

Candellila Wax Offers Profit Opportunities

*Recovery of Valuable Wax from Plant Native to Texas
and Mexico Still in Condition of Retarded Development*

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THE Candellila plant, or *Yerba*, as it is familiarly known to the natives of Southwest Texas and Mexico is an evergreen that grows in wild profusion in the highlands of Southwest Texas, and in several of the northern states of Mexico, particularly Coahuila, Nueva Leon, and Tamaulipas. The candellila plant constitutes practically the only natural source of vegetable wax for the United States, and although we import almost our entire requirements of these waxes, and the prices are consequently high, only half-hearted and crude attempts have been made to recover the wax on a commercial scale from the candellila plant. Through lack of capital and organization, and the use of such primitive and wasteful methods the attempts to establish the industry have practically failed; yet there is every reason to suspect that with careful preliminary study, sufficient capital, efficient organization, and modern equipment, the industry could be successfully established and supply a good proportion of the vegetable wax now being purchased in foreign countries.

Shoe, furniture, floor and other polishes, candles, phonograph records, varnishes, electrical insulating materials, sealing waxes, dental molding compositions, lacquers for metals, sizes for textile fabrics and many other commodities in daily use contain varying proportions of vegetable waxes sufficient to give them the qualities that only this class of wax can impart. To supply such a wide range of industries producing articles in universal demand we must obviously import large quantities of vegetable wax. According to the statistics published in "Foreign Commerce and Navigation of the United States, Calendar Year 1926, Vol. 1," Vegetable Wax, No. 2248, Group 2, weighing 8,234,153 pounds, valued at \$2,249,548.00 entered the United States of America during the year 1926.

Varieties of Waxes

THE group of vegetable waxes will of course include carnauba, candellila, japan wax, and perhaps myrtle or bay-berry, and Cochin China or cay-cay; separate statistics are not given for each variety of wax, but the report does state that 730,792 pounds of wax valued at \$160,944 came from Mexico, and as candellila is the only variety of vegetable wax exported from that country we are at least certain that that weight of candellila was imported to the United States during 1926. This in itself is not an impressive quantity of this particular variety of wax, yet it would represent a very satisfactory annual output for a modern factory in Southwest Texas. The consumption of candellila wax is no doubt limited by the supply for we import most of our requirements from Mexico, and conditions are such in that country that supplies are irregular and are not dependable. The wax is very versatile in its uses; in many cases can be satisfactorily substituted for the more expensive carnauba wax, and beeswax, and it is reasonable to suppose that if a consistent and uniform domestic supply were available at a price not subject to excessive fluctuation, the demand would very considerably increase.

A word about the candellila plant may not be out of place. As already mentioned, it grows wild and in abundance in the semi-arid highland regions of Southwest Texas; it is not generally to be found on low lying land or in valleys, and the plants requires very little moisture. Cultivation is of course unnecessary, it is purely a weed. Botanically it is known as *Pedilanthus pavonis*, or *Euphorbia cerifera*, belonging to the *Euphorbiaceae*; another variety, *Euphorbia antisiphilitica*, also belonging to the *Euphorbiaceae*, yields a similar wax. The candellila plant has a tuberous woody root from which spring numerous cylindrical bluish-green stalks, or rod-like branches, from $\frac{1}{4}$ inch to $\frac{1}{2}$ inch in diameter. It may consist of seventy or

more stalks growing to a height of from two to five feet, and is entirely without leaves. If pulled, the plant reproduces itself from its main root, usually maturing again within from two to five years. It is also stated to reproduce itself from diminutive seeds. The wax is greyish-green in color, and forms a coating on the entire surface of the plant, very apparent to the sight and feel; it may be readily scraped from the surface of the stalks with the thumbnail or a pocket knife. The amount of wax on a plant varies from three and a half to five per cent.

When gathered, the plant is pulled up by the roots with the hands, or cut from the base of the main stem. In some sections the yield per acre will average from one to two tons, including a certain amount of dirt and stones that the plant retains. The plants are tied in bundles and hauled by means of burros, carts and wagons, and in some cases by motor trucks to the wax-recovery plant.

Methods of Recovery

TWO methods have been used to recover the wax; the old process of boiling with steam (Watson, United States Patent 1,042,992 and 1,058,648), and the more efficient solvent extraction process (Sharp, United States Patent 1,081,589) which recovers a far greater yield of wax and is less costly to operate.

The former method is very primitive and inefficient. Wooden or lead-lined vats are used, capable of treating about five hundred pounds of weeds in a batch. A solution of sulphuric acid is used in the vat with a strength of approximately ten per cent, which is heated either with live steam or direct fire. The weeds are tipped onto a net of iron chains which is placed in the bottom of the vat before it is filled. The temperature of the contents is raised to boiling point, and the candellila is kept submerged about six inches below the surface of the boiling solution for about ten minutes, when the molten wax leaves the plant and collects on the surface of the solution. It is then skimmed off and transferred to lead-lined or galvanized tanks. The exhausted weeds are lifted out of the vat with chains, and burned under the boilers. The solution in the vats is changed about twice weekly.

The crude wax is refined by re-melting, and is kept at boiling temperature to remove the water that has been carried over with the skimmed wax. It is later drawn off from the refining tanks into pans where it is permitted to settle overnight. Dirt, twigs, and other foreign matter settle to the bottom of the pan, and when the cakes are removed from these

pans the impurities at the bottom of the wax are scraped off and returned for re-settling. The clean cakes, still retaining considerable moisture, are placed in another refining tank and heated until the moisture is reduced to less than one per cent, when the color of the wax is usually a light brown. It is finally drawn off into pans, allowed to set, then turned out and sacked for market. Alternatively, the wax can be bleached by exposure to the sun in thin sheets. By the crude method of recovery described above it is possible to obtain a yield of from only one to one and a half per cent of the refined wax from the plant.

The extraction method should at least double the efficiency of the old method, while the cost of operation will be considerably less. For the extraction method the gathered plants are usually allowed to dry in the sun for two weeks before being prepared for extraction. The candellila is pulverized and placed in solvent tanks containing benzol (carbon tetrachloride can be used), and the wax is dissolved. The solvent-wax solution passes through a filtering medium, and the clear solution is subjected to distillation, thus recovering the solvent for re-use. This cycle is continuously repeated, and if the equipment is efficient, the loss of solvent during the process is very small. The wax residue remaining after distillation of the solvent can be refined if necessary before cooling and breaking up for packing.

Owing to the very primitive methods employed to recover candellila wax, and also perhaps to the fact that other wax bearing shrubs may have been inadvertently gathered with the candellila plant, samples of the commercial wax differ very greatly in constituents and characteristics. Typical results of analyses of the brown and light varieties on the market are given, however:

	Light Quality	Brown Quality
Specific Gravity at 15° C.....	0.9930	0.950/0.990
Melting Point	68.4°C.	68/70°C.
Setting Point	63.8°C.	66/68°C.
Acid Value	21.13	13/18
Saponification Value	54.95	50/60

Demand and Costs

IT IS estimated that approximately eighty per cent of the candellila wax consumed by the world's markets is produced in establishments in the vicinity of Nuevo Laredo and Piedras Negras, Mexico, from plants grown chiefly in the state of Coahuila, Mexico. A plant has recently been established in Coahuila, however,

by an American concern, where it is expected to process one hundred and forty tons of weed weekly, and to have a resultant yield of about six thousand pounds of wax weekly.

There is no local consumption of candellila wax in Mexico, and it is all shipped by rail from the producing centers to Tampico for transshipment by vessel to New York and Europe, which are the leading markets for wax.

According to U. S. Consul Lynn W. Franklin, Saltillo, Coahuila, the actual cost of production of candellila wax in Mexico is 52½ centavos for each kilo, or approximately \$0.1134 per pound. The State tax on the wax is two per cent of the actual value; the Federal tax is twenty-five per cent of the state tax, that is, if the value of the wax is 2,500 Mexican silver pesos, the State tax would be 50 pesos, and the Federal tax, twenty-five per cent of the 50 pesos or 12.5 pesos; making the total tax 62.5 pesos. The freight on the wax is 2.05 centavos per kilo delivered to the U. S. Border. The agent's commission amounts to one per cent, and there are sundry weighing and warehouse charges that amount to three fourths of one per cent. The actual value of candellila wax, f.o.b. car at Saltillo is 73½ centavos per kilo, equivalent to \$0.21 (U. S. Currency) per pound c.i.f. New York.

A shipper of candellila wax from Coahuila to New York billed a shipment in 1928 as follows:

7,147 pounds of candellila wax @ 21 cents valued at \$1,500.87 (U. S. Currency).	
Sacking, weighing, and hauling.....	\$ 45.00
Freight to Tampico	75.00
Freight to New York	50.00
Customs Broker Charges Tampico	15.00
Mexican Government Tax	105.00
Consular Invoice	2.50

Total expenses included in above price of
\$1,500.87. \$292.50

Prices for candellila wax placed in New York in 1923 averaged slightly over 17c per pound; in 1926, the average was 23c per pound; in March, 1927, 30c per pound; and in January 1928, 21c per pound. Nominally the wax is worth 1.05 Mexican silver pesos per kilo, which is equivalent to \$52.50 U. S. Currency per 220.46 pounds (1 kilo is equivalent to 2.2046 pounds).

With the crudest methods of production, and with yields of only from one to one and one-half per cent, the Mexican establishments are able to produce the wax for about eleven cents per pound; the average New York market price of candellila wax is approximately double the

cost at the Mexican factory; in other words there is a spread of a further eleven cents to absorb profits, customs and consular charges, Mexican State and Federal taxes, and high freight costs to New York.

Whether extraction factories located in Southwest Texas for the recovery of candellila wax could produce the wax for eleven cents per pound is a matter for determination; it would seem that Texas establishments could at least equal the results obtained in Mexico, and for that matter, with equipment that would give a yield of as much as four per cent wax, and more efficient methods of weed collection and plant operation, they should surpass them. Assuming that they could not recover the wax at a lower cost of production than the Mexican plants, there should still be a sufficient difference between the cost and the market prices to show a good manufacturing profit.

J. Wrench, Sales Manager, Industrial Chemical Sales Company, Inc., of New York left on October 4, on a business trip enroute to the South and the Pacific Coast. His trip will include calls at the company's distributing centers and at the Chicago Office.

In a recent patent on deodorizing fats and oils by steam distillation, the inventor claims; "Steam is caused pneumatically to lift oil from a body to be treated and above the level of the surrounding liquid. The lifted oil and steam are brought into intimate contact in a described apparatus and the steam and gaseous products are then removed." U. S. Pat. No. 1,771,561.

Free fatty acids in animal or vegetable fats or oils are saponified under vacuum by solutions of alkaline compounds having a basic reaction at a temperature of 35-40°C.; the vacuum is increased during or after neutralization until the soap can be separated from the oil or fat by filtration. Fr. Pat. No. 683,468.

Experiments on the preservation of fats by the addition of small quantities of preservatives have shown that lard, for example, can be completely preserved by the use of any one of the following: resorcinol, 1%, oil of clove, 0.38%, guaiacol, 0.66%, thymol 2.5%, creosote 0.25%.—*Am. J. Pharm.* 102, 146-54 (1930).