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Wax obtained from the insect *Dactylopius coccus* Costa, study for its application in natural cosmetic products

Cera obtenida del insecto *Dactylopius coccus* Costa, estudio para su aplicación en productos cosméticos naturales

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Abstract

The insect *Dactylopius coccus* Costa produces a white wax that serves to protect itself from the environment, at the time of harvesting the insect, the wax is separated by sifting, in intensive production of the insect a large amount of wax is discarded. Therefore, the objective of this work was to carry out a physicochemical analysis of three samples from different producers obtained by the same method, to determine if it meets the characteristics to be used in any natural product. The methodology consisted of determining the organoleptic characteristics, as well as the color by means of a colorimeter, determination of pH, melting point, and percentage of humidity. The results obtained were compared with a synthetic (microcrystalline) wax used in a cosmetic product, to see if it could be substituted by the analyzed wax. It was found that it was possible to substitute the synthetic wax for the natural wax due to its conflicting characteristics. Therefore, it is concluded that this wax can be used in the elaboration of natural products. Although it would be necessary to carry out a series of tests of the final product obtained with and without the wax. To determine if the substitution is favorable or not.

Wax, Insect, Cosmetics

Resumen

El insecto *Dactylopius coccus* Costa, produce una cera blanca que sirve para protegerse del medio ambiente, al momento de realizar la cosecha del insecto se separada la cera mediante el cernido, en producciones intensivas del insecto se desecha una gran cantidad de la cera. Por lo que el objetivo de este trabajo fue realizar un análisis fisicoquímico de tres muestras de productores diferentes obtenida por el mismo método, con la finalidad de determinar si cumple con las características para ser usada en algún producto natural. La metodología consistió en determinar las características organolépticas, así como el color mediante un colorímetro, determinación de pH, punto de fusión, y porcentaje de humedad. Los resultados obtenidos fueron comparados con una cera sintética (microcristalina) usada en un producto cosmético, para ver si podía sustituirse mediante la cera analizada. Se encontró que era posible sustituir la cera sintética por la cera natural debido a sus características encontradas. Por lo que se concluye que esta cera puede ser usada en la elaboración de productos naturales. Aunque sería preciso realizar una serie de pruebas del producto final obtenido con y sin la cera. Para determinar si es favorable o no la sustitución.

Cera, Insecto, Cosméticos

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Introduction

The insect (*Dactylopius coccus* Costa), also known as grana cochineal, lodges in the cactus and an active compound is obtained, which is carminic acid, used as a natural colouring agent in various areas (textiles, cosmetics, food, etc.) (Renita et al., 2023). In the development of this insect during its production, once fixed, the nymphs secrete wax in the form of filaments or a white powder (coccicerin), which covers them (nymph I fixed), (Fig., 1) (Hernández-Hernández et al., 2005).

Figure 1 Wax secreted by the grana cochineal insect in its Nymph I stage

Once they reach their adult stage, the males have wings in their adult instar, are mobile and smaller; while the females are apterous, immobile and larger, oval in shape and covered with a talc-like wax (coccicerin), which is easily detached when blown (López Soto, 2005) (Fig., 2).

Figure 2 Wax secreted by the grana cochineal insect in its adult stage (female in the process of oviposition)

In post-harvest handling, when the females are removed from the cactus, the insect is sifted in order to clean the insect and take it to drying. At this stage, the wax is removed (Rosenblueth et al., 2018). This wax in intensive insect productions is discarded in large quantities, so producers seek to give an application to this waxy product, so this work represents a great contribution to the producers of the insect, since they would have another source of income. The objective of this work was to carry out a physicochemical analysis of three samples of wax from different producers obtained by the same method, in order to determine whether it meets the characteristics to be used in a natural cosmetic product.

Methodology to be developed

Preparation of the wax obtained from the insect by means of an extraction method. Some research has used various methods of extraction or cleaning of the insect to obtain the wax, mainly ketones and alcohols (Aldama Aguilera et al., 2005; Vera Ponce et al., 2016). The extraction method proposed for this project consisted of: a) Separate the wax containing the grana cochineal through a sieve. b) Place the wax in a beaker with approximately 350ml of reagent grade acetone (≥99.5%), per 250g of wax. c) Decant, discard the solid (wax impurities) and store the acetone with the resulting dissolved wax under refrigeration for 24 hours. Once the acetone is separated from the wax (evaporation), it can be used for the next step. It should be noted that physicochemical analysis was carried out on three samples from different grana cochineal producers (M1, M2 and M3).

Physicochemical analysis of the wax

The physicochemical tests were carried out using the methodology provided in some published articles (Arroyo Figueroa et al., 2011; Arroyo Figueroa et al., 2016; and Rodríguez et al, 2017, based on the aforementioned regulations, the tests carried out are: organoleptic (physical appearance, odour), colour (using the CR-400 colourimeter, Minolta, considering the CieLab* coordinates), pH (in 10% solution in ethyl alcohol, using a potentiometer), melting point analysed using the melting point Fisher apparatus (NMX-K-492-1980), % moisture using a thermobalance for its analysis (NMX-F-211-SCFl-2006).

Comparison of tests with waxes used in cosmetics

Having the results of the physicochemical analysis of the natural wax obtained from the grana cochineal insect, a comparison was made with a synthetic wax used in the production of a lip balm (microcrystalline wax). In order to determine if it meets the similar characteristics to be used in the formulation of a lip balm in the future, a comparison was made with a synthetic wax used in the formulation of a lip balm.

Results

Melting point comparison

Table 1 shows the comparison of the melting points between the synthetic wax used in the production of the lip balm and the analysed samples of the natural wax obtained from the cochineal insect grana cochinilla. The first value corresponds to the beginning of the melting process and the second value to the end of the melting process, i.e. complete melting. It can be seen that the melting points of the samples analysed (M1, M2 and M3) have a higher value. This would be an alternative application for solid cosmetic products, especially in warmer places.

Sample	Melting point (°C)
Synthetic wax	71-98
Wax samples obtained from the insect	
M1	82.33-113.67
M2	82.33-110.67
M3	86.00-115.67

Table 1 Comparison of the melting point between the synthetic wax and the natural wax samples obtained from the insect

It can be seen that the melting point values reach a higher value in the natural wax, for example, for samples M1, M2 and M3, the maximum values are 113.67°C, 110.67 °C and 115.67°C, respectively. The microcrystalline wax has a range of 71 to 98°C. This indicates that the coccicerin sample can be used in the production of the lip balm, obtaining higher values in the melting point of the final product.

Comparison with colour coordinates

It was observed that the synthetic wax is whiter than the other natural wax samples, since the values of the coordinates a* (-0.40±0.23) and b*(-1.53±0.44) are close to zero.

The wax of sample number two (M2) is observed with the same trend in the coordinate values (a*, -1.31±0.03 and b*, 0.44±0.01). However, for the M1 and M3 samples, higher values are observed in the a* and b* coordinates, in the case of the a* coordinate, the higher the value, the redder the colouration, and for the b* coordinate, the higher the value, the yellower the colouration. It is considered that as the lip bullet is made with the by-product of cochineal (cochineal carmine or carmine lacquer), it does not affect the colouring obtained in each of the samples. However, it would be necessary to process the lip bullets and check the above.

Sample	Average and standard deviation of colour coordinates		
	L*	a*	b*
Synthetic wax	60.74±0.11	-0.40±0.23	-1.53±0.44
Wax samples obtained from the insect			
M1	77.20±0.27	13.12±0.17	2.56±0.05
M2	100.00±0.00	-1.31±0.03	0.44±0.01
M3	82.08±0.76	5.71±0.17	2.43±0.07

Table 2 Comparison of colour coordinates between synthetic wax and natural wax samples obtained from the insect

Comparison of pH and moisture content

The results regarding the pH of each of the samples and the synthetic wax, as well as the percentage of humidity can be seen in table 3. There is not much difference in the pH value, with a range of 6.0 to 6.5, all the samples including the synthetic wax fall in the mentioned range. However, for the moisture percentage, in the case of samples M1, M2 and M3, a range of 2.66 to 5.62% is observed, and the synthetic wax presents a very low moisture percentage of 0.13%. This could have an impact on the final product, however, the formulations should be tested to determine whether this parameter is decisive in obtaining the final lip balm, as it would be the only parameter that could affect the final product.

Sample	pH	% humidity
Synthetic wax	6.53	0.13%
Wax samples obtained from the insect		
M1	6.43	6.09%
M2	5.98	2.66%
M3	6.45	5.62%

Tabla 3 Comparison of pH and moisture content between the synthetic wax and the natural wax samples obtained from the insect

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Conclusions

It was possible to conclude that the wax from the insect can be used in the elaboration of the lip bullet, substituting the synthetic wax (microcrystalline), as it fulfils the characteristics. In order to obtain a completely natural product. It is necessary to verify the above by carrying out formulation tests by substituting the microcrystalline wax in different percentages with coccicerine wax, and to compare the results of the final product.

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