

# Wax

A **wax** is a simple [lipid](#) which is an ester of a long-chain [alcohol](#) and a [fatty acid](#). The alcohol may contain from 12-32 carbon atoms. Waxes are found in nature as coatings on leaves and stems. The wax prevents the plant from losing excessive amounts of water. Carnuba wax is found on the leaves of Brazilian palm trees and is used in floor and automobile waxes. Lanolin coats lambs, wool. Beeswax is secreted by bees to make cells for honey and eggs. Spermaceti wax is found in the head cavities and blubber of the sperm whale. Many of the waxes mentioned are used in ointments, hand creams, and cosmetics (read the ingredients lists).

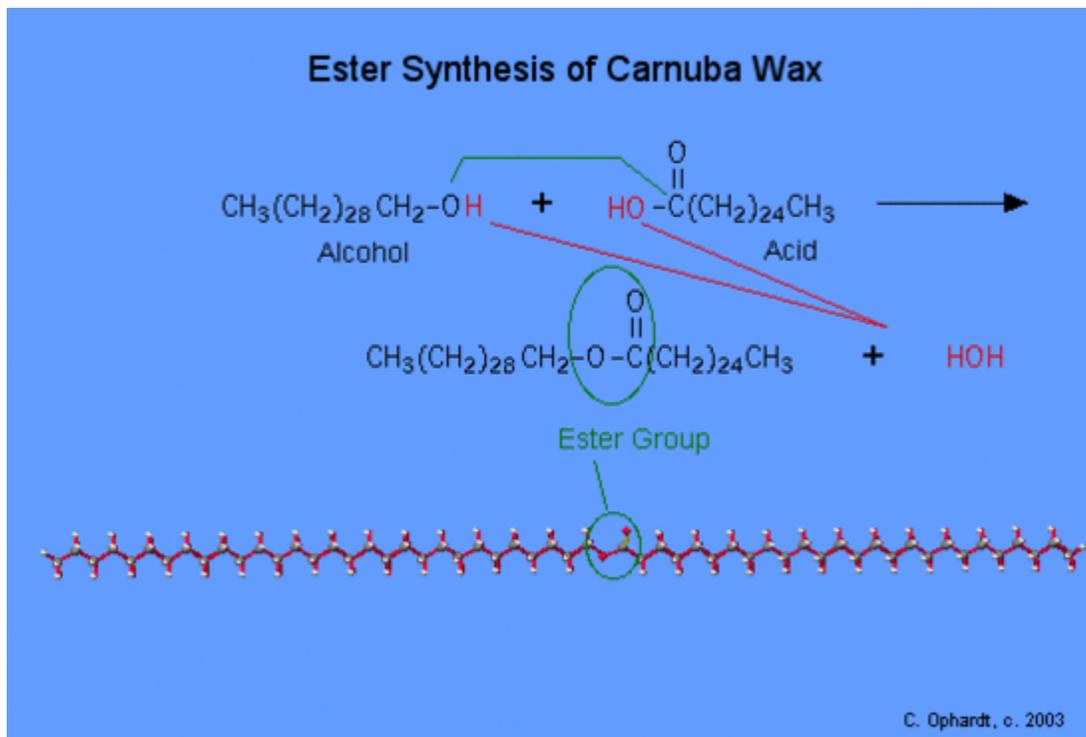
## Introduction

Paraffin wax, used in some candles, is not based upon the ester functional group, but is a mixture of high molecular weight alkanes. Ear wax is a mixture of phospholipids and esters of cholesterol. The waxes with their component alcohols and fatty acids are listed below.

WAXES		
Wax	Alcohol	Fatty Acid
Carnuba	$\text{CH}_3(\text{CH}_2)_{28}\text{CH}_2\text{-OH}$	$\text{CH}_3(\text{CH}_2)_{24}\text{COOH}$
Beeswax	$\text{CH}_3(\text{CH}_2)_{28}\text{CH}_2\text{-OH}$	$\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$
Spermacetic	$\text{CH}_3(\text{CH}_2)_{14}\text{CH}_2\text{-OH}$	$\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$

## Ester Synthesis

Simple esters are made from an organic acid and an alcohol. The ester functional group is of primary importance in the biochemical group of compounds called waxes, triglycerides, and phospholipids. The simplified reaction reveals the process of breaking some bonds and forming the ester and the by product, water. Refer to the graphic on the left for the synthesis of carnuba wax.



First, the -OH (red) bond on the acid is broken and the -H (red) bond on the alcohol is also broken. Both join to make HOH, a water molecule. Secondly, the oxygen of the alcohol forms a bond (green) to the acid at the carbon with the double bond oxygen. This forms the ester functional group. The long carbon chains do not participate in the reaction, but are just part of the final molecule.

## Lipstick

Lipstick consists of a suspension of coloring agents in high molecular weight hydrocarbons, waxes, and/or fats. The color usually comes from a dye precipitated by a

metal ion such as Fe (III), Ni(II), or Co(II) ions. An ingredients list may be: dye (4-8%); castor oil, paraffin, or fats to dissolve dye (50%); lanolin (25%); carnauba and/or beeswax as a stiffening agent (36%); perfume (1.5%). The lipstick is made by first dispersing the dye in the castor oil. Then the other waxes and lanolin are added as the mixture is heated and stirred. The molten waxes are then cast in suitable forms to harden.

### **Eye Makeup**

Eyebrow pencils are very much like lipstick but contain lamp black (carbon soot) as a black coloring agent. A different mixture of waxes may be used to give the desired melting point. Brown pencils are made by adding iron oxide (rust) as a pigment. A water-resistant mascara has a mixture of waxes, fats, oils, and soap. Other coloring agents in addition to blacks and browns may be chromic oxide (dark green) and ultramarine (blue pigment of sodium and aluminum silicate).

Source: <http://chemwiki.ucdavis.edu/>

[Biological\\_Chemistry/Lipids/Non-glyceride\\_Lipids/Wax](http://chemwiki.ucdavis.edu/Biological_Chemistry/Lipids/Non-glyceride_Lipids/Wax)