

Something on Resins.

Professor A. H. Church contributes the following in *Chemistry of Paints and Painting*:

In commercial parlance resins are incorrectly termed gums. The true gums are either soluble in water or swell up in that liquid, but resins are not acted upon by water. The term resin is used throughout the present volume in its proper sense, so that "copal resin," "mastic resin," are spoken of, not "gum copal," "gum mastic." All the resins used for making vehicles and varnishes are of vegetable origin, and are probably oxidation products of certain hydrocarbons in essential oils. Some resins, such as gamboge, contain gum and are called gum resins; others contain a hydrocarbon of an aromatic acid, and are called balsams; others are true resins, but even these rarely, if ever, consist of a single definite compound, but are mixtures of at least two, often of three, four, or five different bodies. Generally these constituents of true resins differ as to their degree of solubility in various liquids, such as alcohol, ether, spirit of turpentine, benzene, petroleum spirit, and heated fixed oils. They contain carbon, hydrogen, and oxygen, with occasionally a little sulphur, and are usually of acid character, and are capable of forming soaps, called resinates, with the alkalis. Resins differ much from one another not only in solubility but also in hardness and in the temperature at which they melt. Those which are least soluble are generally those which are hardest and which require the highest degree of heat to bring them into fusion. Most true resins contain, besides their proper resinous constituents, small quantities of coloring matter, of water, of crystalline aromatic acids, and of a volatile hydrocarbon or terpene. All these impurities, save the first, may be removed generally with advantage by the following treatment. The powdered resin is thoroughly mixed with a little water and placed in a large glass retort. A current of steam is then passed into the mixture until the terpene and volatile acids present have distilled over. To the contents of the retort carbonate of soda is added (1 part for each 100 of resin.) The mixture after agitation is allowed to cool and then filtered through a fine cotton cloth. The purified resin is then washed on the filter with distilled water, then dried in the air and finally in the water oven; the air bath and a temperature of 110° to 120° C. may be used for the desiccation of the harder resins.

Copal is a name given to a number of hard resins which vary not only in their degree of hardness, but also in their degree of solubility; they are the produce of many different species and even genera of trees, while the origin of several of the kinds still remain unknown. One of the hardest, whitest, and best of all is known as Sierra Leone copal, from the port of collection and shipment. It has been identified as the resin produced by a tree,

Copaifera Guibourtiana, which belongs to the sub-order Cesalpinee of the order Leguminosae. It is probable that the hard West African pebble copal is the resin of the same tree, but it occurs in rolled pebbles with an abraded surface, and is at least semi-fossil; it is collected from the beds of streams. Pebble copal has more color than the Sierra Leone copal, but yields as strong a varnish. The latter resin occurs in irregular rounded lumps or masses, generally varying in size from that of a hazel nut to that of a walnut. It is hard and elastic. It consists of at least two resins, one of which, present to the extent of thirty-three per cent, is soluble in absolute alcohol and in spirits of turpentine. The other resin constitutes nearly the whole of the remaining part of the copal and becomes soluble in most of the usual solvents, as well as in hot linseed oil, when it has been previously heated to its melting point or to a temperature of 180° to 221° C. (360° to 430° F.) Another process for rendering this and other kinds of copal soluble is a reduction to a fine powder in the presence of water and the subsequent exposure of this powder to the air for several months or even a whole year. The time requisite for this change may be shortened by keeping the powdered copal at a temperature higher than that of the ordinary atmosphere.

Other species of the genus *Copaifera* yield similar but inferior resins to that produced by *C. Guibourtiana*, but *C. Gorskiana* is the source of Inhambane copal; Benguela copal, Angola copal, and Gaboon copal are other sorts, varying from straw color to a dull reddish orange, produced in all probability by different species of *Copaifera*.

Zanzibar copal is another hard and valuable resin of African origin; it is often called anime. It is produced by another leguminous tree, *Trachylobium Hornemannianum*, which belongs to the same sub-order Cesalpinee, as *Copaifera*. Most of this Zanzibar copal occurs in a fossil or semi-fossil state in the earth near the roots of the trees, or in places where the trees have formerly stood. This fossilized resin is covered when dug up with a semi-opaque, rough and dull brown crust, when this powdery coat is removed the remainder of the mass appears of a transparent yellow color, with a surface covered with small rounded elevations like those on the rind of an orange; this is spoken of as "goose skin." Many of the pieces are flat and tabular, with a thickness of a quarter of an inch or more. The same resin when occurring on the bark of the living trees of the same species of *Trachylobium*, presents a smooth and glossy surface; it is not so hard as the fossil variety. Zanzibar copal melts at a higher temperature than Sierra Leone copal, and is very hard. In order to render it soluble it may be treated in the same manner as the Sierra Leone copal. Its chemical nature requires further study.

A third resin, sometimes designated as copal, sometimes as anime, is produced by

another leguminous tree, *Hymenaea courbaril*, a native of Brazil and other countries of South America. It is rather softer and more soluble than Zanzibar copal. The copal of Madagascar comes from another species of the same genus, *H. verrucosa*. A Mexican copal is probably the resin of an allied species. The resin from *H. courbaril* is generally known as West Indian copal; fine specimens have been received from Demerara.

The bongo tree of Sierra Leone, *Daniellia thurifera*, affords a resin of inferior quality. It is probable that the same leguminous tree is the source of some of the Niger and Soudan copals.

A rather hard resin of comparatively recent introduction is kauri or cowdi copal, produced by the cowdi pine of New Zealand, *Dammara australis*. This is a coniferous tree belonging to the tribe Araucarieae. The largest masses, some of them occasionally over 100 pounds in weight, are found in the earth in many places far from those in which the trees now grow. Kauri resin usually becomes more transparent and yellower by keeping. It is generally somewhat whitish or streaked with opaque bands, when first found. It is cleaned and scraped and then sorted into several qualities. Its use has greatly extended of recent years. It is now largely employed as the basis of most of the so-called copal varnishes on account of its abundance, its low price and its easy manipulation. But the varnish which it yields is inferior in hardness, toughness, and durability to that made from Sierra Leone copal or Zanzibar copal.

Kauri resin is sometimes spoken of as dammar, but this name properly belongs to the resins produced by other trees, not by *Dammara australis*. White or Singapore dammar is the resin of *Dammara orientalis*. It is soft and may be scratched even by mica. "Sal-dammar" is produced by *Shorea robusta*, the sal tree, widely distributed in India. This resin, though soft, yields a good flexible paper varnish. The tree belongs to the Dipterocarpaceae. *Vateria indica*, another Dipterocarpaceae, yields piney resin or white dammar, a similar resin is produced by another species *V. acuminata*, a Ceylon tree. Several kinds of *Hopea* (*H. micrantha* *H. odorata*, etc.), which belongs to the same natural order, yield pale, transparent resins which are a trifle harder than that of the sal tree. Black dammar or Tinnevely resin is produced by *Canarium strictum*; it is of a very inferior quality. This tree belongs to the Burseraceae. Several kinds of elemi resin are also furnished by plants belonging to the same natural order. These elemis are soft, sticky resins, occasionally employed in varnishes to prevent them from becoming brittle and cracking. They contain essential oils and other aromatic bodies, and vary very much in composition and properties, although they resemble one another in their solubility in boiling alcohol and in their easy alterability. They are unsatisfactory resins.