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Emprego de insumo nanobiotecnológico natural em uma formulação farmacêutica

Use of natural nanobiotechnological input in a pharmaceutical formulation

Uso de insumos nanobiotecnológicos naturales en una formulación farmacéutica

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Resumo

O uso de insumos nanobiotecnológicos de origem natural é essencial para a saúde humana e para o meio ambiente. Essa pesquisa é de fundamental importância, devido à conscientização atual dos consumidores em utilizar insumos farmacêuticos mais naturais, sustentáveis e saudáveis. Sendo assim, ocorreu uma crescente demanda por formulações farmacêuticas mais biocompatíveis com o organismo, e que essas deviam possuir em seus rótulos não agressão à natureza (meio ambiente) e a não utilização de testes em animais (USP, 2018). Dessa forma, os consumidores querem direcionar os benefícios que vêm da natureza, entre outros meios de conhecimento, para suas famílias. Eles estão procurando associar o custo do produto cosmético acabado ao benefício que ele traz para a saúde do corpo humano. Nesta pesquisa foi utilizada a continuação de estudos dos cientistas Araújo, Giudici e Sousa, em 2019 [a, b e c], os quais utilizaram esse insumo nanobiotecnológico patenteado (USP, 2018), na formulação natural de sabonete líquido.

Palavras-chave: *Chlorella pyrenoidosa*; Insumo nanobiotecnológica patenteado (USP, 2018); Sabonete líquido natural.

Abstract

The use of naturally occurring nanobiotechnological inputs is essential for human health and the environment. This research is of fundamental importance, given consumers' current awareness of using more natural, sustainable and healthy pharmaceutical ingredients. Thus, there has been a growing demand for more biocompatible pharmaceutical formulations with the body, which should have on their labels no aggression to nature (environment) and no use of animal testing (USP, 2018). Thus, consumers want to direct the benefits that come from nature, among other means of knowledge, to their families. They are seeking to associate the cost of the finished cosmetic product with the benefit it brings to the health of the human body. In this research the continuation of studies of scientists Araújo, Giudici and Sousa, in 2019 [a, b and c], which used this patented nanobiotechnological input (USP, 2018), was used in the natural formulation of liquid soap.

Keywords: *Chlorella pyrenoidosa*; Patented nanobiotechnological input (USP, 2018); Natural liquid soap.

Resumen

El uso de insumos nanobiotecnológicos naturales es esencial para la salud humana y el medio ambiente. Esta investigación es de importancia fundamental debido a la conciencia actual de los consumidores sobre el uso de ingredientes farmacéuticos más naturales, sostenibles y saludables. Por lo tanto, ha habido una creciente demanda de más formulaciones farmacéuticas biocompatibles con el cuerpo, que deberían tener en sus etiquetas sin agresión a la naturaleza (medio ambiente) y sin uso de pruebas en animales (USP, 2018). De esta manera, los consumidores desean dirigir los beneficios que provienen de la naturaleza, entre otros medios de conocimiento, a sus familias. Buscan asociar el costo del producto cosmético terminado con el beneficio que aporta a la salud del cuerpo humano. En esta investigación, la continuación de los estudios de los científicos Araújo, Giudici y Sousa, en 2019 [a, b y c], que utilizaron este insumo nanobiotecnológico patentado (USP, 2018), se utilizó en la formulación natural de jabón líquido.

Palabras clave: *Chlorella pyrenoidosa*; Insumo nanobiotecnológico patentado (USP, 2018); Jabón liquido natural.

INTRODUTION

The use of natural pharmaceutical ingredientes and/or natural nanobiotechnological inputs, that are more biocompatible with the human organism provides health and environmental benefits. According to the scientists Araújo, Giudici & Sousa, in 2019 [a, b and c], the demand for consuming biodegradable, natural and sustainable products that preserve the environment is paramount. In this context, the development of sustainable and technological cosmetics, with natural components from Microalgal extract, associated with biotechnology, aiming at the lowest possible environmental impact is indispensable. With this, the development of new proposals for cosmetics, with natural components from, for example, Microalgal extract associated with nanotechnology, aiming at the lowest possible environmental impact is indispensable, due to the consumer market of beauty being ever more growing in the world.

The Brazil occupies the fourth position, after the United States, Japan and France, in the first, second, and third, respectively, between the ten Countries that consume the most cosmetics in the world (ABIHPEC, 2006). Garcia (2005) reported that major centers involving the development of new technologies in the cosmetics area are found in the United States and Europe. Therefore, researches will be more requested in several industrial areas, especially in this research (Araújo, Giudici & Sousa, [a, b and c]).

Therefore, the growing demand of the vanity industry and skin care, to develop more sophisticated and more renewable cosmetic products for the human being is in increasing progress with different marketing strategies. This is why it is important to innovate cosmetic products so that the consumer can obtain a cosmetic with quality, efficiency and efficacy protecting and preserving the functions of the skin, of the capillary wire (Verma et al., 2003; Araújo et al., 2015; Araújo, Giudici & Sousa, 2019 [c]).

Thus, there was a demand and an increase through consumers, looking for pharmaceutical formulations that appear on their packaging, on their labels the non-aggression to nature (environment) and the non-use of animal tests. They are preferring to associate the cost of the finished cosmetic product with the benefit it brings to the health of the human body (USP, 2018), and they are always researching various sources of knowledge for new pharmaceutical ingredients that may benefit individual health. and collective (familiar). And as there is the growing demand on the part of consumers, who are increasingly demanding to acquire more

interesting cosmetic formulations, so that they can solve problems present in the capillary wire, such as, dryness (capillary wire dehydrated), absence of gloss (capillary wire with matte staining), presence of oiliness (capillary wire with heavy aspect, without malleability in the wires), among other aspects. In this way, consumers want to direct the existing benefits in beauty salons, and in TV commercials, among other means of disseminating knowledge, into their homes. These are looking to associate the cost of the finished cosmetic product with the benefit that this brings the skin (Araújo, Giudici & Sousa, 2019 [c]).

In this form, it can provide consumers with benefits for the hair, skin, moisturizing, rejuvenating and even restructure it, and also, this patented input (USP, 2018) can be used in food, since it is nontoxic, and tastes appreciable to the palate, among other employabilities. This means, increasing the awareness of society for the use of natural products, based on plants and/or microbiotas would diminish the harmful effects, such as the use of synthetic dyes, in foods, medicines and cosmetics (Kulshreshtha & Singh, 2013; Araújo, Giudici & Sousa, 2019 [a, b and c]).

The controlled cultivation of these aquatic organisms (algae), carried out by man, is a growing industry with great projection worldwide and this represents one of the activities of Important food production for the near future. And the same organ evaluated, in 2003, the frequent use of the algal extracts describing them in lists of ingredients present in the cosmetics packaging, mainly in pharmaceutical formulations, such as creams and/or lotions, for the face, hands, and body (Araújo, Giudici & Sousa, 2019 [c]).

Therefore, making use of natural raw materials using different types of algae, such as the use of phycocolloids (alginate, carrageenan and/or agar), in different types of pharmaceutical formulations, can transfer very important physical properties such as stabilizers. suspension and emulsifiers, gelling agents, thickeners and also have water solubility (FAO, 1987; Renn, 1997; Jensen, 1998; Kass, 1998).

The proposal developed in this research was a finished nanotechnological cosmetic product, designating as nanobiotechnological inputs, which were registered in the USP, 2018 patent, which may include several consumers (young, adult, elderly and/or even children). This input used in the natural liquid soap may cause the improvement of existing cosmetics on the market, making them more effective at the time of application on the capillary wire, in addition to that, smart consumers are looking to acquire more products biodegradable, natural

and/or sustainable that can guarantee the preservation of the environment (adapted from Araújo, Giudici & Sousa, 2019 [a, b and c]).

According to the scientists Araújo, Giudici & Sousa, 2019 [a, b and c], this research is in this context that a relevant contribution to research has been proposed, taking advantage of all the possibilities that nanobiotechnology could provide to these sustainable products, in the area of cosmetics for human beings, benefiting them. The use of biotechnological techniques (discontinuous and/or discontinuous feeding processes) and the achievement of new more sophisticated Microalgal products may influence the development of products Finished cosmetics (formulations) more sophisticated, for example, in order to care for the skin, and of the capillary wire.

In conclusion, scientists' research has focused on technology considered " green " associated with sustainable development, which uses biotechnological processes (plant raw materials, microalgae and macroalgae) and at the same time enjoys the benefits of nanotechnology (through viable costs that can enrich the science of nanobiotechnology. Therefore, making use of new pharmaceutical inputs biocompatible with the human organism, which bring benefits, for example, to the capillary wire and the skin, are very important. The input developed in the USP, 2018 patent, which was applied in this research was a promising alternative not only in the cosmetic area, but in other areas, as described in the USP, 2018 patent (Araújo, Giudici & Sousa, 2019 [a, b and c]).

MATERIALS AND METHOD (Araújo, Giudici & Sousa, in 2019 [a, b and c])

PREPARATION OF THE INOCULUM/ MICROALGAL MATERIAL / DETERMINATION OF CELLULAR CONCENTRATION/ DETERMINATION OF PH/ BIOMASS EVALUATION OBTAINED/ BIOMASS EVALUATION OBTAINED/ DETERMINATION OF THE PROTEIN CONTENT OF BIOMASS *C. PYRENOIDOSA*/ DETERMINATION OF THE LIPID CONTENT OF BIOMASS *C. PYRENOIDOSA*/ DETERMINATION OF ASH CONTENT FOR *C. PYRENOIDOSA*/ DETERMINATION OF TOTAL CARBOHYDRATE CONTENT FOR *C. PYRENOIDOSA*/ IDENTIFICATION AND QUANTIFICATION OF FATTY ACID COMPOSITION THROUGH GAS CHROMATOGRAPHY/ IDENTIFICATION AND

QUANTIFICATION OF COMPOSITION OF FATTY ACIDS, THROUGH GAS CHROMATOGRAPHY COUPLED TO MASS SPECTROMETRY

In the present study was used the microalgae strain *Chlorella pyrenoidosa* (*Chlorella sorokiniana*) (UTEX 1663) from the UTEX microalgae (The Culture Collection of Algae of the University of Texas at Austin - U.S.A.) (UTEX, 2011; Araújo, Giudici & Sousa, in 2019 [a, b and c]).

SUPPLY NANOBITECNOLOGICAL (adapted from Araújo, Giudici & Sousa, in 2019 [a, b and c]**)**

The instruments used, the methodology, as well as the analyses for the development of pharmaceutical nanobiotechnological supplies developed in the present invention are described in the patent of USP, 2018. And from it, an adaptation was performed to develop nannobiotechnological supplies. With this, the highest concentration (10%) was used, in which the concentrations of 0.50%, 1% and 2% were removed, and these were used as pharmaceutical supplies in the formulation of the natural liquid soap described in this article.

In this patent, some parameters were evaluated, such as average nanoparticle size and mean zeta potential (USP, 2018).

ANALYTICAL TECHNIQUES TO NATURAL LIQUID SOAP (adapted ARAÚJO et al., 2015 and adapted from Araújo, Giudici & Sousa, 2019 [a, b and c]**)**

Natural liquid soap triplicates were analyzed (**Table 1**) to content of supply nanobiotechnological, 0.50%, 1% and 2%.

It analyzed the following physico-chemical properties:

i) pH between 5.0-7.0, preferably natural liquid soap should have a slightly acidic pH;

ii) viscosity can be determined by a rotary viscometer such as Brookfield and Ford viscosity cup;

iii) density, can be determined in aluminum or stainless steel pycnometer, generally comprises from the 1.010 to 1.020 g/ml;

iv) the foam persistence time, one should add 40 ml of distilled water in a graduated cylinder of 100 mL, then add 1 g of natural liquid soap sample soon after - the graduated cylinder should be covered with the palm of the hand and shake strongly in the vertical direction until the foam fills the entire the graduated cylinder.

Then cap the graduated cylinder with a plastic film, leaving it in protected from light, and measuring time until the total disappearance of the foam, i.e., foam persisting time; among other (Ferreira, 2008).

The development of a natural liquid soap formulation (**Table 1**). The method of preparation: dissolve the dye in water and then dispense and hydrate the xanthan gum to the complete formation of a gel. Add the components of phase B and homogenize. Add phase C and homogenize. Adjust the pH with citric acid (adapted from Araújo, Giudici & Sousa, 2019 [a, b and c]).

Table 1. Natural liquid soap composition (adapted from Ribeiro, 2010; adapted Araújo et al., 2015; adapted from Araújo, Giudici & Sousa, 2019 [a, b and c]).

Natural liquid soap
Phase A
Dye 0.01% (color optional)
Xanthan Gum 0.50%
Water qs to 100mL
Phase B
Supply nanobiotechnological 0.5%, 1% and 2%*
Biosaccharide gum-1 2.00%
Organic extract (rice**, lemon, lotus, apple**, kiwi, grape, ginger, orange, bamboo**, among others) 0.60%**
Phase C
Natural fragrance 0,30% (optional)
Tea tree oil 0.10%

Brazil nuts oil 0.10%

Copaiba oil 0.15%

Cocoyl glutamate sodium 5%

Decyl glucoside 20%

Phase D

Citric acid (adjust the pH) pH 5.5-7.0

*developed in this research (USP, 2018).

**used in this natural liquid soap (blends of organic extracts: rice (0.20%); apple (0.20%) and bamboo (0.20%)).

There is concern and awareness by consumers to demand quality and origin of the constituents of cosmetic formulations. Many look for more natural products, which use in their plant extracts formulations, vegetable oils, in short, raw materials exploited with sustainability of nature, the most varied (diverse) kingdoms, vegetables, minerals, protists, among others (Araújo, Giudici & Sousa, 2019 [a, b and c]).

The formulation of this cosmetic can be used for young, adult, elderly and/or even children, especially those who may have skin problems, such as psoriasis, dermatitis, acne, among others, and/or people who have allergies to any pharmaceutical ingredient that may cause dryness in the skin. skin, as it is a biocompatible formulation with the human body, being natural and non-toxic

The formulation of this cosmetic can be used for children, adults and elderly, especially those who may have skin problems, such as psoriasis, dermatitis, acne, among others, and/or people who have allergies to any pharmaceutical ingredient that may cause dryness in the skin, as it is a biocompatible formulation with the human body, being natural and non-toxic.

This cosmetic formulation showed little foam, which could be better accepted, for children, thus decrease the chance of contact of the foam, for being slippery, with eyes thus reducing eye irritation (Morelli & Weston, 1987; Klein, 2004; Ferreira, 2008; Araújo et al., 2015; Araújo, Giudici & Sousa, 2019 [c]).

Thus, the substances responsible for foam appearance are called surfactants, the most widely used by the industrialized shampoos, natural liquid soap are usually sodium lauryl sulfate, lauryl ether sodium sulfate, and derivatives of fatty coconut acids, such as this survey, sodium cocoyl glutamate, decyl glucoside (Leidreiter, Gruning & Kaseborn, 1997; Imokawa, 1997; Araújo et al., 2015; adapted from Araújo, Giudici & Sousa, 2019 [c]).

Although the latter can cause less irritability, there are reports in the literature of the occurrence of late human hypersensitivity using them in cosmetic formulations, however there are also reports that these may have a low degree of oral irritation, skin and eye (Goossens & Merckx, 1997; Vilaplana, Mascaro & Trullas, 1992; Korting et al., 1992; Fowler, 1998; Barany, Lindberg & Loden, 1999; Mowad, 2001; Santucci, Cannistraci & Lesnoni, 2003; Araújo et al., 2015; Araújo, Giudici & Sousa, 2019 [c]).

RESULTS AND DISCUSSION

Through analysis of variance (ANOVA one-way) the Tukey and Fischer tests were applied with a 95% confidence interval for each sample and was carried out tests in triplicate natural natural liquid soap (**Table 2**), which showed significant differences ($p<0.05$) between them for the parameters analyzed here: viscosity, density and the foam persistence time. There was no significant difference for pH, ($p>0.05$) (Araújo et al., 2015; Araújo, Giudici & Sousa, 2019 [c]).

The viscosity values for the natural liquid soap with 1% supply nanobiotecnhnological (**Table 2**) corroborated with 1.50% shampoo viscosity values described by Araújo, Giudici & Sousa, 2019 [c]. This pharmaceutical formulation is safe for use, as it is completely non-toxic, for human use (USP, 2018; Araújo, Giudici & Sousa, 2019 [c]).

In Vitro tests, *in vivo* and *ex vivo* were not analyzed in this natural liquid soap were only evaluated some physic-chemical parameters, cited below.

And the cultivation was carried out in closed shaker, to avoid contamination of microalgal raw material.

Table 2. The experimental were performed in triplicates, for each natural liquid soap formulation.

	Supply nanobiotechnological *C. pyrenoidosa*		
	0.50%	1%	2%
viscosity (cps)	1.130±0.02^{A}	1.321±0.22^{B}	2.62±0.33^{C}
density (g/mL)	0.06±0.15^{A}	0.81±0.22^{B}	1.73±0.18^{C}
pH	6.5±0.01^{A}	6.5±0.02^{A}	6.5±0.01^{A}
foam persistence time (minutes)	2±0.5^{a}	3±1.2^{b}	5±1.6^{c}

* Different letters in the same line represent statistically different values.

This article shows the importance of the use of pharmaceutical products (natural liquid soap) with non-toxic pharmaceutical ingredients, which involve personal care and do not harm the environment. There are numerous studies that report environmental contamination and the risk to ecological health (Olkowska et al., 2014; Ramos et al., 2015; Teo at al., 2015; Araújo, Giudici & Sousa, 2019 [a, b and c]).

In this research was developed a new active pharmaceutical ingredient, biocompatible with the human organism, nontoxic, sustainable for the environment (USP, 2018; Araújo, Giudici & Sousa, in 2019 [a, b and c]). The use of this is indicated, in different pharmaceutical formulations (shampoo (Araújo, Giudici & Sousa, 2019 [c]), natural liquid soap (as of this research), bar soap, cream, lotion, among others formulations), mainly in formulations that ingredients are dispensed through the use of running water, through the bath,and/or through hand hygiene, because it does not contaminate the environment (soil and groundwater) (Araújo, Giudici & Sousa, 2019 [a, b and c]).

CONCLUSION

The algae obtaining supply nanobiotechnological associated with natural cosmetic formulations, for example, can be a feature that present good acceptance by consumers because it is environmentally friendly. Depending on the species of algae studied, it will be appreciated, for example, protein compositions and/or different lipids. These can be used in various purposes of cosmetic formulations, as was the case of this research. A better understanding of secondary metabolites, designated ecological chemistry, called the ‘’green’’, can allow us to discover and find these valuable compounds for use not only in cosmetics, but

also for use in medicines, and/or several industrial purposes, improving the life of human beings as a whole. The search for more sustainable alternatives in obtaining for more renewable raw materials is part of the awareness of the current technological society (Araújo et al., 2015; USP, 2018; Araújo, Giudici & Sousa, 2019 [a, b and c]). In conclusion, patented nanobiotechnological inputs can be used in different formulations such as shampoo (Araújo, Giudici & Sousa, 2019 [a, b and c]), natural liquid soap (as of this research), bar soap, cream, lotion, among others formulations.

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