Isolation and Purification of Sugarcane Waxes from Sugarcane Peels and Filter Cake Mud

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Abstract

Sugarcane bagasse was collected from different sources(from local juice centre, Egyptian Sugar & Integrated Industries Company, The residue of the sugar production and by scratching of sugarcane). The waxes were extracted using different solvents (water, ethanol, n-hexane, toluene and methylene chloride). The waxes obtained from each solvent containing different components. The extracted waxes were crystallized and then carrying out different analyses for each fraction of them (FT-IR, H NMR and GC-MS spectra), depending on the analyses we determined the wax components.

Keywords: Sugarcane bagasse, Filter cake mud, Waxes, Scratching, Isolation.

Introduction:

Sugarcane (***Saccharumofficinarum L.***) is an important economic plant. The area planted with the sugarcane in Egypt about125000 Hectares **= 297619.047** Feddanproducing about 12.5 MMT of sugar cane [1].

Egyptian Sugar & Integrated Industries Company tries to maximize the utilization of all components of sugarcane. The integrated industry policy makes the sugar company to use all the byproducts of sugar industry. The sugarcane bagasse used as raw materials for paper and fiber board industries. Molasses used in the production of different important chemicals (ethanol, acetone, acetic acid, butanol, yeasts) and other chemicals. Filter cake mud was used as fertilizer.

In the light of the sugar companies policy and the policy of the Sugar Technology Collage, we found that there is a product no less important than previous products must be taken in consideration. This product is sugarcane waxes as, a whitish to dark yellowish coating on the surface of sugarcane which gets extracted and separated along with press mud during crushing and processing of the cane juice. This wax portion finds applications in cosmetics, paper coating, textiles, fruit and vegetable coating, leather sizing, lubricants, adhesives, polishes, and pharmaceutical industry[2- 4].

In the filter cake is observed an average order of wax and raw lipids from 5 to 14% on a dry basis with different proposals for their use but they often are sent to fields as fertilizer in the six weeks prior to planting grass[5]. During the grinding rod, about 40% of lipid material is dispersed in the juice as sludge while the remainder is retained in the pulp after the grinding [6].

Sugarcane wax has always been a matter of interest, due to its industrial applications, in particular in the cosmetic and pharmaceutical industry **(Taylor, 2000)** [4]**.** It is a potential substitute for costly carnauba wax widely used in cosmetics, foods and pharmaceuticals. In addition, sugarcane wax is also a source of long chain primary aliphatic alcohols as Policosanol PC which are a waxy material that are high-Mw aliphatic alcohols with chain lengths that vary from 24 to 34 carbon atoms. The most common sources of policosanols used for nutritional supplements are sugarcane. The most components of PC are octacosanol (C28), triacontanol (C30) and hexacosanol (C26)). These compounds were first approved as a dietary supplement, which find applications as cholesterol-lowering products **(Laguna Granja et al., 1999** [7]**; Mas et al., 1999**[8]**)**. During the agro-industrial process, a large part of the wax is dissolved in the crude juice, and then removed in the wastes during the subsequent defecation-clarification step (filter cake from sugar refinery) or distillation (fermentation wastes and vinasses).

Wax recovery from filter cake is well documented **(Paturau, 1989)** [9] as the relevant methods and techniques at the laboratory or industrial level **(Lamberton and Radcliffe, 1965;** [10, 11] **Parfait, 1997** [12]**; Askew et al., 1999)** [13], [14]. Octacosanol is a

main component of policosanols, the fatty alcohol mixture, found in plant waxes common in fruits, leaves, surface of plants, and whole seeds.

In the light view of the previous benefits of sugarcane waxes, we decide to extract and isolate the sugarcane waxes from both sugarcane bagasse and filter cake mud and we are sure that represents an added value to the sugar industry in Egypt.

Material and Methods

1. Sugarcane peels were collected from local sugarcane juice shops in Assiut city, also by the sugarcane peeling or by scrape the outer crust of sugarcane stalks.
2. Soxhlet extractor to carrying out the waxes extraction processes.
3. Solvents: Distilled water provided from the Chemistry Department, Assiut University. Also, toluene, ethanol, methylene chloride were purchased from Sigma-Aldrich Co.

Analyses

The Fourier transform infrared (FTIR) spectra were recorded using potassium bromide disks on a FT-IR 8201 PC Shimadzu. A Bruker 400 MHz and Varian 90 MHz spectrometers were used to measure ^{1}H NMR spectra in the presence of tetramethylsilane as an internal standard. Chemical shifts were measured in ppm. Gas-Mass (GC/MS) detection, an electron ionization system with ionization energy of 70 eV was used at Chemistry Department, Assiut University.

Experimental and procedures

Extraction of wax from sugarcane peel provided from the sugarcane juice centers:

Preparation of samples: Sugarcane peels are first removed and shredding surface of sugarcane before crushing and pressed for the juice in case of juice processed for the retail market. Thus, it was comprehended that if one removes peel before juice processing, extraction of wax would be a much easier and cleaner process. Sugarcane peels were collected from some local juice centers. The waste material was first dried in sunlight and then pickling and sieved in a mesh sieve

Extraction by water

Dried sugarcane peels (22 g), put them in cartouche and introducing to the soxhlet extractor. Water (200 ml) in a (500 ml) round bottomed flask was connected to the soxhlet extractor and heating using heating mantle at 100 ˚c for 8-10 hours. The extraction process was repeated three times without change the solvent using another quantity and the same weight of sugarcane peels at each time.

Solvent was evaporated using rotatory evaporator and the residue contained wax mixtures with some impurities.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	22.59 g	20.55 g	2.04 g
2	22.59 g	19.34 g	3.25 g
3	22.59 g	20.03 g	2.55 g
total	67.77 g	59.92 g	7.85 g

The weight of wax extracted from sugar cane peelis7.85g.
The % of waxes =7.85X100/67.77 = 11.58 % yield
Melting point = 82 °C.
IR: υ = 3400 cm^{-1}(OH carboxylic group),2950 cm^{-1} (CH aliphatic), 1700 cm^{-1} (CO group).

Extraction of wax from sugarcane peel by toluene:

The procedure in the previous experiment was repeated with using of toluene as a solvent instead of water.

The results summarized in the following Table.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	22.59 g	20.75 g	1.84 g
2	22.59 g	20.63 g	1.96 g
3	22.59g	20.64 g	1.95 g
total	67.77 g	62.02 g	5.75 g

The weight of wax extracted from sugar cane peel is5.750g.
The % of waxes = 5.750/67.77X100 = 8.48 % yield, m.p. 73 ˚C.
IR: υ = 3426cm^{-1}broad band (OH), 2917 cm^{-1} (CH aliphatic), 1712 cm^{-1} (C=O).
H NMR (90 MHz) ($CDCl_3$):δ= 0,8(t, 3H, CH_3,), 3.98(s,1H,OH alcoholic), 2.35, 2.6, 1.54, 1.18 for (m, 54H, 27CH_2).

GC/MS spectrum showed different signal related to long chain unsaturated hydrocarbons 9-eicosene, octacosene (which were produced from the loss of water molecule from long chain alcohols) and long chain fatty acid e.g. octadecanoic acid and its ethyl ester, 1-eicosanol.

Extraction of wax from sugarcane peel by n-hexane:

The procedure in the previous experiment was repeated by using of n-hexane as a solvent.

The results summarized in the following Table.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	22.59 g	21.46 g	1.13 g
2	22.59 g	21.45 g	1.14 g
3	22.59 g	21.45 g	1.14 g
total	67.78 g	64,36 g	3.41 g

The weight of wax extracted from sugar cane peel is3.41g.
% Waxes = 3.4/67.78X100 = 5.02% yield, m.p. 84 ^{o}C.
IR: υ = 3426 cm^{-1} broad band (OH), 2917 cm^{-1} (CH aliphatic), 1736 cm^{-1} (C=O)
GC/MS: Base peak at 57.1 and molecular ion peak at 446.5, and other fragments related to long chain saturated and unsaturated hydrocarbons e.g., n-octacosane,1-octacosene, 1-heptacosene and 1-

hexacosene (which were produced from the loss of water molecule from long chain alcohols).
^{1}H NMR 90 MHz ($CDCl_3$): δ = 0.9 (t, 3H, CH_3) and at 1.3(m, 54H, 27 CH_2).

Extraction of wax from sugarcane peel by ethanol (95%):

The procedure in the previous experiment was repeated with using of ethanol (95%) as a solvent.

The results summarized in the following Table.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	22.59 g	18.44 g	4.14 g
2	22.59 g	17.76 g	4.81 g
3	22.59 g	20.27 g	2.32 g
total	67.72 g	57.32 g	10.45 g

The weight of wax extracted from sugar cane peel is10.45g.
%Waxes = 10.45/67.78X100 = 15.41 % yield, melting point 82˚C
IR: υ = 3419 cm^{-1} broad band (OH), 2917 cm^{-1} (CH aliphatic), 1737 cm^{-1}(C=O)
^{1}H NMR 90 MHz ($CDCl_3$):δ = 0.9 (t, 3H, CH_3) and at 1.3(m, 54H, 27 CH_2).

Extraction of wax from sugarcane peel by methylene chloride:

The procedure in the previous experiment was repeated with using of methylene chloride as a solvent.

The results summarized in the following Table.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	22.59 g	16.98 g	5.61 g
2	22.59 g	19.74 g	2.85 g
3	22.59 g	17.32 g	5.26 g
total	67.78 g	54.04 g	13.73 g

The weight of wax extracted from sugar cane peel is13.73g.
% waxes = 13.73/67.78X100 = 20.25 % yield, melting point 83 ˚C.
IR: υ = 3419 cm^{-1} broad band (OH), 2917 cm^{-1} (CH aliphatic), 1736 cm^{-1} (C=O)

^{1}H NMR 400 MHz ($CDCl_3$):δ = 0.9 (t, 3H, CH_3), 1.3(m, 54H, 27 CH_2) and at 3.6 (s, 1H, OH).
GC/MS spectrum showed different signal related to long chain saturated and unsaturated hydrocarbons e.g, n-octacosane , 1-octacosene, 1-heptacosene and 1-hexacosene(which were produced from the loss of water molecule from long chain alcohols) and long chain fatty acid e.g., octadecanoic acid and its ethyl ester, 1-eicosanol.

MS spectra m/z: Base peak at 97.1 and other peaks at m/z 410 and 392 due to octacosanol and its dehydrated 1-octacosene respectively.

Extraction of wax from press mud of sugarcane

Preparation of samples: We are obtained the press mud of sugarcane from some sugarcane factories of the sugar industry. It was first dried in sunlight and grounded.

- **Extraction of wax from press mud by methylene chloride**

Dried powder of press mud (22 g) using a soxhlet extractor and (200 ml) of methylene chloride in a (250 ml) round bottomed flask at 80 ˚C for 8-10 hours using heating mantel. The extraction process was repeated three times without change the solvent using another quantity and the same weight of sugarcane press mud at each time.
Solvent was evaporated using rotatory evaporator and the residue contained wax mixtures with some impurities was collected.

The results summarized in the following Table.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	22.59 g	21.08 g	1.51 g
2	22.59 g	21.40 g	1.18 g
3	22.59 g	20.08 g	2.50 g
total	67.77 g	62.56 g	5.20 g

The weight of wax extracted from press mud of sugarcane is 5.2g
The % of waxes = 5.20X100/67.77= 7.67% yield, melting point 79˚C.
IR: υ = 3418.95 cm^{-1} (OH group), 2917.56 cm^{-1} (CH aliphatic), 1736.99 cm^{-1} (CO group).
^{1}H NMR 400 MHz ($CDCl_3$): δ = 0.9 (t, 3H, CH_3), 1.3(m, 54H, 27 CH_2) and at 3.6 (s, 1H, OH).
MS Spectra: Base peak at 97.2 and molecular ion peak at552.8 and other peaks at m/z 410 and 392 due to octacosanol and its dehydrated 1-octacosene, respectively.

Extraction from press mud of sugarcane by ethanol (95%):

The procedure in the previous experiment was repeated with using ofethanol (95%)as a solvent.

The results summarized in the following Table.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	**22.59 g**	**21.28 g**	**1.30 g**
2	**22.56 g**	**21.52 g**	**1.04 g**
3	**22.59 g**	**21.68 g**	**0.90 g**
Total	**67.74 g**	**64.48 g**	**3.26 g**

The weight of wax extracted from press mud of sugarcane is 3.24 g
% waxes= 3.26/67.74.X100 = 4.81% yield, melting point 78˚C.
IR: υ = 3363.47 cm^{-1} broad band (OH), 2917.23 cm^{-1}(CH aliphatic), 1716.20 cm^{-1} (CO group).
^{1}H NMR 90 MHz ($CDCl_3$):δ = 0.9 (t, 3H, CH_3) and at 1.3(m, 54H, 27 CH_2).

Extraction of wax from press mud by n-hexane
The procedure in the previous experiment was repeated with using ofhexane as a solvent.

The results summarized in the following Table.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	22.59 g	21.86 g	0.72 g
2	22.59 g	21.95g	0.63 9
3	22.59 g	22.25 g	0.33 g
Total	67.77 g	66.06 g	1.71 g

The weight of wax extracted from press mud is 1.71 g
% waxes = 1.71/67.77X100 = 2.52 % yield, melting point 83˚C
IR: υ = 3422 cm^{-1} broad band (OH), 2917 cm^{-1}(CH aliphatic), 1735 cm^{-1} (CO group).
^{1}H NMR 400 MHz ($CDCl_3$):δ = 0.9 (t, 3H, CH_3), 1.3(m, 54H, 27 CH_2) and at 3.6 (s, 1H, OH).
MS Base peak at 97.1 and molecular ion peak at 539, and other fragments at m/z 410 and 392 due to octacosanol and its dehydrated 1-octacosene respectively. Other m/z for heptacosanol and hexacosanol also present.

Extraction of wax from press mud by toluene

The procedure in the previous experiment was repeated with using of toluene as a solvent.

The results summarized in the following Table.

Trial No.	Weight before extraction	Weight after extraction	Difference in weight
1	22.60 g	21.75 g	0.85 g
2	22.57 g	21.77 g	0.80 g
3	22.59g	20.99 g	1.59 g
total	67.76 g	64.51 g	3.25 g

The weight of wax extracted from press mud (practically) is 3.25 g
% Waxes =3.25/67.76X100 = 4.79% yield, melting point 74˚C
IR: υ = 3381 cm^{-1} broad band (OH), 2917cm^{-1} (CH aliphatic), 1715 cm^{-1} (CO group).
^{1}H NMR 90 MHz ($CDCl_3$):δ = 0.9 (t, 3H, CH_3) and at 1.3(m, 54H, 27 CH_2)
GC/MS: Base peak at 57.1 and molecular ion peak at 429, and other fragments at m/z 392,390, 364.

Results and discussion

Sugarcane waxes commonly exists in the surface of plants, part of these waxes remained in the sugarcane bagasse and its majority gone with juice and after industrial processes gone to the filter cake mud.

In the present work we aimed to isolate and purify of sugarcane waxes from three stages of sugarcane treatment processes.

The sugarcane waxes for this study obtained from three sources:

1. From the sugarcane peels by shredding surface of sugarcane before crushing and pressed for the juice in case of juice processed for the retail market.
2. From sugarcane bagasse after crushing and pressed for the juice in case of juice processed for the retail market.
3. From filter cake mud provided from sugar companies.

The analyses of the waxes obtained from the three sources showed that the obtained wax is a mixture of hydrocarbons, alcohols, aldehydes and carboxylic acids.

From the previous processes, in the first case we extracted the waxes from sugarcane peels with toluene. The % of waxes obtained = 8.48 % yield relative to the sugarcane peels used. The waxes mixture m.p. is 73 ˚C.

From its IR and mass spectra, it appeared that it containing long chain fatty carboxylic acid and alcohols while their revealed absorption bands at 3450 cm^{-1} broad band (OH), 2900 cm^{-1} (CH aliphatic), 1700 cm^{-1} (C=O).

GC/MS spectrum showed a molecular ion peak at m/z = 494 that is indicate to the presence of $CH_3(CH_2)_{31}COOH$ with ratio at 0.02%; and other fragment at m/z= 454 for $CH_3(CH_2)_{28}CO_2H$ with ratio at 0.02%; at m/z = 438 with ratio at 0.06 $CH_3(CH_2)_{27}CO_2H$ in Addition to alcohols Octacosanol ($CH_3(CH_2)_{26}CH_2OH$)at m/z = 410 with ratio at 0.11%; Docosanol $CH_3(CH_2)_{20}\mathbf{C}H_2OH$ at m/z = 326 and with ratio at 0.12%; Tetracosanol $CH_3(CH_2)_{22}CH_2OH$ at m/z=354 with ratio at 0.07%; Hexacosanol at m/z = 382 with ratio at 0.17%; Hexacosanol $CH_3(CH_2)_{24}CH_2OH$ at m/z = 396 with ratio at 0.09%; Nonacosanol $CH_3(CH_2)_{27}CH2OH$ at m/z = 424 with ratio

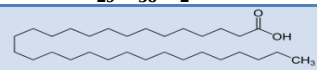
at 0.16%; Triacontanol $CH_3(CH_2)_{28}CH_2OH$ at m/z = 438 =0.13 in addition to alkanes (Triptane) 2,2,3-Trimethylbutaneat m/z = 100 with ratio at 17%;

Fatty acids Hexadecanoic acid $CH_3 (CH_2)_{14}COOH$ at m/z = 256with ratio at 0.27%; Octadecanoic acid at m/z = 284with ratio at 0.12%; octadeca-9, 12-dienoic acid at m/z = 280 with ratio at 0.33; 9-Tetradecenoic acid at m/z = 226 ratio at 0.82%; Octacosanoic acid $CH_3 (CH_2)_{26}CO_2H$ $C_{28}H_{56}O_2$ at m/z = 424with ratio at 0.16%.

H^1NMR (90 MHz, $CDCl_3$) showed signals (t, at 3.57), 3.98 for OH alcoholic, 2.35, 2.6, 1.54, 1.18 for CH_2, and 0.8 (t) for (CH_3).

When the sugarcane wax extracted with ethanol (95%), we obtained a waxes mixture with m.p at 82 ^oC with yield 15.41 % relative to the quantity of sugar peels used. From its analyses, we found it a mixture of different compounds including long chain alcohols and carboxylic acids. Its IR showed an absorption bands at 3419 cm^{-1} broad band (OH), 2917 cm^{-1} (CH aliphatic), 1736 cm^{-1}.

The other fragmentations which we can identified was listed in the following Table:

m/z	fragment	Intensity %	Structure
	Alcohols		
	n-Tetracosanol	**0.05**	**(n-$C_{24}H_{49}OH$ (354.66))**
	n-Hexacosanol	**.02**	**n-$C_{26}H_{53}OH$(382.71)**
	n-Octacosanol	**0.14**	**n-$C_{28}H_{57}OH$(410.77)**
	n-Nonacosanol	**0.02**	**n-C29H59O(424.79)**
	n-Triacontanol	**0.15**	**n-$C_{30}H_{61}OH$(438.82)**
	n-Dotriacontanol	**0.02**	**n-$C_{32}H_{65}OH$(466.88)**
	n-Tetratriacontanol	**0.01**	**n-$C_{34}H_{69}OH$(494.93)**
Fatty carboxylic acids			
	n-Hexacosanoic	**0.03**	 **$C_{26}H_{52}O_2$(396.70)**
	n-Octacosanoic	**0.02**	**$CH_3(CH_2)_{26}CO_2H$ $C_{28}H_{56}O_2$=424.75**
	n-Nnonacosanoic	**015**	**$CH_3(CH_2)_{27}CO_2H$ 438.8$C_{29}H_{58}O_2$**
	n-Triacontanoic	**0.01**	 **$C_{30}H_{60}O_2$452.46**
	n-Dotriacontanoic	**0.01**	**$C_{32}H_{64}O_2$ (480. 86) $CH_3(CH_2)_{30}CO_2H$**
	n-etratriacontanoic	**0.01**	**$C_{34}H_{68}O_2$ (508.91) $CH_3(CH_2)_{32}CO_2H$**

When the sugar cane peels was extracted with methylene chloride the yield of crude waxes about 20.26% relative to the sugarcane peels used, m.p. 83 ^oC.

% Waxes = 13.7321/67.7818 X100 = 20.2592 % yield, melting point 83 ˚C.

The IR: υ = 3419 cm^{-1} broad band (OH), 2917 cm^{-1} (CH aliphatic), 1736 cm^{-1}(C=O)

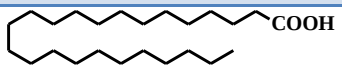
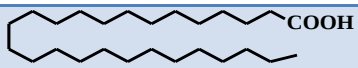
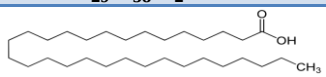
^{1}H NMR 90 MHz ($CDCl_3$):δ = 0.9 (t, 3H, CH_3) and at 1.3 (m, 54H, 27 CH_2).

^{1}H NMR 400 MHz ($CDCl_3$): δ = 0.9 (t, 3H, CH_3), 1.3(m, 54H, 27 CH_2) at 3.6 (CH_2–OH), and 9.29, 9.69 (s, H, carboxylic group).

Gas mass spectrum showed a molecular ion peak at m/z = 538, and base peak at m/z = 97.1

The fragmentation pattern of gas mass spectrum showed that the waxes are composed of a mixture of hydrocarbons, aldehydes, alcohols and carboxylic acids.

The other fragmentations identified were listed in the following Table:

m/z	fragments	Intensity %	Structure
41	**Aldehydes**		
	n-Tetracosanol	**0.09**	**(n-$C_{24}H_{49}OH$ (354.66))**
	n-Hexacosanol	**.01**	**n-$C_{26}H_{53}OH$(382.71)**
	n-Octacosanol	**0.01**	**n-$C_{28}H_{57}OH$(410.77)**
	n-Nonacosanol	**0.03**	**n-$C_{29}H_{59}O$(424.79)**
	n-Triacontanol	**0.03**	**n-$C_{30}H_{61}OH$(438.82)**
	n-Dotriacontanol		**n-$C_{32}H_{65}OH$(466.88)**
	n-Tetratriacontanol	**0.01**	**n-$C_{34}H_{69}OH$(494.93)**
Fatty carboxylic acids			
	n-Tetracosanoic	**0.02**	 **$C_{24}H_{48}O_2$ (368.64)**
	n-Hexacosanoic	**0.02**	 **$C_{26}H_{52}O_2$(396.70)**
	n-Octacosanoic	**0.03**	**$CH_3(CH_2)26CO_2H$ $C_{28}H_{56}O_2$=424.75**
	n-Nonacosanoic	**0.01**	**$CH_3(CH_2)27CO_2H$ 438.8$C_{29}H_{58}O_2$**
	n-Triacontanoic	**0.01**	 **$C_{30}H_{60}O_2$452.46**

The isolation of sugarcane waxes from filter cake mud was carried by extraction of the mud by four solvents (n-hexane, methylene chloride, ethanol and toluene).

When press mud of sugarcane was extracted with methylene chloride, the crude waxes produced equal to 7.67 % relative to the mud weight used and its melting point 79˚C. The produced wax was identified by different analyses. Its IR showed absorption bands at

3418.95 cm^{-1} (OH group), 2917.56 cm^{-1} (CH aliphatic), and 1736.99 cm^{-1} (CO group).
Its ^1H NMR 90 MHz ($CDCl_3$): δ = 0.9 (t, 3H, CH_3) and at 1.3(m, 54H, 27 CH_2). ^1H NMR 400 MHz ($CDCl_3$): δ = 0.9 (t, 3H, CH_3), 1.3(m, 54H, 27 CH_2) and at 3.6 (CH_2–OH).

Mass spectra: Base peak at m/z 97.2 and molecular ion peak at m/z =552.8 , and other (fragments at 43,1, 57.1, 69.1, 83.1, 111.2, 125.2, 139.2, 153.2, 181.2, 209.3, 236.3, 264.3, 292.4, 320.4, 364.4, 392.5, 414.4, 440.5, 470.6, 501.8, 523.1, 552.8).Peaks at m/z 410 and 392 due to octacosanol and its dehydrated 1-octacosene, respectively.

But when the mud was extracted with ethanol (95%), the waxes yield equal 4.81% yield, melting point 78 ^oC. its IR showed absorption bands at 3363.47 cm^{-1} broad band (OH), 2917.23 cm^{-1}(CH aliphatic), 1716.20 cm^{-1} (CO group). Its ^1H NMR 90 MHz ($CDCl_3$): δ = 0.9 (t, 3H, CH_3) and at 1.3(m, 54H, 27 CH_2).

Extraction of press mud with hexane, the weight of wax extracted is 1.71 g
% Waxes = 1.71/67.77X100 = 2.52 %yield, melting point 83˚c
IR: υ = 3422.01 cm^{-1} broad band (OH), 2917.73cm^{-1}(CH aliphatic), 1735.81 cm^{-1} (CO group).
^1H NMR 90 MHz ($CDCl_3$): δ = 0.9 (t, 3H, CH_3) and at 1.3(m, 54H, 27 CH_2).
^1H NMR 400 MHz ($CDCl_3$): δ = 0.9 (t, 3H, CH_3), 1.3(m, 54H, 27 CH_2) and at 3.6 (CH_2–OH).

Mass spectra: Base peak at m/z 410 and 392 due to octacosanol and its dehydrated octacosene respectively. Other m/z for heptacosanol and hexacosanol also present

Extraction of press mud with toluene produce 4.79% waxes. That is relative to the weight of mud used and its yield, melting point 74 ^oC. The analyses of produced waxes is as follows: IR showed absorption bands at 3381.96 cm^{-1} as a broad band's characteristic for (OH) alcoholic and carboxylic OH, at 2917.33cm^{-1} (CH aliphatic), and at 1715.46 cm^{-1} (CO group) of carboxylic group. Its Gas mass give a base peak at 57.1 and molecular ion peak at 429, and other fragments at393,390,and 364. Its ^1H NMR 90 MHz

($CDCl_3$) showed a signals at 0.9 (t, 3H, CH_3) and at 1.3(m, 54H, 27 CH_2).

Conclusion

Isolation the sugarcane waxes from either sugarcane peels or the press mud which considered as waste in the sugar industry. The sugarcane waxes is considered as added value to the sugar industry specially those which isolated from the press mud. Whereas the crude waxes produced reaches to 85% relative to the weight of press mud used. From waxes analyses we conclude that is a mixture of long chain fatty acids and long chain alcohols.

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الملخص العربي

فصل وتنقية شمع قصب السكر من قشر قصب السكر وطينة المرشحات

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يعتبر قصب السكرمن النباتات الاقتصادية المهمة. تبلغ المساحة المزروعة مع قصب السكر في مصر حوالي 125000 هكتار = 297619.047 فدان تنتج حوالي 12.5 مليون طن متر من قصب السكر.

تحاول الشركة المصرية للسكروالصناعات التكاملية الاستفادة الى حد كبيرمن جميع مكون قصب السكر. واستخدام جميع المنتجات الثانوية الناتجة من صناعة السكر حيث يتم استخدام المصاصة لقصب السكركمواد خام فى صناعة الورق والألياف. والمولاس يستخدم في إنتاج مواد كيميائية مهمة بمختلف انواعها (الإيثانول ،الأسيتون ،حمض الخليك، البيوتانول ،الخمائر) وغيرها من المواد الكيميائية. وتستخدم طينة المرشحات كسماد.

في ضوء سياسة شركة السكر وسياسة كلية تكنولوجيا صناعة السكر وجدنا أنه كمنتجً الايقل أهمية المنتجات السابقة يجب أخذه في الاعتبار. هذا المنتج هو شمع قصب السكر. وهوعبارة عن طبقه لونها أبيض مائلة للاصفرار موجودة على سطح قصب السكر، يتم استخراجه وفصله مع طينة المرشحات أثناء تكسير ومعالجة عصير القصب. يدخل في صناعة مستحضرات التجميل، طلاء الورق، المنسوجات ،طلاء الفاكهة والخضروات تحجيم الجلود، مواد التشحيم، المواد اللاصقة، ملمعات والأدوية.

لوحظ في طينة المرشحات متوسط ترتيب للشمع ودهون خام من 5 ال 14% وهذا على اسس موضوعية مع بعض المقترحات المختلفة لاستخدامها ولكن غالبا ما يتم ارسالها الى الحقول كسماد فى الاسابيع الستة السابقة لزراعة العشب. وأثناء طحن العود تتناثر حوالى 40 % من المواد الدهنية فى العصير كراسب بينما يتم الاحتفاظ بالباقي فى اللب بعد الطحن.ويظل شمع قصب السكر موضع اهتمام نظرا لتطبيقاته الصناعية لا سيما فى صناعة مستحضرات التجميل والادوية. وهو يعتبر بديل لشمع الكرنوبا المكلف الذى يستخدم على

قدر واسع في مستحضرات التجميل والادوية. بالإضافة الى ذلك شمع قصب السكر يعتبر ايضا مصدر للكحوليات الاليفاتية ذات سلسلة احادية طويلة .

البوليكوسانول عبارة عن مادة شمعية من الكحوليات عالية الايفاتية ذات سلسلة طويلة وطولها يتراوح بين 24 ال 34 ذرة كربون. من المصادر الشائعة البوليكوسانول والتي تستخدم كمكملات غذائية هي قصب السكر. ومن بعض مكوناتها الاوكتاكوزانول والهيكساكوزانول والترياكونتانول .وهذه المكونات تمت الموافقة عليها لاول مرة كمكملات غذائية ولها تطبيقات عديدة منها انخفاض مستوى الكوليسترول فى الدم. اثناء عملية التصنيع جزء كبير من الشمع يذوب فى العصير الخام ثم يتم ازالته فى النفايات اثناء خطوة تنقية وترويق المعلق(طينة المرشحات من صناعة السكر)اواثناء التقطير.

الاوكتاكوزانول يعتبر مكون إساسي في البوليكوسانول وهو مخلوط دهني من الكحوليات وموجود في الشموع النباتية والفواكه والاوراق واسطح النباتات والبذور الكاملة.

وفى ضوء الفوائد السابقة لشمع قصب السكر الناتج من كلا من قشر قصب السكر ومصاص قصب السكر وطينة المرشحات فنحن على يقين انه يمثل قيمة مضافة لصناعة السكر فى مصر.