therefore, no definition in the arbitration of the astreintes, because an inadequate fixation can easily hurt the principles of proportionality and reasonableness, it is not a question of funds that originally integrate the party's credit, but legal instrument of coercion used to support executive jurisdictional provision.

KEYWORDS: *Astreintes. Obligation. Traffic ticket. Process. Execution.*

RESUMO

O tema deste artigo é: Astreintes, o panorama de alterações desenvolvidas anteriores à reforma do código de processo civil de 2015. Investigou-se o seguinte problema: Decorrente da mudança do código CIvil de 1973 para 2015 e expressamente suas interpretações, como vem se originando a fixação adequada das astreintes? Cogitou-se a seguinte hipótese: Qual vem sendo o critério adotado

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pelo legislador para a fixação das Astreintes. O objetivo geral é discutir a real mudança que trouxe o novo código frente ao descostume atrelado às Astreintes. Os objetivos específicos são: Compreender as características; a natureza jurídica; o histórico; as origens e o papel fundamental das astreintes no processo de execução cível ao longo do tempo. Este trabalho é importante para a sociedade e o operador do Direito, pois aborda os reflexos decorrentes de um instituto hoje pouco falado academicamente sendo juridicamente relevante. Trata-se de uma pesquisa qualitativa teórica com duração de cinco meses. Em decorrência da pesquisa realizada, conclui-se que não há, portanto, definição no arbitramento das astreintes, pois uma fixação inadequada pode ferir facilmente os princípios da proporcionalidade e razoabilidade, não se tratando de verba que integra originariamente o crédito da parte, mas sim de instrumento legal de coerção utilizado para apoiar a prestação jurisdicional executiva.

PALAVRAS-CHAVE: *Astreintes. Obrigação. Multa. Processo. Execução.*

INTRODUCTION

The so-called Astreintes are an important mechanism whose objective is to enable the fulfillment of obligations arising from do's and don'ts. It must be asked that the purpose of this obligation is to compel the defendant to comply with the obligation, as a result of bearing greater losses than he would have to comply with it. Circumstantially, the Judiciary has repeatedly taken controversial decisions on the subject. There are several decisions that reduce the value of astreintes after a long period of noncompliance on the grounds that maintaining the value would result in the plaintiff's illicit enrichment. On the other hand, other decisions understand that there is no need to talk about limiting the fine to the amount of the main obligation, since such a reduction could allow the defendant to freely abstain from fulfilling the obligation and only after the passage of time and the movement of the judicial machine, pay, at most, the equivalent of the principal.

There are scholars who divide the jurisdictional activity into two: cognitive, or knowledge, and enforceable, or execution. In the first, intellectual activity prevails, that is, the judge's analysis of the facts and the rule to be applied. In the second, material activity prevails, the search for a practical, concrete result (WAMBIER; ALMEIDA; TALAMINI, 2008, p.44).

Following the interpretation of Humberto Theodoro (2009, p.109), an interesting distinction between the execution and the knowledge process. In execution, the State acts as a substitute for the creditor, demanding the satisfaction of the provision, that is, execution is only possible when the debtor does not voluntarily fulfill the obligation. In the acknowledgment process, the judge examines

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the dispute with a view to applying the law to the specific case. In forced execution, on the contrary, it is not sought to apply the rules to the concrete case, but to put into practice the rule already applied in order to modify the factual reality. That is, in the cognition process, there is a search for the rights of the litigants and a decision on the merits, while in the execution one already starts from the certainty, in theory, of the creditor's right attested by the enforceable title, without a decision on the merits.

This article proposes to answer the following problem: As a result of the change of codes and expressly their interpretations, and clairvoyant that new dogmatics will be shaped for the party with the greatest influence, be it the creditor or the debtor, has been originating from this new conjuncture of influences a proper fixation of the astreintes ? The debtor party irrefutably bear the losses and the creditor the illicit enrichment or vice versa, the issue arises from the lack or even excess of the so-called Judicialization of the specific policy for the application, within the astreintes institute . In this sense, the more progress there is in improving such processes and in the legal instruments to guarantee compliance with obligations, the more effective the Judiciary will be and the better will be the fulfillment of social demand.

It follows from such logic that the execution process is not dialectical, since there is no objectivity on the rights involved due to the existence of the title that derives in theory, a liquid and certain right of the creditor. In forced execution, the State interferes with the debtor's assets to satisfy the creditor's right. There are two ways to achieve this purpose: specific performance and performance of a subsidiary obligation. In the first one, the payment due is effectively sought, whereas in the second one, through expropriation of the defaulting debtor's assets, a value equivalent to the original obligation is sought. In both modalities, the executive process aims at carrying out the sanction (THEODORO JÚNIOR, 2009, p.110).

The hypothesis raised in the face of the problem in question was critically analytical of how the adaptation of the Astreintes institute has been due to the new code of Civil Procedure (BRASIL, 2015) against the old and already revoked code of process (BRASIL, 1973) . The sanction, at the patrimonial level, which is of interest to forced execution, translates into practical measures that the legal system itself outlines so that the State can invade the sphere of the individual's autonomy and effectively enforce the rule of law. Because it has this coercive character, forced execution only occurs upon non-compliance with the obligation, that is, payment prevents the execution from being proposed and prevents execution if it has already been proposed (GONÇALVES, 2019, p.188).

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A subtle terminological distinction must be made between the process of execution and forced execution. The first would be the set of coordinated judicial acts with the objective of compulsorily satisfying the creditor's right at the expense of the debtor's assets. It is an ongoing legal relationship governed by public law. Forced execution, on the other hand, would be the content of the execution process, the material realization of the rule through a court action (BRASIL, 2018a, STJ).

The general objective of this article is to discuss the real change that brought the new code in face of the unfamiliarity linked to Astreintes . The execution of extrajudicial title underwent changes with Law No. 11,382/2006. The main one was the extinction of the rigid separation between the knowledge and execution process. Before, as already mentioned, in the case of a court decision it was still necessary to file an enforcement action, as compliance could not be carried out within the scope of the same process as a continuation of the knowledge phase, another change was in relation to incidental actions for liquidation of sentence that were also extinguished, becoming incidents of the process against which there is an appeal and no further appeal (NERY J; NERY, 2016, p.1454; ALVIM; GRANADO; FERREIRA, 2019, p.2055).

Currently, extrajudicial enforceable titles are enforced through an autonomous enforcement process, while, as a rule, judicial bonds will be enforced upon compliance with a judgment. This rule applies to convictions handed down in civil proceedings. The convictions in a criminal sentence with reflexes in the civil sphere, the arbitration sentence, the foreign sentence approved by the Superior Court of Justice and the conviction against the public treasury, despite the fact that they constitute a judicial enforcement order, still require the initiation of a new process to its execution (WAMBIER; ALMEIDA; TALAMINI, 2008, p.61; BRASIL, 2016, STJ).

The effectiveness of an executive title is given to certain documents by the legislator, that is, to be considered an extrajudicial executive title, an express legal provision is required. With it, it is possible to enter directly with the execution process, not being necessary the knowledge process, because, in theory, there is no controversy about the right, since it is expressed in the title. Enforceable title is each of the legal acts that the law recognizes as necessary and sufficient to legitimize the execution of the execution, without any new or previous inquiry about the existence of the credit, or other terms, without any new or previous cognition as to the legitimacy of the sanction. whose determination is conveyed in the title (THEODORO JÚNIOR, 2009, p.116).

The Specific Objectives of this work are to understand the characteristics; the legal nature; the respective temporal events; The historic; the origins and key role of

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astreintes in the civil enforcement process over time. This work is important for the operator and future operator of the Law, and for all the public that arouses interest, as it addresses the consequences arising from an institute that is currently little discussed academically and legally relevant and used. With the advent of the reform of the code of civil procedure and the restructuring of the articles, such a significant advent capable of compelling the defendant to fulfill the obligation, in practice is taken to complete disdain.

In addition to being little debated, the proposed theme has significant scientific and social relevance, because with the little feasibility proposed by the Astreintes Institute , the judiciary currently did not hold back in making controversial decisions on the subject, from large contractors and international representatives who, in refusing to pay, are exempt from the obligation, after a long period of non-compliance on the grounds that maintaining the value would result in the plaintiff's unlawful enrichment, cases ranging from debts arising from labor charges or related to the defense and protection of the Consumer, in disparity of labor powers, employer and consumer, conglomerates respectively. It is hoped to give the reader a good view of Astreintes , their relevance to the effectiveness of judicial decisions and the prospects for improvement with procedural reform.

For the elaboration of this article, the type of research used was the descriptive bibliography, having as a research method the treatment of qualitative data of a secondary nature, using as a research instrument books, doctrine and jurisprudence, articles and theses defended from the keywords: Astreintes ; Obligation; Traffic ticket; Process; Execution. Being made the analysis regarding the Obligatory Rights; The understanding defended and adopted by the courts; The point of view of those who defend what results from this obligation and those who suffer from the bad formulation of fines against them; in line with the code reform. This literature review research is expected to take five months. In the first and second months, a survey of the theoretical framework was carried out; in the third and fourth month, the literature review; in the fifth month, the elaboration of the pre -textual and post-textual elements that make up the entire work.

As Gonçalves (2019a) adds, the literature review consists of the perspective of bringing public bibliographic data as an instrument of reflection to a subject that is intended to debate or dialogue. A qualitative research treats the information collected with an analysis of all the nuances allowed in it (GONÇALVES, 2019b).

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ASTREINTES: THE OVERVIEW OF CHANGES DEVELOPED PRIOR TO THE REFORM OF THE CIVIL PROCEDURE CODE OF 2015.

The astreintes emerged in the early 19th century by praetorian initiative. Initially, the doctrine considered the institute *contra legem* , however, after several questions and periods of setback, with the help of jurisprudence, there was a consolidation of the instrument as a coercive measure and independent of compensation for damages. Thus, French law recognized in 1972, through Law n° 72-626, the astreintes under the title: On Astreintes in civil matters, expressly providing for its application as a fine by the French courts. Later, in 1991, the French enforcement process was reformulated and the legislator dedicated an exclusive session to astreintes (AMARAL, 2010, p.5; DINAMARCO, 2003a, p.38).

The resistance found by the institute in French law is related to the defense of freedom and autonomy of the will, very much in vogue at the time. This freedom was apparently contrary to the imposition of an attitude on the defendant. Therefore, the old Napoleonic Code expressly prohibited the fine and provided only for the settlement of obligations in terms of losses, damages and interest. Over time, the judges themselves felt the need to apply the fine, even if it was against the law, giving rise to the astreintes . Even so, for more than a century, they were considered as a simple advance of compensation for damages (MARINONI; ARENHART, 2008, p.72; DINAMARCO, 2001, p.24; DINAMARCO, 2003b, p.33).

The position of the doctrine contrary to this view and the repeated decisions of lower court judges were decisive in the change in the understanding of the Court of Cassation in France. Thus, in 1959, the First Civil Chamber of this Court determined that the astreintes had an impositional nature, seeking to compel the debtor to perform and not indemnify nature, not to be confused, therefore, with losses and damages. In 1972, the advance was even greater, Law 72,626 expressly provided for the application of the measure, that is, now the fine would have legal support. In 1991, with the reform of the enforcement process in France, a specific section was edited for astreintes in Law 91,650 (AMARAL, 2010, p.8; CAPPELLETTI; GARTH, 1988, p.32).

Even before the CPC reform, such a forecast already existed. In fact, its insertion in the Brazilian legal system occurred with the CPC of 1939. However, with the new wording, there was mention of the possibility of imposing the fine in anticipation of guardianship and its application to the obligations to deliver things. Before Law No. 10,444/02, the Brazilian State had difficulties in satisfying creditors with obligations to do and not to do, precisely because of the lack of means to coerce the debtor to perform the obligation without converting it into damages. Although

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article 287 of the CPC provides that the author must request the imposition of astreintes , from Law No. both in the anticipation of guardianship and in the final sentence (PACHECO, 1999, p.260; DINAMARCO, 2001, p.24; DINAMARCO, 2003b, p.38).

It should be noted that article 461-A, introduced in the CPC by the reform introduced by Law No. 10,444 of 5/10/2002, applies the same provision to obligations to deliver certain or uncertain things. With this change, precedent 500 of the Federal Supreme Court, (BRASIL, 1968) which provided for the non-application of punitive action in obligations to give, was superseded. The initial term for application of the fine is default, that is, it can be imposed from the moment the debtor does not fulfill the obligation within the deadline, or when he is summoned to fulfill it and does not do so promptly. This period is defined by the judge when forwarding the compliance order to the defendant. The initial term of the daily procedural fine will be fixed by the judge, if not already provided for in the title. A reasonable period must be established before the start of its incidence, taking into account the specific circumstances: not so distant as to render the protection in favor of the creditor innocuous, nor so close that it becomes impossible for the debtor, even if he wants to satisfy the obligation without incurring a fine. (WAMBIER; ALMEIDA; TALAMINI, 2008, p.335).

It is noteworthy that if the decision imposing the fine does not include the period within which it will begin to apply, the decision will be invalid, applying precedent 410 of the STJ (BRASIL, 2007; BRASIL, 2009). The fine is foreseen in the sentence itself and the judgment of an appeal in relation to it is pending, with suspensive effects, the fine does not apply until the appeal is decided. In the case of a fine imposed in anticipation of guardianship, the effects are immediate (TALAMINI, 2003, p.253; DINAMARCO, 2017, p.103).

The opposite of opinions referenced by the scholars is that the fine can only be charged after the final decision has become final, provided that the anticipation of guardianship in which the fine was applied is confirmed. This current argues that the intended coercion with the application of the fine is in the threat of payment and not in the immediate collection. Didier disagrees with this argument, since there is no suspensive effect to the decision, preventing the provisional execution is not justified. This position seems to be the most correct and is vehemently the most used by legislators (TALAMINI, 2003, p.254; DINAMARCO, 2003b, p.41; DIDIER JR, 2010, p.456).

The fine will apply until the obligation is fulfilled, or while there is a possibility of fulfillment. If compliance is no longer possible, or the option to convert into damages is made, the fine will no longer apply. In these cases, the credit arising from the

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period in which the fine was imposed remains, and its deduction from the indemnity for damages is not applicable (DINAMARCO, 2013, p.91).

The impossibility of specific protection can be verified ex officio by the judge. A specific request by the plaintiff is only necessary in the event that there is still the possibility of specific protection and he, even so, chooses to convert it into damages, ceasing the incidence of the fine. Astreintes also cease to apply when surrogate means are applied to achieve an equivalent practical result (TALAMINI, 2003, p.256).

The major doctrinal discussion is about the final term of astreintes in case the default goes on for a long period. It is questioned whether it would be possible for the fine to be levied indefinitely. One current states that it is not possible. For these authors, the judge must verify, after some time, that the fine has not reached its coercive purpose and stop its incidence. From there, the obligation could be converted into damages, for example. The author points out as a solution the verification, by the judge, of the possibility of obtaining an equivalent practical result. If there is such a possibility, surrogate means must be used to achieve it, ceasing the incidence of the fine. If this possibility does not exist, there is no need to contain a glimpse through the legitimacy for the cessation of the incidence of the fine based only on the defendant's insistence on failing to comply with the order, and the fine must be maintained and the other measures applied (WAMBIER; ALMEIDA; TALAMINI , 2008, p.336; ALVIM; GRANADO; FERREIRA, 2019, p.2657).

The astreintes fell as a kind or means of coercing the defendant in order to compel him to comply with a court order. They are used within the scope of specific protection. It is a coercion of an economic nature that aims to influence the mood of the debtor. The longer he delays the performance of the obligation, the greater the fine to be paid (ALVIM; GRANADO; FERREIRA, 2019, p.2005).

In the words of Plácido e Silva (2016, p.153), This term has a French core, lacks interpretation for the correlate and indicates, in the civil procedural technique, the pecuniary penalty within the execution. It is the injunction measure of unfavorable constriction against the debtor to do or not to do, whose daily value is rooted through a judge in the executed sentence, which will last as long as the default persists.

The astreintes are the daily fine used as a coercive means for the execution of the executive order. It would be a kind of indirect execution, designed to psychologically pressure the debtor to satisfy the obligation. It is included in the Code of Civil Procedure (BRASIL, 2015), with legal provision in article 814:

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> Art. 814. In the execution of an obligation to do or not to do based on an extrajudicial title, when dispatching the initial, the judge will set a fine for the period of delay in fulfilling the obligation and the date from which it will be due. Single paragraph. If the amount of the fine is provided for in the title and is excessive, the judge may reduce it.

Although the recipient of the fine is, in general, the debtor of the obligation, he understands that there is a possibility of its application to the claimant, as in the case of counterclaims, for example, formulated in a counterclaim or in claims of a dual nature. He also points out the possibility of imposing the fine on a third party outside the dispute. This would be the case, for example, of a mandatory sentence aimed at a legal entity, with provision for a fine in case of non-compliance to be imposed on the individual responsible for ensuring compliance with the order (DIDIER JR, 2010, p.468; DINAMARCO, 2017, p.114).

It should be noted that the fine is also applicable in cases of fungible duty , since , even if it is the use of subrogatory means is likely , nothing prevents the execution from being sought by the defendant himself. This is also because compliance by different people often becomes more onerous and complex. There is no value limitation, and may even exceed the total of the obligation, and they are provisional, since they cease with the performance of the obligation. This value can be changed by the judge in the execution, either for more or for less (TALAMINI, 2003, p.245; OLIVEIRA, 2001. p.327).

Initially, the astreintes were applied in the condemnation of the execution process. However, more recently, the conviction has been waived, and the judge can apply them in the anticipation of guardianship. Its application cannot be retroactive, given its purpose of coercion, that is, it will start counting from the non-compliance with the court order and will no longer apply from the fulfillment, from the impossibility of the demanded fulfillment or not of the defendant's fault, from the choice by the plaintiff for compensation for damages, the exclusive adoption of acts of subrogation or the loss of the coercive capacity of the astreintes resulting from the defendant's insolvency, for example. The dismissal of the action also determines the extinction of the fine. The origin, in turn, does not reinstate those established in anticipation of relief revoked by a later decision (TESHEINER; AMARAL, 2010, p.12).

Notwithstanding Article 814 of the CPC only refers to a daily fine, usually, astreintes are fixed for a period of time, whose compensation is given by a daily or monthly fine, for example, and even an hourly fine. However, the dominant understanding is that there is no fence for setting a fixed value. This option comes from the protected object, when it comes to rights whose violation is instantaneously consummated, the most correct is the fixed fine, whereas when it comes to continued

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illicit, the periodic fine is more appropriate (ALVIM; GRANADO; FERREIRA, 2019). , p.2005; BRASIL, 2018b, STJ).

The unit value of the periodic fine may , however , different as long as it is too small or too much for the purpose coveted . It is also required that time be given skillful for the defendant carry out the task _ antecedent of the incidence of astreintes . Partial performance authorizes the reduction of the fine, provided that the obligation be divisible (TESHEINER; AMARAL, 2010, p.13).

Understanding the legal nature of astreintes is very relevant to understanding their function and effects in the Brazilian legal system. First, it should be noted that its legal provision, as demonstrated, is found in the Code of Civil Procedure, hence its procedural nature is already demonstrated. Regarding its specific legal nature, there is a lot of doctrinal divergence. For a long time it was understood that it was a matter of compensation, confusing a fine with reimbursement. In 1959, the French Court of Cassation clarified the issue, determining that astreintes constituted a measure completely different from damages, not having a compensatory nature. The controversy was definitively resolved, in that country, with Law 72,226/72, which expressly provided for the application of the measure and its appropriateness. Following the same path, in Brazil, §2 of article 461 of the old civil procedure code (BRASIL, 1973), made it clear that the fine is independent of compensation for damages, that is, there is no need to speak of an indemnity nature. (MARINONI; ARENHART, 2008, p.74; GONÇALVES, 2019c, p.188).

One of the most defended positions today is that the astreintes would be a coercive measure in order to protect the authority of judicial decisions and the very dignity of the Judiciary. In fact, the coercive purpose of the fine is to convince the debtor to comply with the obligation and this imposition is carried out by the State. Despite this, in both French and Brazilian law, the beneficiary of the fine is almost exclusively the plaintiff . German law, on the other hand, follows a different line, providing for the fine to be directed to the State, since such a measure serves to defend the authority of the State-Judge, there are authors who criticize this theory, asking what applies only to some types of obligation, that is, if their nature were really that of an instrument of defense of the state authority, the correct thing would be that they were applied to any and all judicial decisions, since in all of them there is a need to protect the dignity of the Judiciary, since when there is noncompliance, there is offense to it and the fine is not capable of preventing this from happening (AMARAL, 2010, p.57; MARINONI; ARENHART, 2008, p.74).

The fine has a coercive and accessory nature, not having an indemnity or punitive nature. It exists simply to coerce, to convince the debtor to fulfill the

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obligation. He agrees with Guilherme Rizzo Amaral that astreintes should not be confused with a punitive fine for *contempt of court ;* attack on the dignity of justice. The current that understands that the nature of the fine is a procedural instrument aimed at inducing the defendant to comply with the warrant, without compensation or even compensatory nature. The daily fine is a typical mechanism for preserving the judge's authority, constituting a public procedural measure. (DIDIER JR; BRAGA; OLIVEIRA; CUNHA, 2020, p.445; TALAMINI, 2003, p.239; WAMBIER; ALMEIDA; TALAMINI, 2008, p.336).

According to the understanding of the Superior Court of Justice, 4th class (BRASIL, 2013) in decision, the astreintes would have a hybrid nature, with characteristics of procedural and substantive law. The specific nature would be a coercive measure used to compel the defendant to comply with the obligation. However, there is no consensus even within the scope of the STJ, 3rd class (BRAZIL, 2012a), since, in another decision, the court expressed its opinion on the purely procedural nature of the institute; Possibility of cumulating astreintes with contractual charges due to the different nature of the two institutes. Procedural nature of astreintes and substantive law of contractual charges. Therefore, it appears that the divergences around the legal nature of astreintes have not yet been resolved even by jurisprudence. Despite the different understandings, the positions prevail in the sense of their hybrid character, being the procedural and material character (AMARAL, 2010, p.28; CARVALHO, 2004, p.216).

Regarding the amount of the fine, §4 of art. 461 of the former CPC (1973) refers to compliance with the sufficiency and compatibility of the fine with the obligation. Compatibility is related to the hypotheses that the fine is applicable, while sufficiency is more directly related to the value attributed to it (BRASIL, 2014, STJ).

Astreintes are not limited to the value of the obligation, nor to the damages derived from its default, as they do not have an indemnity nature, for this there is a penalty clause and losses and damages, different institutes of astreintes . In this sense, the understanding is that the amount resulting from or deriving from the fine will tend to be fixed so that it fulfills its function as a pressure mechanism on the debtor's will. Therefore, it is not necessarily limited to the value of the obligation being performed. There must be an amount capable of shaking the debtor in his decision to continue disregarding the executive order; (WAMBIER; TALAMINI, 2018, p.337).

In establishing the amount to be paid, the judge must seek to assign a value that can concretely influence the defendant's behavior, taking into account his economic situation, his ability to resist, the advantages for him arising from the default, and other values not assets that may be involved. Therefore, as the judge

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must necessarily observe the parameters of sufficiency and compatibility, in addition to the circumstances of the specific case, Talamini understands that there is no discretion in the allocation of this quantum. Even so, this value can be reviewed by a higher court based on disobedience to the aforementioned criteria and the principle of least sacrifice (TALAMINI, 2003, p.248; GONÇALVES. 2019, p.188).

In the case of an increase in the amount of the fine, the new amount will apply from the date of communication to the defendant, which will contain a reiteration of the compliance order. Talamini (2003, p.254) clarifies that it would not make sense for the increase to take effect in the event of new facts, as its objective is to psychologically pressure the defendant, which will not occur until he is aware of the increase. It is important to point out that there may be changes even to the fine provided for in an extrajudicial executive title. Luiz Rodrigues Wambier and Eduardo Talamini (2018, p.218) talk about this possibility in cases where the judge considers the stipulated fine to be excessive.

The Superior Court of Justice understands the review of the fine as a new probative analysis, providing legal certainty to the decision that arbitrated it. That is, the value of astreintes must respect the principles of proportionality and reasonableness, but applied to the specific case, based on the evidence and allegations brought to the case. This means that, within the scope of the STJ, there will only be changes in values if the stipulated amount is clearly derisory or exaggerated. However, if there is a change in the factual situation, the values of the astreintes can be modified even after the final decision, without any harm to the res judicata. In this sense, the STJ (BRASIL, 2012b) has already expressed its opinion in its Jurisprudence Report No. 481 (DIDIER JR; BRAGA; OLIVEIRA; CUNHA, 2020, p.445; THEODORO JÚNIOR, 2017, p.127).

The execution of the credit derived from the fine is carried out in the same process in which the order to fulfill the obligation was given. However, the procedure adopted will be the execution for a certain amount of a judicial title. The tax calculation on the exact amount to be received does not depend on liquidation, as it is a mere arithmetic calculation, in the event of a decision on appeal or an action of challenge defining that the plaintiff was not entitled to specific protection, the resulting credit of the fine will be void. That way, if the author has already received it, he will have to return it. It is also possible to partially enforce the fine, that is, it is not necessary to wait for the term of its incidence to receive part of the credit, its enforceability is sufficient. If the incidence continues, the author may carry out successive executions. There is already a manifestation on the subject by the STJ; impossibility of enforcing the fine based on an interlocutory decision. (DIDIER JR,

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2010, p.453; TALAMINI, 2003, p.263; ALVIM; GRANADO; FERREIRA, 2019, p.2454; GONÇALVES, 2019c. p.282; BRASIL, 2013, STJ).

The use of the fine as a coercive measure is widely adopted by the Brazilian judiciary. However, Didier (2010, p.459) makes some reservations regarding the dissemination of this practice in small-value obligations or in the face of defendants who do not have the financial conditions to support the application of the fine. For the plaintiff, when the obligation is of small value, the fine can become the main objective of the plaintiff, who starts to want the defendant not to fulfill the obligation in order to obtain a greater gain, which may result in an unjust enrichment of the plaintiff. .

If the defendant does not have the financial means to bear the fine, its application as a coercive measure is in itself innocuous. In relation to this topic, an important issue was raised in the III Civil Law Journey of the Federal Justice Council (BRASIL, 2004): the principle of objective good faith of the creditor to avoid the aggravation of the damage itself. According to this principle, the plaintiff has a duty to mitigate his/her losses, that is, to take steps to avoid further aggravating his/her losses. As a result of this principle, the position of the author who omits himself, failing to perform procedural acts to protect his rights, with the objective of delaying the fulfillment of the obligation, obtaining a greater gain with the astreintes . Failure to comply with this principle constitutes an illicit act that violates the general clause for the protection of objective good faith (DIDIER JR, 2010, p.462; DIDIER JR; BRAGA; OLIVEIRA; CUNHA, 2020, p.461).

Another criticism that is founded by scholars and that is made against astreintes is in relation to their exclusive destination to the author of the action. It is believed that this definition was influenced by French law, first raised by Guilherme Rizzo Amaral (2010, p.41). The fact is that many scholars consider the public character of the fine to be inconsistent with its allocation to the author and not to the State, as in German law, for example.

Talamini (2003, p.264), however, sees two major advantages in allocating the fine to the author. The first would be the increase in psychological pressure on the defendant with the prospect that the credit resulting from the fine will be quickly and rigorously executed, since this will be the responsibility of the author and not the State. The second advantage would be that the credit of the fine could be used in an eventual composition with the opponent, the author could, for example, give up part of the fine in exchange for fulfilling the obligation.

On the other hand, Talamini (2003, p.265) points out criticisms made by French doctrine to the same provision belonging to that legal system. There, it is alleged that the judges, already knowing that the cumulation of the fine with the

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losses and damages will result in a very high amount, capable of generating an excessive gain for the plaintiff, end up establishing the fine at a very small amount, losing , with this, the instrument's ability to intimidate, which points in this direction Humberto Theodoro Jr (2017, p.829).

Here in Brazil, however, this practice is not yet observed by magistrates. Having made these considerations, Talamini (2003, p.267) analyzes the perspective of the plaintiff's unjust enrichment in two situations: in infungible obligations and in fungible ones. In the former, the author rules out any possibility of unjust enrichment, since the damage caused by failure to comply with the original duty to do or not do is pecuniarily inestimable, and there is no parameter to speak of unjustified gain.

In the case of fungible obligations, when there is full or precise monetary equivalence, or when the state arising from the transgression is subject to full and economically assessable restitution, unjust enrichment may be verified. Even so, this situation occurred as a result of the defendant's free and spontaneous conduct, and linking the amount of the fine to the economic dimension of the obligation would remove much of its effectiveness as a subpoena instrument. For the above reasons, the aforementioned author defends the constitutionality of the astreintes , making only a suggestion that the amount of the fine that exceeds the obligation should be allocated to the State and not to the author.

FINAL CONSIDERATIONS .

the *astreintes* are provided for in several laws of the Brazilian legal system, such as the Civil Procedure Code, the Consolidation of Labor Laws, the Public Civil Action Law, the Consumer Defense Code and others. The main purposes are to guarantee the effectiveness of specific jurisdictional protection and protect the dignity of the Judiciary. They replace the *manu militari activity* of the State, which would be inoperative and, perhaps, could become violent, because, in the final analysis, it would fall directly on the person of the debtor, possibly undermining his freedom.

It has to be said that the astreintes could be conceptualized as a fine imposed by the Judiciary, in the face of non-compliance with an obligation to do or not to do, whether fungible or non-fungible. Such a fine may even be imposed ex officio by the magistrate. They emerged as a way of trying to guarantee the specific protection of the State. Demand from people who seek assistance from the Judiciary to claim mandatory rights. The legislator's intention is for this right to be implemented as closely as possible to the initial agreement.

The purpose of this article is to provide a basis for the general panorama and how the changes in the codes expressly modified their interpretations in this way,

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how has the adequate fixation resulting from the astreintes ? It happens that, previously, the judicial protection could not compel the debtor to comply with the agreement, thus, the obligation was converted into damages and the end of the demand was almost always resolved with a payment in cash. However, this is not the outcome desired by the legislator. As a way of trying to change this situation, the astreintes , of French origin, were included in Brazilian Law. Such an instrument, currently, is nothing more than a daily fine for the period of non-compliance with the obligation. Astreintes constitute a technique of coercive and accessory protection, which aims to pressure the defendant to comply with a court order, pressure exerted by means of a threat to his assets, embodied in a periodic fine to be levied in case of non-compliance.

Coercion, as well as the enforceability of a fine, presupposes that it is possible to fulfill the task in its original form. Once the *in natura* payment is not possible , even due to the debtor's fault, the condition of the coercive fine will no longer be admissible. Its end does not stem from punishment, but basically from acquiring the specific quota. If the fulfillment of the obligation is impracticable, the creditor has to settle for the economic equivalent in losses and damages. However, if this infeasibility was incidental to the requirement of the daily fine, the validity of the measure will prevail until the event that made the original quota impossible.

The competence to set the astreintes rests with the judge responsible for the process, he may set them ex officio or at the request of the parties. This determination can be made in any instance, as long as there is a risk of default on the obligation. It should be noted that the astreintes do not apply in the case of a judicial decision that determines a specific procedure for its compliance and in the case in which direct execution by the Judiciary itself is possible. It is important to emphasize that the astreintes have no relation with moral damages, being completely autonomous institutes between them.

Discussing the transformation demanded by the new code of civil procedure of 2015, the fine, an essential characteristic of injunctive relief, aims to pressure the defendant to comply with the judge's order, aiming at preventing the illicit by preventing its practice, its repetition or its continuation. This fine may be provided for in the conviction itself or may be arbitrated during the execution of the sentence. In the case of an extrajudicial enforcement order, the fine will be fixed by the judge when issuing the initial execution, at which time he will also define the date from which it will be due.

There is, therefore, no means of definition in the arbitration of astreintes , since it is not a sum that originally integrates the party's credit, but a legal instrument of

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coercion used to support the executive jurisdictional provision. It is for this reason that there is no res judicata in the decision that defines the amount of the fine and its periodicity.

The change demanded by the 2015 code brought innovations on the subject. The main practical innovation refers to the allocation of the fine, which will be due to the plaintiff up to the limit of the equivalent of the main obligation, with the surplus destined to the State. It is noted, therefore, that the proper setting of astreintes is extremely relevant, since an inadequate setting can easily violate the principles of proportionality and reasonableness, as for the fact that the beneficiary of the claim is the author, a multitude of criticisms are arranged in the middle juridical, the nature of the fine being coercive and not indemnifying.

The solution presented at the time by the Project of the new Civil Procedure Code was to allocate the amount that exceeds the amount of the obligation to the State. In this way, the dispute is resolved, avoiding, at the same time, the author's illicit enrichment and the lack of effectiveness of the coercive power of the fine, which often becomes more advantageous than the performance of the obligation. It should be noted that in cases of inestimable quantum, it will be up to the judge to set a maximum value for astreintes destined for the creditor, with the value that exceeds this limit destined for the State. The Project also brought the possibility of provisional execution of the fine, through the judicial deposit of the amounts, an amount that will only be raised after the decision-making phase of the process, or through the provision of a bond, protecting the legal security of both procedural poles .

Such points are relevant, since the legal proceedings aimed at the fulfillment of obligations are a representative part of the total Brazilian legal demand. In this sense, the more progress there is in improving such processes and in the legal instruments to guarantee compliance with obligations, the more effective the Judiciary will be and the better the service of the requesting social demand will be.

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ENTREPRENEURSHIP AND INNOVATION IN HEALTH: AN ANALYSIS OF OPPORTUNITIES

EMPREENDEDORISMO E INOVAÇÃO NA SAÚDE: UMA ANÁLISE DAS OPORTUNIDADES

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ABSTRACT
The paper discusses health economics considering actual opportunities and the discussion about the current systems due to the Covid-19 pandemic. The analysis is exploratory based on a bibliographic search and a didactic approach to provide as a result the list of opportunities in the market. The work shows the importance of the health sector for national GDPs, the elements that characterize the health economy and the cognitive models used to define demand and supply of health goods. The result shows opportunities in different innovative areas such as health care services; diagnosis and therapeutics; financing and payment; well-being, platforms and support. The analysis focuses on health demand, a focus that differs from the classic economic approach that is based on the model of analysis of supply, a model still used mainly by the government in its management of the public health system.

KEYWORDS: *HEALTH ECONOMICS. ENTREPRENEURSHIP. OPPORTUNITIES*

RESUMO
A pesquisa parte do tema da economia da saúde pensado as oportunidades presentes e devidas a discussão sobre os sistemas atuais em decorrência da pandemia de Covid-19. A analise e exploratória com base uma pesquisa bibliográfica e uma abordagem didática para chegar ao resultado de fornecer uma lista de oportunidades no mercado. O trabalho mostra a importância do setor saúde para os PIBs nacionais, os elementos que caracterizam a economia da saúde e os modelos cognitivos usados para definir demanda e oferta do bem saúde. O resultado mostra oportunidades em diferentes áreas inovadoras como serviços de assistência à saúde; diagnóstico e terapêutico; financiamento e pagamento; bem-estar e plataformas e suporte. A analise tem foco na demanda, foco que se diferencia da abordagem econômica clássica que tem como base o modelo de analise da oferta, modelo ainda utilizado, sobretudo pelo poder publico na sua gestão do sistema de saúde publico

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PALAVRAS-CHAVE: ECONOMIA DA SAÚDE. EMPREENDEDORISMO. OPORTUNIDADES

INTRODUCTION

Studying the economics of health implies understanding the production of goods and services, components, inputs, sales and public services, that is, supply and demand. Considering the various markets: pharmaceutical, medical care, services of the national health system, etc., it is an important part of the national GDP in terms of values and occupation.

From 2019, with the beginning of the pandemic, we need to reflect more on what the future of the health economy can be and its opportunities for entrepreneurship, which, in our view, presents one of the most promising sectors besides the computer market.

How to innovate and undertake from 2021 in this market? The purpose of the article is to show the opportunities that are available today. The methodology of the work is exploratory and uses a bibliographic research and a didactic approach. It is intended to explore, starting from the health economics, the areas where new trends and innovations can be detected, endogenous or due to the pandemic crisis, using reports and scenarios from international consultants.

The work is justified to guide future entrepreneurs and researchers who are interested in patenting or producing applied research. The final suggestions are the result of the analysis and will be placed in a table as a summary to answer the question of what are the basic opportunities at this moment.

The work is divided into a brief literature reference, an analysis of the current health market, a discussion of trends and opportunities and a conclusion and references to close.

Health Economics a description through the literature

According to Kenneth Arrow (1963) there are conceptual distinctions between health and other goals that include government intervention, uncertainty, asymmetric information, barriers to entry, externalities and the presence of third parties in health care. An agent is the public power that provides health services. Another agent is the doctor, who guides the patient's purchase decisions in the market, for example: ordering a laboratory test, prescribing a medicine, performing a surgery, etc.

So a formal definition of health economics might be this: "the study of the allocation of resources to and within health economics to maximize scarce resources" and, in general, health economics can be researched on the following main topics:

- What is good health and the factors that influence health;
- The value of health;

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- The demand for health;
- The offer for health;
- Evaluation of health services and health systems;
- Health projects or planning, budgeting and monitoring mechanisms.

In the study of health economics, economists use characteristic approaches to their analysis based on statistical studies of diseases and the supply of goods and services. An early model of the production and supply of health was that of Michael Grossman from 1972, which considers each individual as both a producer and a consumer of health. In the Brazilian microeconomics manuals of health economics we find this logic of Grossman (BRASIL 2021)

Health is considered in the model a capital good. This good is treated as a stock or a capital good that decreases over time. As with all capital goods over time, maintenance or "investments" must be carried out so that the good can remain in good condition. (GROSSMAN 1972)

The model thus defines that health is both a consumer good that generates direct satisfaction and utility, and an investment good, which generates satisfaction to consumers indirectly, that is, with fewer diseases it is possible to obtain higher wages.

However, investments in health are expensive because it is necessary to choose between time and resources devoted to health. This is good has a hidden opportunity cost and direct costs like exercise at a local gym, medical checkups or interventions like dental care, annual checkups etc. they are alternatives for using resources (time, money) against other goals.

The model is used to determine the optimal level of health that an individual will demand. Among the variables used are the prices of health care and other goods, employment and wages, and technological changes. (FOLLAND 2013)

With this model, it is said that the demand for medical assistance is a demand derived from the supply for health. Health care is demanded because consumers want to achieve a greater stock of capital health good. The demand for health presents a differentiation from other goods because individuals consume health but allocate resources to invest in health.

Criticism of the classical economic model

From another point of view, Aveni (2020b) points out that a model that considers health as a capital good is not complete, as it presupposes that health is simply comparable to a good. The problem is in the definition of what is “good” health and its value.

On 25 September 2015, the United Nations General Assembly adopted a new development agenda, 'Transforming our World: The 2030 Agenda for Sustainable Development' which builds on the 1990 Millennium Development Goals (MDGs).

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As was conceivable, health occupies a central place as almost all the other 16 SDGs are directly or indirectly related to health. In particular SDG 3 aims to 'Ensure healthy lives and promote well-being for all ages'. The objective is broken down into 13 goals including reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases (NCD), mental health and road traffic injuries.

A Universal Health Coverage (UAC) system is a necessary and fundamental solution to SDG 3 in both rich and poor countries. The development of an AUC recognizes the important role of state legislative and executive bodies in reforming health financing systems to achieve universal coverage. That's why it's important in all countries because everywhere there are differences in income and access to the system. Therefore, to be universal, it must be possible for everyone to access basic services.

As suggestions for reforming health financing systems, the 2008 UN World Health Report on Primary Health Care, followed by the 2010 World Health Report on Health Financing for UHC suggest adopting the risk pooling method with the approach prepayment for financial health contributions as a means of: increasing population coverage to ensure adequate and equitable distribution of good quality health systems and to ensure sustainable financing of health programs or activities.

Thus, according to Aveni (2020a, 2020b) there are several problems of economic and social analysis, but, above all, health is a natural state of the human being that must be preserved and cannot be considered simply a good. It is a good/right in the sense that it cannot be ceded (it is part of the category of public goods) and must have priority in the choices of “use of resources” for the well-known law of “survival”.

Thus, always according to Aveni (2020b), the simplifications of the economic model distort the importance of health as a public good. The model puts the objective of the model to understand only which services and prices should guide the economic system on the supply side to reach an optimal solution or “ equilibrium” of the markets.

The problem, on the contrary, is that for health there is no balance and there is a phase of life in which the human being experiences more health and others in which he is more fragile and needs to be more careful with his health. It is about evaluating the cycle of “good health” for each human being.

At the end of life, there is no capital value of health that can be preserved, evaluated and given away. Health completely loses value despite the investments and in a certain period of time the maintenance or investments in health, besides being expensive, does not preserve health. For example, in terminal illnesses or at the end of life the cause of old age. Any investment would have no marginal utility which is contrary to the rules of classical economics.

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Thus, it should be considered that human beings must think of health as their good/right whose value is the maximum value they have and that they must think of health expenditures as a model of preventive expenditures. Like a scheduled maintenance. Every priority of personal expenses must be oriented mainly to health. A better model for doing this is a model of risk analysis and mitigation of adverse events, such as the current biohazard due to Covid-19. A model that must start from the "consumer" and its demand. It is thus perceived that the problem of medical care only exists when there is no health or the state of health is investigated. When the person is healthy, he should only be concerned with the probability of (risk) of getting sick.

Thus, economic models of health should be defined in terms of risks, probabilities and in terms of preventive assessments to maintain the optimal level of health depending on the age and location where the person lives. In our view, an analysis of choosing which resources among those available are the optimal solution for spending or which resources to allocate to medical care is only partial.

On the other hand, guidance for personal choices also depends on education. The State should take care of health education before a system for assistance. The human right to life and health takes precedence over other economic choices, being a fundamental human right that literally guarantees the lives of its citizens.

In the literature review, a new view of health economics thus focuses on consumer demand and requirements. Thus, an economy is emerging that deals with: health care services ; diagnostic and therapeutic; financing and payment; wellness and platforms and support (PWC 2021).

Importance of health economics

The healthcare market is one of the largest markets in the world offering products and services from various chains and industrial sectors, such as the production chain of pharmaceutical goods, machinery and equipment, hospitals, services and laboratories.

The entire health market prioritizes the supply of private and public goods and services, and the latter is the largest supply sector in terms of employment and GDP generated in many countries and nations. The private offer focuses on high-end goods and services with a wide profit margin, which leads to the public offer so that everyone can have a service that, with a private offer, would be limited to those who can pay.

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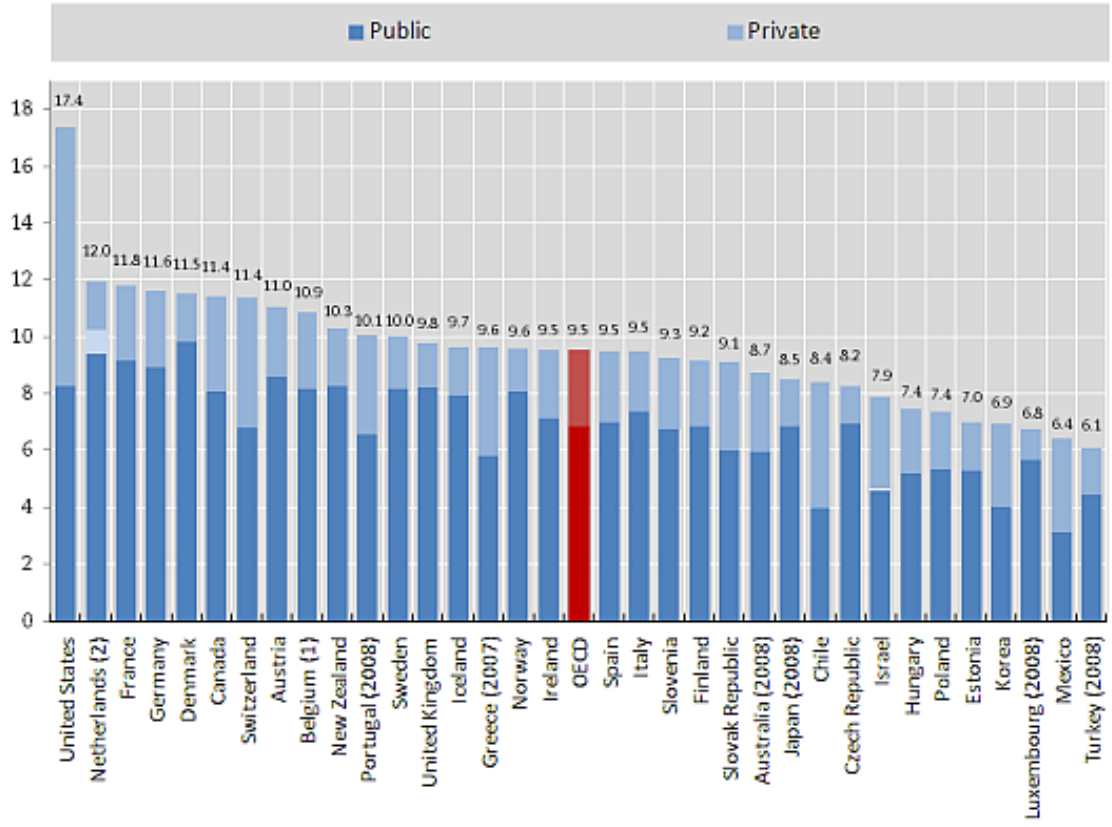

Source OECD (2018): https://www.oecd.org/els/health-systems/healthspendingcontinuestooutpaceeconomicgrowthinmostoecdcountries.htm

The healthcare market in the US accounts for 17% of GDP. The graph below shows the comparison of expenditures between OECD countries, divided between public and private. The average of total expenditures is 9.5% of GDP for the OECD. The following figure shows private (light blue) and public (dark blue) spending by OECD countries in 2009. US spending is considered to exceed 17% of GDP spending. The OECD average is 9.2% of GDP spending. (OECD 2018, 2019)

In 1960, food accounted for about 25% of expenditures, housing for about 15% and medical care for only 5%. This situation reflects the importance of labor and capital in the health economy. The other side of the expense reflects the jobs created in the US healthcare economy in 2009, 15.5 million people, 11.1% of all employed civilians worked in various healthcare facilities. These numbers continued to grow despite the loss of more than 5 million jobs in the US economy between 2007 and 2009.

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Among health expenditures, the hospital care sector and hospitals are the most important and fastest growing, employing 40.5% of health professionals. Other major employers include medical offices and clinics (10%), nursing care facilities (12.1%) and dental offices and clinics (5.2%) (OECD 2018, 2019, WHO 2019)

Graph 1 – Spending in % GDP OECD.

The size of the health economy is reflected by other indicators. For example, in 2009 it was found that US consumers spent 17.9% of their budgets on healthcare versus 13.8% on food and 18.8% on housing. When we add in drug spending, we find that just over $1 out of $5 of consumer spending goes towards healthcare, in addition to drugs and sundries. These numbers represent a major shift in spending patterns (OECD 2019)

Health economics is such an important area that the US in 2009, despite spending on health that was twice the average for OECD countries, with the OBAMA or *Patient Reform system Protection and Affordable care Act* (PPACA), had about 50 million Americans without health protection and without a public system.

The study of health economics can be understood through public expenditure indicators in three related ways: (1) the size of the contribution of the health sector to the economy in general; (2) national policy concerns resulting from the importance many people attach to the economic problems they face in seeking and maintaining their health; and (3) the many health problems related to economic development (FOLLAND 2013)

As has already been reported, one of the problems of a health system, that is , for the production and provision of public services with a health system, there must be financing of the relative costs. There are five main methods of financing health systems (WHO 2019):

- General taxation of the Union, State and Municipality;
- National health insurance;
- Voluntary or private health insurance;
- direct payments;
- Donations to charities.

This is valid for production costs, ie supply. The demand analysis is formed considering the expenses of users and customers of health goods and services. Private spending provides an indicator of purchases of goods and services or final consumption of health goods and services (current health expenditures). It includes spending of all types of financing arrangements (eg, government-based programs, social insurance or direct spending) on medical services and goods, population health and prevention programs, and health system administration.

Thus, nowadays the financing of health expenditure combines public service and compulsory financing schemes with private insurance of a mandatory nature (they occur, for example, in Switzerland and the

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Netherlands). However, there are different schemes in all countries. Voluntary private insurance in the United States is included in employer-based private insurance and is currently required by the Affordable Care Act (WHO 2019).

Discussion about the market and its opportunities

As seen in the previous section, the health sector is a large and growing part of all GDPs of all economies in the world. It is a sector in which it is worth investing and undertaking. The importance of health savings in personal expenses is responsible for a large part of the domestic product.

Before entering the market, the entrepreneur must understand the competition and how the market works, that is, he must know the opportunities and threats of the environment. Regarding threats, the current health market is not economically competitive in the economic sense of free competition and number of companies. The medical profession and health services that should be public services are services offered on a contingent basis, it is only possible to practice the profession through examinations and public authorizations. This implies difficulty in reducing the price with services of equal value, but at a lower cost.

In informal market situations, there may be illegal health services that provide services at a lower cost, but without guarantees to the patient. This informal market can grow with a lack of competition and proper regulation. This failure in supply and the increase in unmet demand impacts income groups that are unable to pay the tariffs imposed by the system (WHO 2019). There are problems with the efficiency, effectiveness and equity of markets.

Another element of market analysis is to evaluate the agents and actors present. The key actors in the healthcare sector are hospitals, long-term care, doctors, professionals and the pharmaceutical industry.

Another element of analysis is assessing the risk analysis. In the end, health economics must look at the market for products that cause damage to health, epidemiology and its relations with the economy (HIV/AIDS in Africa, influences, etc.).

Among the challenges of managing public services rich, which can generate opportunities, it is necessary to remember that an element that the public and the private must still evaluate and incorporate in their business is the impact on the environment, as well as circular economy solutions. observing the cost reduction requirements of environmental recovery, hospital waste management and reduction of carbon gas emissions, among others.

Always from the point of view of environmental analysis in relation to the right, the health economy must integrate its analysis and way of acting in accordance with human rights. It can help in the discussion of patient choices in health economics, in decision theory, with game theory models, in the use of institutional or *public economics. choice* , and in the administration of demands answered with an offer of value.

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The analysis of health goods or services, as public goods (non-rival in consumption) and on negative externalities of some goods (alcohol) does not cover the definition of the health service, as the provision of services only meets part of the health requirements (AVENI 2020a).

Regarding demand and supply analysis, we must transform the supply-centric economy into a customer-centric economy and for society (PWC 2021). For, the analysis of demand for welfare and social equity cannot equal the demand for goods and services in a consumer market.

Health economics must be seen from the point of view of the discipline of the economics area, but also to assess social variables and the national ecosystem. Health economics should also be studied from a management point of view (FOLLAND 2013).

In management studies it is necessary to evaluate the role of the manager and the organization to assess whether in organizations there is this function that is similar to the general director of an industry. Management and administration are the basis for undertaking in the sector and guidelines are needed to use management tools.

It is also necessary to understand the political strategies of concentration and decentralization of services, financing of expenditures and social insurance that observe the local situation and future trends. The proposed changes take place in a scenario where innovation is quite accelerated and transforms our lives, as it is possible to perceive with the Covid 19 pandemic (AVENI 2020a).

In healthcare, the economic cycle of supply and the financial cycle that leads to profit are delayed when the company works with public proposals, which happens in most cases, as public logic does not reflect business efficiency. This causes financial backlog, demand overloads, bureaucracy and, potentially, the ongoing danger of public system collapse.

Private service companies offer increasing management and personnel costs, so all private services are expensive and not always effective. They are certainly not cost efficient, as competition in the case of healthcare increases the initial costs of entering the market (education, specialization, tools, marketing, etc.) and this is reversed in higher prices for patients. In other words, the increase in costs translates into an increase in prices. On the other hand, it is not possible to reduce costs by reducing patient care as in a normal market for goods and services.

However, with new technologies it is possible to reduce costs and propose alternative models for the provision of health services (AVENI 2020a). As an example, the use of telemedicine can solve cost and care problems as will be explained in a topic of this discipline. Other solutions are to improve efficiency and collaboration between hospitals, clinics and establishments in terms of managing patient data and information whenever these cost savings translate into cost savings. The same can happen with the community and home care system.

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Our perception is that a demand-oriented economy must first assess human rights and then supply in terms of savings or scarce resources. Public policies must offer basic, cheap and sufficient services so that the population is not held hostage by an economy based on private interests. That is, it should solve the problem of scarcity of services in the market and let companies compete for the market bands that can or want to pay for extra services.

The need for natural monopolies such as the health system is a problem, as it limits the market, but it cannot be eliminated. The evidence is the functioning of the health system in the event of pandemics and accidents. A capitalist market would be death for those who do not have access to assistance, an immoral situation that does not consider human rights.

What remains outside basic health care and can be privatized is a market that is too broad for companies and professionals and does not limit the freedom to undertake or create businesses. But basic and universal health can save lives as well as being ethical.

Finally, in order to achieve universal health in the future, it is necessary to review the policies of education and authorization of medical professionals in terms of prices for consultations, offering good quality hospitals and clinics at affordable prices. One of the possibilities is to create a system of agreements, insurance and popular service that meets the demands of the population. This happened with drugs in pharmacies and with the possibility of creating teams for popular clinics in various parts of the world. But, this is only part of the question (WHO 2019).

Using information technology, it is possible to serve the population well and provide low-cost services, however it is necessary to develop more processes and models to adapt the system according to future requirements due to the increase in population, in addition to solving specific and local epidemiological problems.

Discussion results

As a final guideline for opportunities, it can be said that the macro analysis of the environment and markets, presented here, leads to defining some opportunities for the entrepreneur who wants to enter the market.
The results will be presented briefly below.

1 - Understanding of “good health”

A first opportunity can be seen in “outside the box” thinking and creativity in relation to an innovative approach to health. This is to assess whether to maintain the vision of health as a capital asset and therefore enter into competition in the current market or to think of health as a good/right and risk management. In our view, the second hypothesis , in addition to looking more at the customer's needs, has a different perception of the object of the business,

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the good. If the client realizes that health is not something to take care of when it is lacking but because it must be continuously monitored, there will be a critical change as well, for example in the food system. Consumers will demand healthier foods. The different view of good allows creating products such as preventive or financial assistance that are not currently available on the market. That would be a radical innovation.

2 - Investment in education and health as a system of life or well-being

Here, innovation is not radical because we already have educational and didactic systems on the subject of health. Here the opportunity is less radical, more marginal and focused on educational content. The type of “consumer” depends. One should think about courses for children, teenagers, adults and seniors. Each must be oriented to prevention and management in a different way. In our view, it should not be a study subject typical of a specialization, for example by doctors , but necessary knowledge that is above physical education, the latter being a part of the health discipline. Increasing age should include examples and practical internships (eg first aid) and be included as in-company training for all employees. Among the topics should be considered a base of medicine but also of psychology and everything that can serve to understand how to achieve personal well-being.

3 - Supply and demand market opportunities.

Here we have narrowed down all opportunities into four categories that include supply and demand (PWC 2021)

- health care services;
- diagnostic and therapeutic;
- financing and payment;
- wellness and platforms and support

a) health care services;

Here, one can consider current services that will not disappear, such as hospitals, doctors, nurses, drugstores, whether public or private or from the third sector. A better focus and investments should be geared towards:

• universal health systems (including the ranges currently exceeded)
• home care systems (because it is less expensive for public assistance)
• preventive and diagnostic systems

Regarding innovation, following the classification of the OSLO manual, the focus more than on product/service assistance should be thought of improving processes, marketing and organizational solutions. For example, simplifying and making the assistance process more efficient . Change marketing by changing the idea of pushing the product (pharmaceutical sector) to waiting for customers to pull. Changing organizations into multidisciplinary teams where doctors are not necessarily in a dominant position and where the focus is not on selling products and services but on consulting.

b) diagnostic and therapeutic;

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Here with the digital revolution there is a huge range of opportunities. The technology and tools available are much greater than in years past and continue to grow exponentially. The relationship with the “consumer” is also made through means of communication such as telephone and video calls. The collection and service for diagnoses nowadays is done at home or at the work place, avoiding queues and congestion. Therapies and tools for implantation and organ replacement are including 3D production systems and innovative materials. Thus , in addition to the innovative results, there are opportunities for research and development of materials and very advanced machines. The entire value chain here is rapidly innovating and developing techniques and technologies. One should think about the rapid production times of vaccines for Covid-19. Digital systems have faster and safer diagnostics and information management. This also allows you to plan battery packs of exams and results more efficiently and at lower costs.

c) financing and payment;

Here the opportunities are even greater because in many countries where the public health system has a universal focus there is a natural monopoly intended by the state. As the costs and results of the system are found to have adverse financial effects, a change becomes necessary in all countries. In particular, with the aging of the population in terms of cash, the contributions of workers in force to the universal system are no longer able to pay the current expenses for a population of retirees with increasing costs of services and number of retirees. The financial problem must be solved, but not just by changing the rules for retirement. The life and health cycle must be understood as something to be better planned and supported by insurance systems. Insurance and guarantee systems for retirement must be used in an innovative way with products differentiated by age class . The reserves that are formed in the families or the insurances for the current retirement can be improved with less expensive solutions (increasing the number of insured) and differentiated in relation to the requirements and the agreements with offers of better or private services.

d) wellness and platforms and support

This area presents a challenge to creativity and innovation. Including services for well-being enters into a philosophy of medicine called a lifestyle. Lifestyle medicine is a medical approach that aims to pursue a lifestyle with healthy habits. The basis of the philosophy is prevention and not health care and the use of the health system. This approach falls outside the monopoly of public health care. Ahead of health risks, this is the method to reduce adverse events or health risks, avoid new diseases and poor quality of life. Risks are assessed based on illness and death statistics. For example, physical inactivity and its effects, or the effects of different eating habits. To support a lifestyle, doctors can obviously provide guidance , but those who accompany the “consumer” are mainly members of a multidisciplinary team that includes:

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psychologists, nurses, physical trainers, nutritionists, pharmacists, dentists, financial managers, other consultants and professionals for improve and maintain the lifestyle.

Conclusion

The work addressed the problem of understanding which opportunities in the health economy for entrepreneurs today. The analysis was not limited to the situation after the pandemic, as it is clear that the pandemic only accelerated in the proposal of digital solutions, but problems with the health system remain and we still do not know the final costs of two years of pandemic in the public coffers.

The pandemic, however, is an ideal time to reflect on the current system given the deficiencies shown in all governments in the use of public health systems and in the responses. There was no comment on the lack of planning and management that manifests itself in all governments in the world even today after two years of the pandemic. The problem of the innovative process and the need for patents in the sector were also not addressed. This limitation can be covered with a subsequent study with this focus. The topic is also relevant for its ethical aspects, which were also not discussed in the current work.

However, despite this, many opportunities were found. Depending on how health is understood (capital good or good/right) entrepreneurs can think about competition in the market in which they have a competitive advantage or trying to create something different and innovative (a destructive innovation) in a market by thinking outside the “box”

As examples for this, the theme of the view of health as a life cycle and risk gestures and lifestyle medicine was addressed. An entrepreneurial vision outside the box allows avoiding bloody competitions, referring to the Blue Ocean strategy, but, above all, anchoring itself to an international vision of sustainable goals based on human rights proposed by the UN commented above.

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