MONSANTO CHEMICALS

AROCLORS

AS USED TO EXTEND OR SUBSTITUTE CARNAUBA WAX

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Selected blends of AROCLORS*, chlorinated biphenyl and chlorinated polyphenyls, are attractive extenders or substitutes for carnauba wax in the manufacture of polishes.

This bulletin gives several practical formulas using Aroclors in wax blends possessing the qualities of carnauba wax for automobile, wood, leather and linoleum polishes.

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I. INTRODUCTION

The AROCLORS, chlorinated biphenyl and chlorinated polyphenyls, when properly blended possess the unusual qualities required to satisfactorily extend or substitute carnauba wax. Moreover, the extension of carnauba wax with blended Aroclors constitutes not only a saving of this unique and versatile wax, which has become scarcer in supply, but it also offers an attractive saving in cost.

Particularly in England, considerable work has been done to replace carnauba wax with blends of other waxes and Aroclors. Much of the following information about the use of Aroclors for this purpose is taken from the publication "Carnauba Wax Substitutes" by G. W. Wood (Maxwaxa Limited), presented in the Manufacturing Chemist and Manufacturing Perfumer, March 1948, Volume XIX.

The physical properties of Aroclors are given in Monsanto's Technical Bulletin No. P-115, "The Aroclors".

II. PROPERTIES OF PURE CARNAUBA WAX

Pure carnauba wax has the following characteristics:

Specific gravity	0.99 at 15°C.
Melting point	84.1 - 91°C.
Acid value	2.0 - 7.0
Sap. value	78.4 - 88.3 mg. KOH

Although there are several grades of commercial carnauba wax, in general the following properties are typical:

Specific gravity	0.978 at 15°C.
Acid value	7.8
Sap. value	87.0
Iodine value	9.9%
Alcohols	49.22%
Melting point of alcohols	81°C.
Acetyl value	122
Hydrocarbons	Nil

These properties indicate to the experienced wax blender that the preparation of a worthwhile substitute for carnauba requires the use of unique materials in order to conform with the qualities of the natural wax.

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III. CHARACTERISTICS OF A CARNAUBA WAX SUBSTITUTE

The principal requirements of a good carnauba wax substitute are:

Hardness or penetration value should be at least equal to that of the natural wax.

Texture should be homogeneous, preferably non-crystalline and somewhat brittle.

Melting point should be similar to the natural wax and the setting point should not be more than about 6°C. below this point, otherwise protracted cooling phenomena will be experienced.

Performance. Especially with respect to physical appearance and performance, the substituted wax composition must possess the working characteristics of the natural wax with reference to the particular end use application of the substitute.

IV. PREPARATION OF CARNAUBA WAX SUBSTITUTES

The early work done both in America and in Europe to prepare carnauba wax substitutes was based largely on blending materials such as paraffin wax, ceresin, colophony, montan wax, beeswax, candelilla wax, ozokerite and shellac wax to arrive at a blend possessing properties similar to carnauba wax. Like the case of carnauba wax, several of these naturally occurring substitute materials have increased in price and have become scarce. Also, with the use of naturally occurring waxes there has always been the problem of maintaining uniform quality. These factors led to the recent interest in Aroclors as extenders or substitutes for carnauba wax. A number of suggested blends and the characteristics are given in the following table.

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TABLE I.

COMPOSITION AND CHARACTERISTICS OF AROCLOR-WAX BLENDS

No.	Composition	Parts by Weight	Color	Texture	Softening Point	Melting Point
(1)	Aroclor 1268 Aroclor 1242 Carnauba wax Ceresin Paraffin	5.0 2.5 2.5 20.0 70.0	Light Cream	Smooth, hard non-tacky	58°C.	67.5°C.
(2)	Aroclor 1268 Aroclor 1242 Carnauba Wax Ceresin Paraffin	10.0 5.0 5.0 20.0 60.0	Pale yellow, white	Similar to above	60°C.	78°C.
(3)	Aroclor 1268 Aroclor 1242 Carnauba wax Ceresin Paraffin	19.6 4.9 6.8 19.6 49.0	Pale yellow	Similar to above	77°C.	79°C.
(4)	Aroclor 1268 Aroclor 1242 Carnauba wax Ceresin Paraffin	30.0 5.0 10.0 20.0 35.0	Pale yellow	Smooth, hard, slightly brittle	78°C.	78°C.
(5)	Aroclor 1268 Aroclor 1242 Carnauba wax Ceresin Paraffin	35.0 5.0 30.0 20.0 10.0	Pale cream	Slight surface crystallinity	79°C.	86°C.
(6)	Aroclor 1268 Aroclor 1242 Carnauba wax Ceresin	35.0 5.0 40.0 20.0	Cream	Similar to above	81°C.	86.5°C.
(7)	Aroclor 1268 Aroclor 1242 Carnauba wax Ceresin	35.0 5.0 50.0 10.0	Cream	Smooth, carnauba ringed surface	80.5°C.	88°C.

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It should be noted that a liquid or plasticizer-type Aroclor such as Aroclor 1242 is used in combination with the resinous-type Aroclor 1268. This is done to enhance the compatibility of the resinous type Aroclors with the wax and to increase solubility of the blend in inexpensive solvents such as mineral spirits. Mixtures of Aroclors 1254 and 5460 are also suggested for preparing the wax blends.

A good commercial natural brown grade of ceresin wax is incorporated for binding and absorption of all surplus liquid in the wax blend. The standard white commercial grade of paraffin wax, melting point 135°-140°F., is used largely as a filler. The type of carnauba wax used in preparing the blends is prime yellow with a melting point of 84.5°C.

All of these compositions possess excellent molding properties and would be entirely suitable for the manufacture of molded products. Mixtures No. 5, 6 and 7 can be especially recommended for this purpose or for electrical insulation work.

Mixture No. 4 is excellent for use in polishes.

V. TYPICAL FORMULAE OF POLISHES

The following are typical formulae for a household polish and a car polish:

Household Polish

Composition	Parts by weight
Composition No. 4 (Table I) . .	1
Natural ozokerite	3
Paraffin, hard	26
Mineral spirits	70

Characteristics. This is a smooth, soft paste possessing very good polishing properties on wood and linoleum.

Car Polish

Composition	Parts by weight
Composition No. 4 (Table I) . .	15
Candelilla wax	2
Natural ozokerite	3
Mineral spirits	80

Characteristics. This is a smooth paste possessing good polishing properties on all automobile paints and on leather upholstery.

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VI. AROCLOR-WAX BLENDS WITHOUT CARNAUBA WAX

Ouricury wax is less expensive than carnauba, generally much harder, with a melting point of 89-95°C. and has equally good luster-producing properties. The drawbacks of ouricury wax are inorganic impurities, chiefly admixed silica, and its dark color usually ranging from light chocolate brown to very dark brown.

The following formulation illustrates the replacement of carnauba with a purified commercial grade, medium brown ouricury wax possessing a melting point of 89°C., acid value 11.0 and saponification value of 86.1:

Composition	Parts by weight
Aroclor 5460	30
Aroclor 1242	5
Ouricury wax	30
Ceresin	20
Paraffin	15

Characteristics:

Color --	Light buff.
Texture --	Very smooth, hard.
Softening Point --	60°C.
Melting Point --	78.5°C.

The following car polish was made according to this formula:

Car Polish (Ouricury)

Composition	Parts by weight
Wax blend (as prepared above)	8
Natural ozokerite	2
Paraffin, hard	10
Aroclor 1242	5*
Mineral spirits	75*

*Dissolved with agitation before adding to the molten waxes.

(It is noteworthy that aluminum stearate should not be used in this composition.)

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Characteristics:

The color of this composition is a light brownish-tan similar to polishes made from fatty gray carnauba wax. It has good polishing properties on all types of surfaces.

VII. TOXICOLOGICAL CONSIDERATIONS ABOUT THE USE OF AROCLORS

In the manufacture of wax compositions containing Aroclors, precautions should be taken to avoid breathing the vapors from hot Aroclors. In this connection, the atmosphere of the workroom should be vented by the use of a suitable exhaust fan in line with ordinary and good factory operating practice.

When Aroclors are used at normal temperatures, usually only normal precautions relative to the handling of chemicals or ordinary cleanliness concerning commercial plant practice are followed.

With reference to the normal end use of polishes containing Aroclors as suggested in the formulations given in this bulletin, it is not expected that the Aroclors would present a problem of toxicity to humans. This is based on the following information reported by a reliable source.

It was determined by the skin patch test procedure given by Doctor Louis Schwartz and Doctor Samuel M. Peck in Reprint No. 2552 from the Public Health Reports, Vol. 59, No. 17 (April 28, 1944) that cotton fabric coated with Aroclor 5460 and an oil modified alkyd resin in such a manner that each square inch of fabric contained 10.5 mg. of Aroclor 5460, was neither a skin irritant nor a sensitizer.

VIII. GENERAL COMMENTS

1. The use of a selected mixture of Aroclors permits the extension or substitution of carnauba wax to a substantial amount without detracting from the desired characteristics of the finished polishing wax formulation. This is accomplished at an attractive saving in cost.

2. Using a selected mixture of Aroclors and ouricury wax, it is possible to completely eliminate carnauba wax.

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3. Polishing compositions of this type are excellent for use on practically all wood, leather, paint and linoleum surfaces.

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