

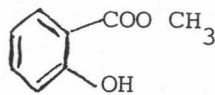
#### REFERENCES

1. Albin H.W., The Natural Waxes in The Chemistry and Technology of Waxes, 2d ed., pp. 92-241, Reinhold Publishing Co, N.Y. 1960.
2. Blaug, S., Semisolid Dosage Forms. in Prescription Pharmacy, 2d ed., pp. 228-259, J.B. Lippincott, Company, Philadelphia, 1970.
3. Blaug, S.M., Medicated Applications. in Remington's Pharmaceutical Sciences, 15th ed., pp. 1523-1540, Mack Publishing Company, Easton, Pennsylvania, 1975.
4. Bottari, F. et al. "Influence of Drug Concentration on In Vitro Release of Salicylic Acid from Ointment Bases" J. Pharm Sci. 63 (1974) : 1779-1783.
5. Idson, B. "Percutaneous Absorption" J. Pharm Sci. 64 (1975) : 901-921.
6. Idson, B, and Lazarus J., Semisolid. in The Theory and Practice of Industrial Pharmacy, 2d ed., pp. 215-229, Lea and Febiger, Philadelphia, 1976.
7. Parrott, Eugene L., Plastic Pharmaceutical Suspension and Emulsion. in Pharmaceutical Technology, pp. 364-380, Burgess Publishing Co., Minneapolis, Minn, 1970.
8. Dale E. Wurster and Sherman F. Kramer. "An Investigation of Some Factors Influencing Percutaneous Absorption" J. Pharm Sci. 50 (1961) : 288-293.

9. Ewart A. Swinyard, Werner Lowenthal, *Pharmaceutical Necessities*.  
in Remington's Pharmaceutical Sciences, 15th ed., pp.  
1232, 1248, 1258, 1268, Mack Publishing Company, Easton,  
Pennsylvania, 1975.
10. Winton F.R. and Lippoid O.C.J., *Body Fluids in Human Physiology*,  
5th ed., pp. 244, The Williams & Wilkins Company,  
Baltimore, 1972.
11. Windholz., *Beeswax, Carnauba wax, Methyl salicylate and Theobroma  
oil* in The Merck Index, 9th ed., pp. 132, 235, 798, 1195,  
Merck & Co., Inc., N.J., 1976.
12. Takiru Higuchi and Einer Brochmann-Hanssen, *Hydroxy benzoic Acid  
and Their Derivatives*. in Pharmaceutical Analysis, pp.  
21-24, Interscience Publishers, N.Y., 1961.
13. Zopf, L.C. and Blaug. S.M., *Semisolid Dosage Forms*. in American  
Pharmacy, 7th ed., pp. 234-245, J.B. Lippincott Company,  
Philadelphia, 1974.
14. Sasithorn Wasuwat, Prakangsiri Chuntharasumboon, Pornsawan  
Dissayabud. : "The Utilization of Sugarcane Wax from  
Filter Mud in Sugar Industry." Technical Report No. 53/1,  
TISTR, Bangkok, 1975.
15. E.W. Eckey, *Malvales*. in Vegetable Fats and Oils, pp. 670-677,  
Reinhold Publishing Corporation, N.Y., 1954.

Appendix

Methyl salicylate (9, 11)



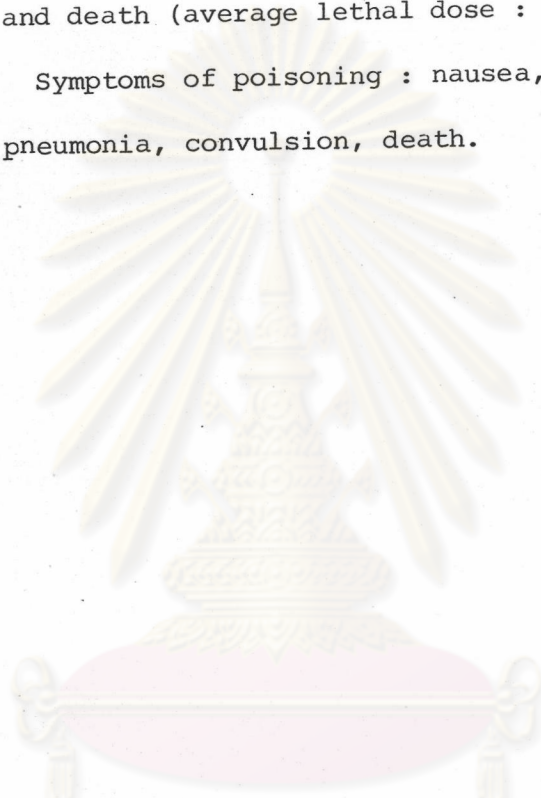
Benzoic acid, 2-hydroxy, methyl ester; Gaultheria oil; Wintergreen oil; Betula Oil; Sweet Birch Oil; Teaberry Oil; Artificial Wintergreen Oil; Synthetic Wintergreen Oil.

Me. Sal. produced synthetically or is obtained by maceration and subsequent distillation with steam from the leaves of Gaultheria procumbens Linne (Fam. Ericaceae) or from the bark of Betula lenta Linne (Fam. Betulaceae). Commercial product is usually synthetic, made by esterifying salicylic acid with methyl alcohol in the presence of sulfuric acid and distilling. Me. Sal. is a colorless, yellowish or reddish oily liquid, having the characteristic odor and taste of wintergreen. It is slightly soluble in water, soluble in alcohol and glacial acetic acid.

It is used as a pharmaceutical necessity and counterirritant (local analgesic). As a pharmaceutical necessity, it is used to flavor the official Aromatic Cascara Sagrada Fluidextract and it is equal in every respect to wintergreen oil or sweet birch oil. As a counterirritant, it is applied to the skin in the form of a liniment, ointment or cream; however, care should be exercised since salicylate is absorbed through the skin.

Dose. Topical, in lotions and solution in 10 to 25% concentration.

Toxicity. Ingestion of relatively small amount may cause severe poisoning and death (average lethal dose : 10 ml in children, 30 ml in adults). Symptoms of poisoning : nausea, vomiting, acidosis pulmonary edema, pneumonia, convulsion, death.



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## Physiological Fluid (10)

Sodium chloride	0.9	gm.
Potassium chloride	0.042	gm.
Calcium chloride	0.024	gm.
Sodium bicarbonate	0.02	gm.
Water to	100	ml.



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## YELLOW WAX NF (9, 11)



Beeswax, Yellow beeswax.

The purified wax from the honeycomb of the bee, Apis mellifera Linn'e (Fam. Apidae) is yellow to grayish brown solid with an agreeable, honey-like odor, and a faint, characteristic taste; specific gravity about 0.95; melts between 62° and 65°C. It is insoluble in water; sparingly soluble in cold alcohol; completely soluble in chloroform, ether and fixed and volatile oils; partly soluble in cold benzene and carbon disulfide; completely soluble in these liquids at about 30°C. It consists of a mixture of three different substances, which may be grossly separated by use of alcohol :

1. myricin, insoluble in boiling alcohol and consisting chiefly of myricyl palmitate  $[C_{30} H_{61} (C_{16} H_{31} O_2)]$  and myricyl alcohol  $[C_{30} H_{61} OH]$ ;
2. cerin or cerotic acid  $[C_{26} H_{52} O_2]$ , formerly called cerin when obtained only in an impure state, which is dissolved by boiling alcohol, but crystallizes out on cooling;
3. cerolein, which remains dissolved in the cold alcoholic liquid.

This latter is probably a mixture of fatty acids, as indicated by its acid reaction to litmus paper.

Beeswax is used as a stiffening agent in many pharmaceutical preparations and ingredient of many polishes. Beeswax is used in

modelling flowers, fruits, illustrations of botanical specimens, and the finest work in the arts.

#### Chemical Composition of Yellow Beeswax (1)

Esters of Wax Acids : 71%

Esters (m. 64.5°C) comprise alcohols (m. 77-80°C) 60 part and acids 42.5 parts.

Simple Esters :

$C_{15}H_{31}CO.O.C_{30}H_{61}$  myricyl palmitate (m. 73°C) 23%

$C_{15}H_{31}CO.O.C_{32}H_{65}$  lacceryl palmitate (2%)

$C_{26}H_{53}CO.O.C_{30}H_{61}$  myricyl cerotate (12%)

$C_{15}H_{29}CO.O.C_{30}H_{61}$  myricyl hypogaeate (12%)

Hydroxy Esters :

$C_{15}H_{30}(OH).Co.O.C_{26}H_{53}$  ceryl hydroxypalmitate (8-9%)

Acid Esters : 4-4½%

Diesters : 6-6½%

Acids Diesters, Triesters, Hydroxy Diesters : 3-3½%

Cholesteryl Esters of Fatty Acids : 1%

Cholesteryl isovalerate

Coloring Matter : 1-3-dihydroxyflavone (m. 285°C) 0.3%

Lactone : w-myristolactone (m. 33-34°C) 0.6%

Free Alcohols :  $C_{34}-C_{36}$  1-1.25%

Free Wax Acids 13.5-14.5%

Normal acids (m.77.5-79°C, m.wt.412)

Saturated :

Lignoceric acids	1-1½%
Cerotic acid (m.82.5°C)	3.8-4.4%
Montanic acid (m.86.8°C)	
Melissic acids (C <sub>30</sub> , or C <sub>31</sub> ) (m.90°C)	2%
Psyllic acid, C <sub>33</sub> H <sub>66</sub> O <sub>2</sub> (1.3-1.5%)	

Unsaturated :

Hypogaecic acid, C <sub>16</sub> H <sub>30</sub> O <sub>2</sub> (m.25°C)	1.5%
--	------

Hydrocarbons 10.5-13.5%

Saturated :

Pentacosane, C <sub>25</sub> H <sub>52</sub> (m.54-54.5°C)	(0.3%)
Heptacosane, C <sub>27</sub> H <sub>56</sub> (m.59.5°C)	(0.3%)
Nonacosane, C <sub>29</sub> H <sub>60</sub> (m.63.5 C)	(1-2%)
Hentriacontane, C <sub>31</sub> H <sub>64</sub> (m.68.4-69°C)	(8-9%)

Unsaturated :

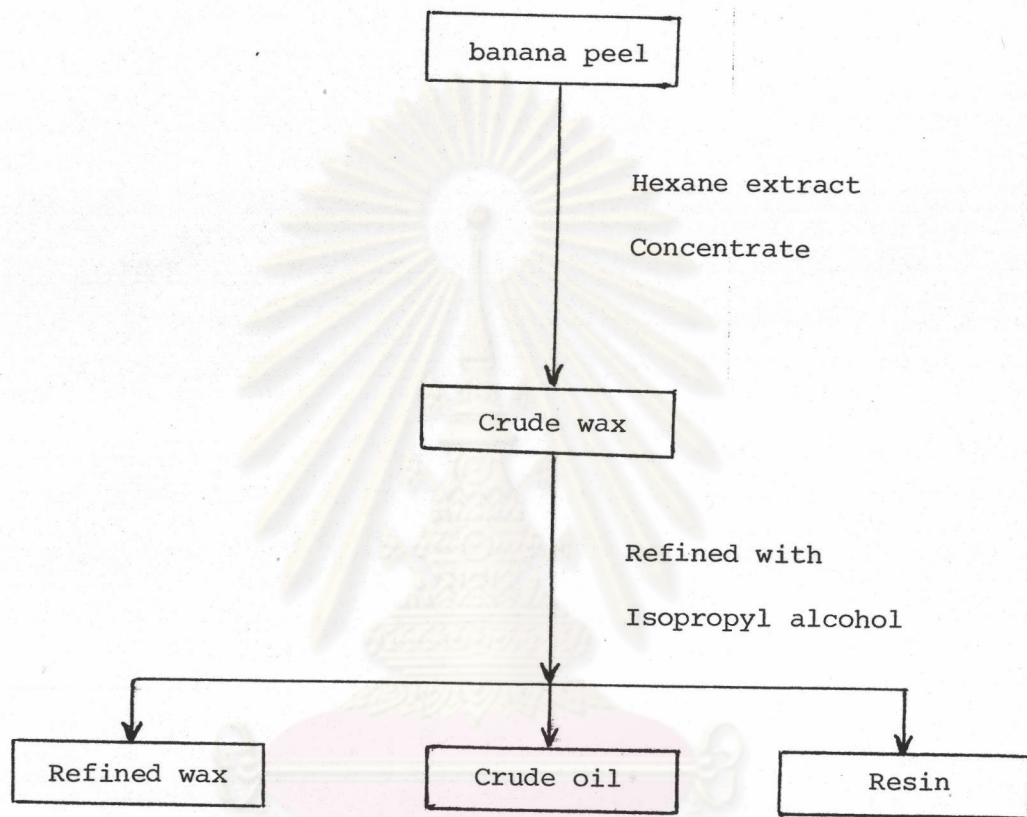
Melene, C <sub>30</sub> H <sub>60</sub> (2.5%)	
--	--

Moisture and Mineral Impurities : 1-2%

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



Figure 16 Recovered and purified banana wax from banana peel



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## CARNAUBA WAX (9, 11)

Carnauba wax is obtained from the leaves of Copernicia cerifera Mart. It is light-brown to pale yellow, moderately coarse powder, possessing a characteristic bland odor, and free from rancidity; specific gravity about 0.99; melts between  $81^{\circ}$  and  $86^{\circ}$ . It is insoluble in water; freely soluble in warm benzene; soluble in warm chloroform and toluene; slightly soluble in boiling alcohol. Carnauba wax contains chiefly of myricyl cerotate with smaller quantities of myricyl alcohol, ceryl alcohol and cerotic acid.

Carnauba wax is used as a polishing agent in the manufacture of coated tablets. It is used in leather dressing and floor-polish industry.

## Approximate Composition of Carnauba wax (1)

Alkyl Esters of Wax Acids	84-85%
Simple esters of normal acids, 5-6%	
Ceryl arachidate, and behenate, 1%	
Montanyl, myricyl, and lacceryl lignocerate, 2.5%	
Lacceryl cerotate, 0.5%	
Geddy lignocerate, montanate, and melissate, 1%	
Acid esters, $C_{18}$ - $C_{30}$ 5-6%	
Diesters, 19-21%	
Esters of hydroxylated acids, 53-55%	
Saturated, 38-40%	
Ceryl-w-hydroxymelissate, and -w-hydroxymelissate	
Myricyl-w-hydroxymelissate	

Esters of  $C_{18}$ ,  $C_{20}$ ,  $C_{22}$ , and  $C_{28}$ -w-hydroxy acids

Unsaturated, 14-26% (Iodine no. 5.3-5.5)

Free Wax Acids : 3-3.5%

Carnaubic acid

Cerotic acid

Lactides 2.3%

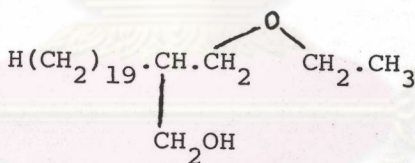
(Demeric) w-l-lactone (m.103.5°C) of hydroxymedullic acid

Free and Combined Polyhydric and Oxy-Alcohols : 2.3%

Dihydric pentacosanol,  $C_{23}H_{46}(CH_2OH)_2$  (m.103.6°C) (Now considered to be a mixture of  $\langle C_{22}, C_{22}, C_{24}, C_{26}, C_{28}$  and  $\rangle$   $C_{28}$  diols)

Oxy-alcohol derived from carnaubenol,  $H(CH_2)_{19}CH(CH_2OH)$

$CH : CHCH_3$  (m.39°C)



Resins (alcohol soluble) : 4-6%

Hydrocarbons : 1.5-3%

Heptacosane (m.59.2°C), nonacosane, and hentriacontane

Moisture and Mineral Matter : 0.5-1%



## RICEBRAN WAX (1)

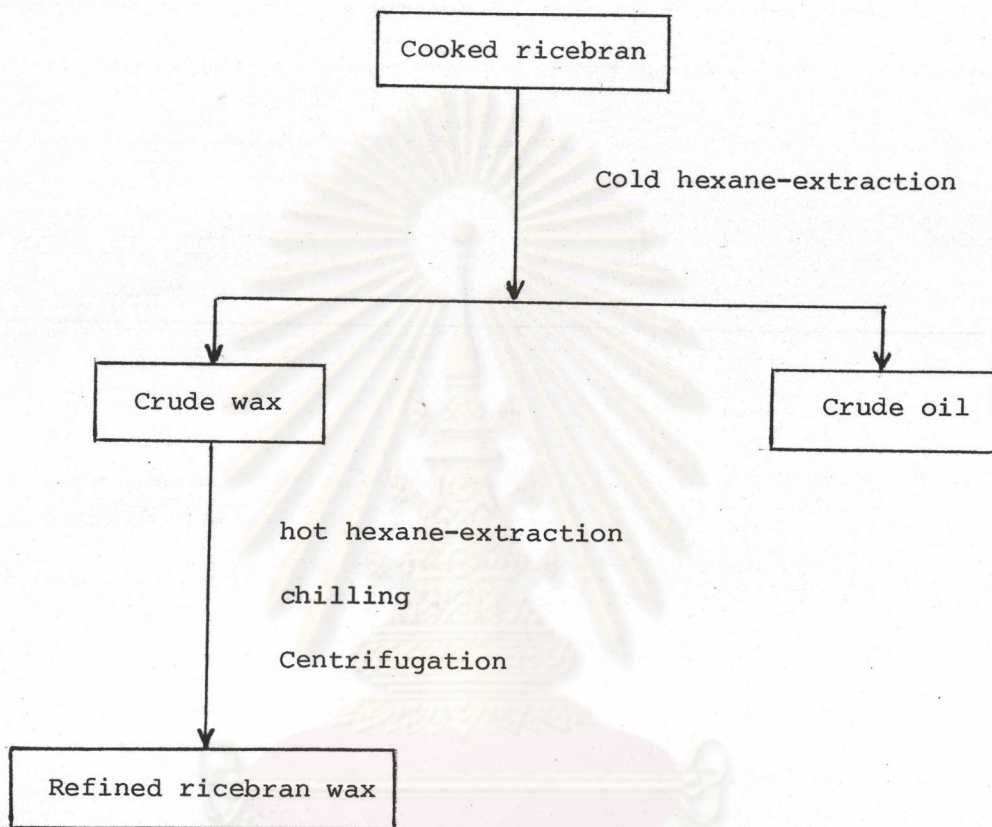
Ricebran wax is obtained from the ricebran in the milling of rice, Oryza sativa L., (Fam. Gramineae). The chemical composition of ricebran wax comprises esters of waxy acids of 22, 24 and 26 carbons, combined with alcohols of 26, 28 and 30 carbons. It is insoluble in water, freely soluble in warm benzene, soluble in warm chloroform and toluene, slightly soluble in boiling alcohol.

Ricebran wax is used as an enteric coating for lozenges, as a constituent in wax emulsion, used in the treatment of fruit and vegetables and as an ingredient in the foundation employed in the manufacture of carbon papers.

## Chemical composition of ricebran wax (1)

Myricyl cerotate	43-44%
Ceryl cerotate	21-22%
Isoceryl-isocerotate	9.5-10.5%
Free fatty acid	6.5-7.5%
Phytosterol	4.7%
Unidentified material	11.3-15.3%

Figure 17 Recovered and purified ricebran wax from cooked ricebran (1)



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## SUGARCANE WAX (1)

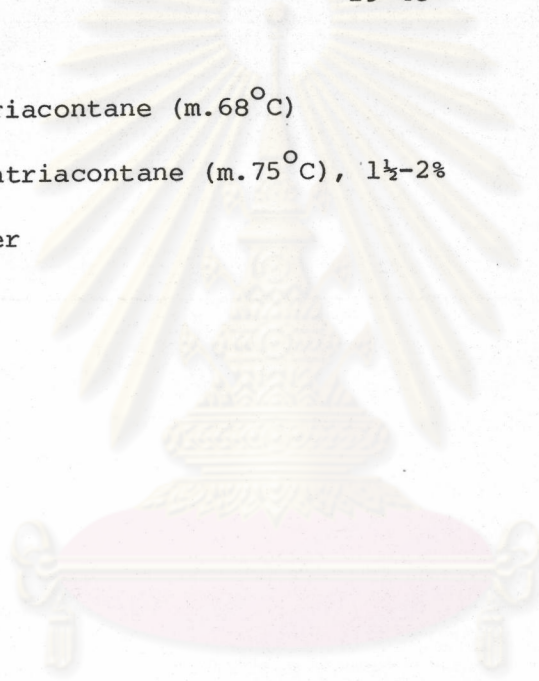
Sugarcane wax is the whitish to dark-yellowish powdery deposit on the surface of the stalks of the sugarcane, Saccharum officinarum L., may be obtained from solvent extraction of filter mud, which is a waste material from sugar industry. Sugarcane wax is partially soluble in cold alcohol, ethylene dichloride. It is quite soluble in chloroform, but very sparingly soluble in cold ether. The wax is soluble in hot amyl alcohol, melts between  $75^{\circ}$ - $78^{\circ}$ C, specific gravity about 0.961. It consists of wax esters 78-82%, free fatty and wax acid 14%, alcohol 6-7% and hydrocarbon 3-5%.

Sugarcane wax can be used in the manufacture of polishes, articles, and impregnated and coated products.

## Chemical Composition of Semirefined Sugarcane Wax (1)

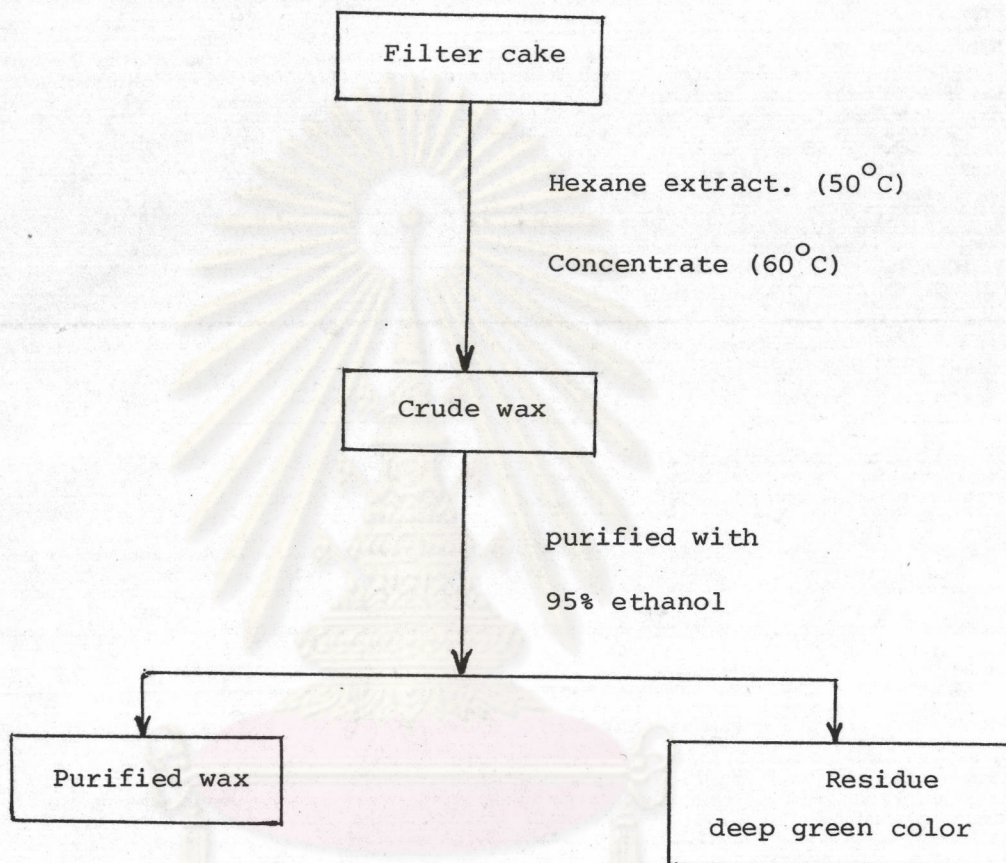
Wax Esters	78-82 per cent
Myricyl palmitate (m. $73^{\circ}$ C),	28%
Ceryl melissate (m. $86-87^{\circ}$ C),	1-2%
Myricyl melissate,	small amount
Phytosterol esters of dihydroxypalmitic acid (m. $55^{\circ}$ C),	13%
Stigmasteryl. ester of palmitic acid,	37-38%
Glycerides :	present, small amount
Free Fatty and Wax Acids	14 per cent
Palmitic acid,	large amount
Melissic acid,	small amount
Hypogaecic acid (m. $21^{\circ}$ C),	small amount

Alcohols	6-7 per cent
Aliphatic (free) trace	
Cyclic and derivatives :	
Brassicasterol, $C_{29}H_{50}O$ (m. $138^{\circ}C$ ), 0.8%	
Saccharostandiol, $C_{29}H_{52}O$ (m. $206^{\circ}C$ ), 4%	
Saccharostenone, $C_{29}H_{48}O$ (m. $106^{\circ}C$ ), $1\frac{1}{2}$ -2%	
Hydrocarbons	3-5 per cent
Hentriacontane (m. $68^{\circ}C$ )	
Pentatriacontane (m. $75^{\circ}C$ ), $1\frac{1}{2}$ -2%	
Mineral Matter	$\frac{1}{2}$ -1 per cent



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

Figure 18 Recovered and purified sugarcane wax from filter cake (14)



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



## THEOBROMA OIL (9, 11)

Cacao Butter; Cocoa Butter; Oil of Theobroma.

The fat obtained from the roasted seed of Theobroma cacao Linne (Fam. Sterculiaceae). It is yellowish, white solid with a faint, agreeable odor and a bland or chocolate-like taste; usually brittle below 25°C; specific gravity between 0.858 and 0.864. It is slightly soluble in alcohol; soluble in boiling dehydrated alcohol; freely soluble in ether and chloroform. Chemically, it is a mixture of stearin, palmitin, olein, laurin, linolein, and traces of other glycerides.

Because of its low fusing point and its property of becoming solid at a temperature just below the melting point, theobroma oil is valuable in pharmacy for making suppositories. In addition to this use, cacao butter is an excellent emollient application to the skin when inflamed; it also is used in various skin creams.

ศูนย์วิทยุทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

Table 6 Analytical Constants of natural waxes (1, 14, 15)

Natural waxes	Melting point °C	Acid value	Saponification value	Ester value	Iodine value
Beeswax	62-65	18-21	90-97	71-79	6-11
Banana wax	69-70	6.30-12.45	97.95-114.28	91.65- 101.83	83.02- 88.59
Carnauba wax	81-86	2.1-7.3	77.0	74.1	9.4
Ricebran wax	75-80	3.8	56.9-104.4	54.8-97.1	11.1-19.4
Sugarcane wax	75-78	7.62-17.05	30.0-37.5	20.45-22.38	-
Theobroma oil	32-35	1-4	190-198	189-194	33-40

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

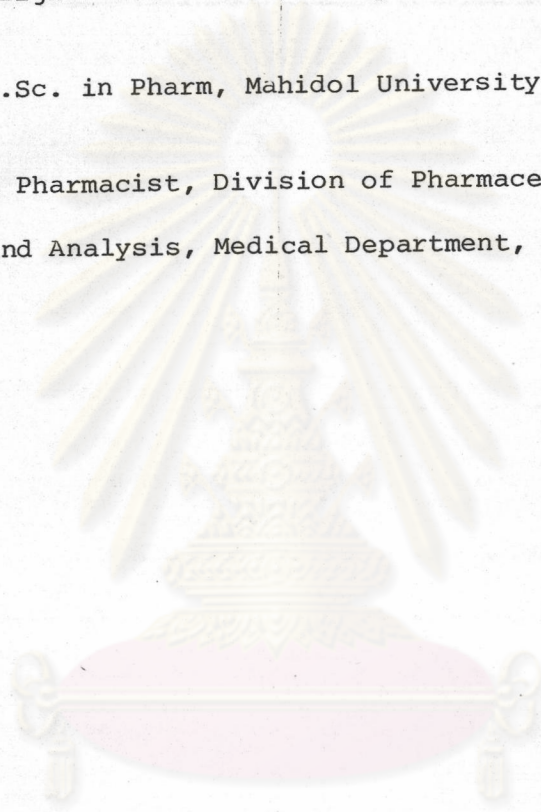


## VITA

Name : Flight Lieutenant Tanimporn Mongkolvit

Education : B.Sc. in Pharm, Mahidol University, 1971

Position : A Pharmacist, Division of Pharmaceutical Research  
and Analysis, Medical Department, Royal Thai Air Force.



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย