The properties of two Aroclors

OF SPECIAL INTEREST TO MANUFACTURERS OF

Lacquers

AROCLOR #1254
AROCLOR #1262

CHLORINATED DIPHENYLS · · · EXCLUSIVE SWANN PRODUCTS



THE SWANN
CHEMICAL COMPANY
BIRMINGHAM, ALABAMA
GRAYBAR BUILDING, NEW YORK
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The Properties of Two Aroclors of Special Interest to Manufacturers of Lacquers

AROCLORS 1254 AND 1262

The Aroclors are lacquer softeners with some of the properties of resins. They are recommended as softener-resins because of their moisture-proofing properties, stability, resistance to sunlight, permanency, and the resistance to weathering imparted to lacquer films by their proper use.

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In a dammar-type lacquer the plasticizer-softener combination, such as the usual dibutyl phthalate-castor oil combination, may be advantageously replaced by an Aroclor alone. The resulting lacquer is less subject to checking and cracking on outside exposure and retains its gloss.

Aroclor 1262 may also be substituted entirely for the resin in certain types of lacquer. The clear lacquer, so produced, is practically colorless and provides an excellent base for white enamels.

The advantageous properties of the Aroclors in imparting added weather resistance to properly formulated lacquers may be traced to their resistance to the action of sunlight, to their perma-

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nency in the film, and to their extreme chemical stability. The Aroclors do not oxidize, "dry" or harden. The Aroclors are unaffected by dilute acids and even by hot caustic solutions. They are not subject to polymerization, rancidity or other change, as far as is known.

When added to a nitrocellulose solution, the Aroclors reduce the viscosity slightly. This change in viscosity takes place at once and no further change due to the presence of the Aroclor occurs on several months aging in closed containers.

By virtue of their high refractive index, they impart apparent depth to the lacquer film. Aroclor 1262 has adhesive properties and the lacquers containing it have excellent adhesion. Lacquers containing the Aroclors dry normally and give a hard, non-tacky, durable film of excellent gloss.

* * * *

In addition to the properties of general interest, other properties of the Aroclors are of value in formulating lacquers to fit special requirements. Aroclors 1254 and 1262 do not support combustion, and when present in nitrocellulose films they retard the rate of burning. The Aroclors retard the rate of transfer of moisture and of gases through a nitrocellulose film, and by virtue of this fact have found extensive use in protective lacquers for application over those types of electrical insulating materials, such as rubber, that deteriorate rapidly in contact with oxygen, ozone, moisture or other vapors or gases.

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Methods of Formulation of Aroclor Lacquers

The formulation of lacquers containing the Aroclors is easily accomplished, provided a few simple rules are observed in the planning of the lacquer formulas. These rules are expressed in the table below as the limiting allowable percentage of the Aroclors based on the total weight of nitrocellulose, plasticizer and resin employed in the lacquer formula:

TABLE 1

Guide to Formulation of Nitrocellulose Lacquers Containing Aroclor 1254 or 1262

RESIN	PLASTICIZER OR SOFTENER	The Aroclor must not exceed the percentage, given below, based on the total weight of nitrocellulose, plasticizer and resin in the lacquer formula.
Dammar	Aroclor 1254	40%
Glyptal	Aroclor 1254	40%
Rezyl	Aroclor 1254	40%
Dammar	Aroclor 1262	30%
Glyptal	Aroclor 1262	30%
Rezyl	Aroclor 1262	30%
Ester Gum	Aroclor 1254 or 1262	9%*
Amberol	Aroclor 1254 or 1262	9%*
Aroclor 1262	Dibutyl Phthalate	30%
Aroclor 1262	Tricresyl Phosphate	30% to 40% depending upon amount of tricresyl phosphate present.

**The required additional plasticizer may be supplied by adding one of the commonly-used plasticizers such as dibutyl phthalate, tricresyl phosphate, etc.*

The limiting percentages given in the table above have been carefully determined by a large number of experiments.

The Aroclors perform their desirable function in the lacquer when used in these percentages. In some cases a smaller percentage is sufficient. In any case the compatibility limits as expressed by the percentages above must not be exceeded, otherwise the value of the Aroclor is entirely lost.

The experimental work on which the above table is based may also be expressed in the form of trilinear diagrams. For those lacquer formulators who prefer to make use of the trilinear type of diagram, these are reproduced on pages 6 and 7.

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Suggested Formulas for General Use

As examples of practical lacquers, based on the use of Aroclor 1262, the following three lacquer enamel formulas are given. Fairly wide deviations from these formulas may be made with entirely satisfactory results provided the limits set forth in Table I, or in the trilinear diagrams are observed.

Formula 1:

A dammar lacquer for sanding and polishing; of excellent durability.

1/2 Sec. Nitrocellulose (Dry Basis)	100.0 parts by weight
Dammar	80.2 parts by weight
Aroclor 1262	20 to 39.5 parts by weight
Dibutyl Phthalate	20 to None parts by weight

Formula 2:

An ester gum lacquer for sanding and polishing; of excellent durability especially in air near sea-coast.

1/2 Sec. Nitrocellulose (Dry Basis)	100 parts by weight
Ester Gum	80 parts by weight
Aroclor 1262	20 parts by weight
Dibutyl Phthalate	20 parts by weight

Formula 3:

A softer lacquer, very flexible, not suitable for sanding, of good weathering qualities. This formula is typical of the lacquers in which the Aroclor performs the function of the resin. The clear lacquer made according to this formula is practically colorless. It is especially useful for white enamels in those cases where unusual flexibility is desired.

1/2 Sec. Nitrocellulose (Dry Basis)	100 parts by weight
Aroclor 1262	80 to 70 parts by weight
Lindol (Tricresyl Phosphate)	39 to 70 parts by weight

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Pigments:

For white enamels either French Process Zinc Oxide or Titanox may be used.

As examples of the amount of pigment, we suggest that the white pigments may be used in the proportion of 147 parts by weight on the basis of the above formulas or 40% of the weight of total solids including the pigment. For the colored enamels the pigments may be used in the usual proportions down to the carbon blacks which may be used in the proportion of 15 parts by weight on the basis of the above formulas or 6.4% of the total solids including the pigment.

Solvents:

The mixed solvent should be one in which the high boiling constituent is amyl or butyl acetate. Other types of mixed solvents in which the high boiler is of an entirely different type are well known to the industry, but consistently good results have not been obtained with such solvents for lacquers containing the Aroclors. We, therefore, strongly recommend the use of a balanced solvent in which the least volatile constituent is amyl or butyl acetate.

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Diagrams Showing Practi
of Lacquers U

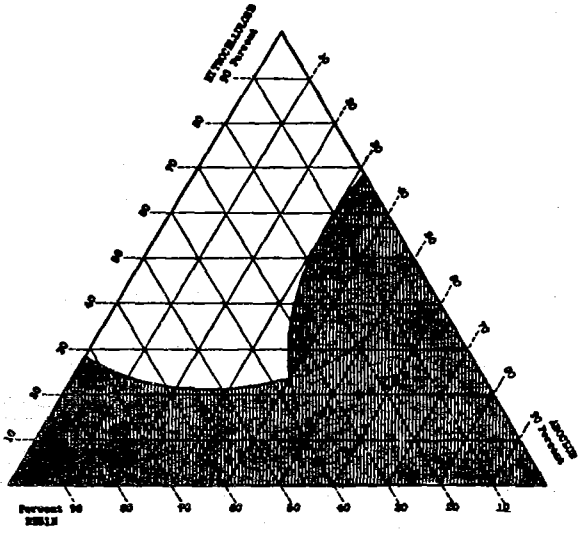

Figure 1
For combinations where the resin is Dammar or a resin of the phthalic anhydride-glycerol type (Glyptal or Rezyl) and where the Aroclor is Aroclor 1262.

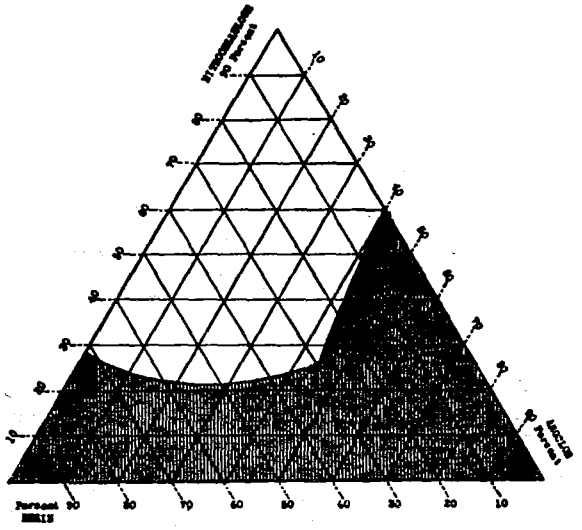

Figure 2
For combinations where the resin is Dammar or a resin of the phthalic anhydride-glycerol type (Glyptal or Rezyl) and where the Aroclor is Aroclor 1254.

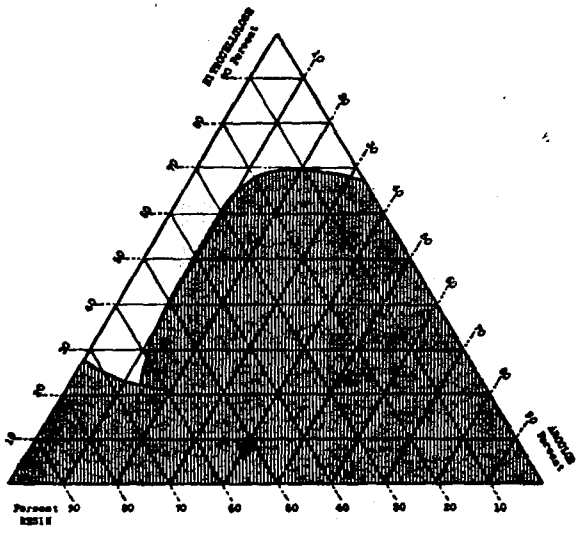

Figure 3
For combinations where the resin is Ester Gum or Amberol and where the Aroclor is Aroclor 1254 or Aroclor 1262.

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al Compositions
ng Aroclors 1254 and 1262

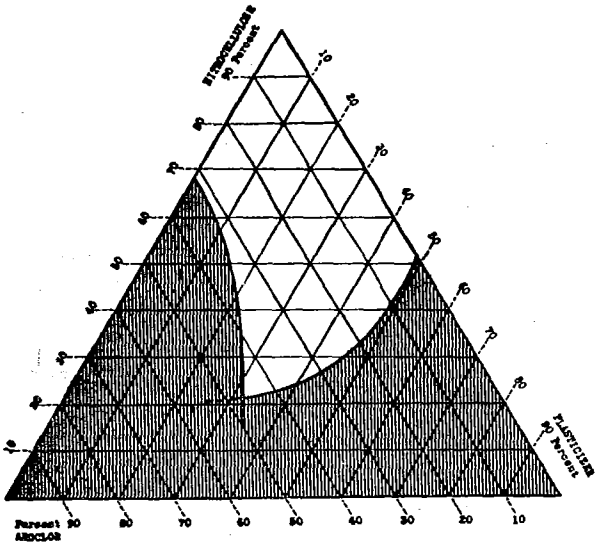

Figure 4
For combinations where the Aroclor resin is Aroclor 1262 and where the plasticizer is Dibutyl Phthalate.

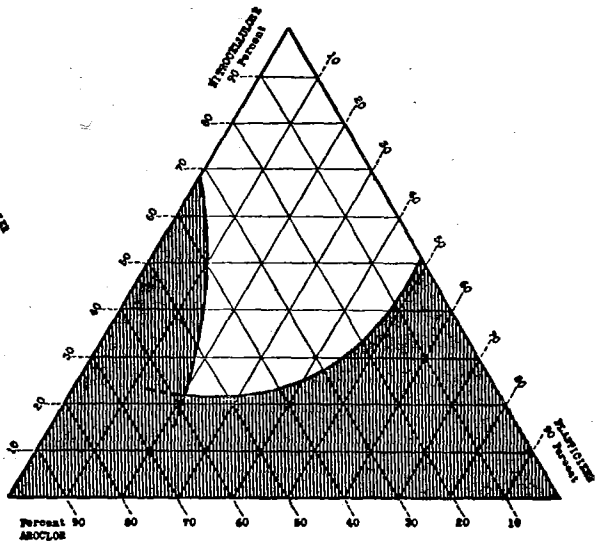

Figure 5
For combinations where the Aroclor resin is Aroclor 1262 and where the plasticizer is Tricresyl Phosphate.

In the trilinear diagrams the compositions, represented by any point in the unshaded areas, are those which produce homogeneous lacquer films. On the other hand compositions represented by points in the shaded areas produce impractical, segregated, brittle or soft films. For detailed information as to the derivation and use of these diagrams reference is made to the following articles:

Jenkins & Foster, "Compatibility Relationships of the Aroclors in Nitrocellulose Lacquers," Ind. Eng. Chem. *23*, 1362 (1931).

Hofmann & Reid, "Graphical Methods in Lacquer Technology," Ind. Eng. Chem. *20*, 431 (1928); "Formulation of Nitrocellulose Lacquers," Ind. Eng. Chem. *20*, 687 (1928).

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Properties of Aroclors 1254 and 1262

	Aroclor 1254	Aroclor 1262
State at ordinary temperatures	Pale yellow viscous oil.	Light yellow soft resin.
Color (Lovibond yellow No. 510; 1″ depth of liquid)	0.5 to 1.0	0.6 to 1.2
Maximum Acidity (Mg. KOH per gram of Aroclor)	0.01	0.02
Viscosity (Seconds Saybolt at 210° F. (98.9° C.)	46 to 48	90 to 103
Distilling Range (A.S.T.M.; °C)	352-381	370-404
Pour Point (A.S.T.M.; °C)	8.0 to 12.6	34.9 to 38.0
Freezing Point	Non-crystalline at 0° C.	Non-Crystalline at 0° C.
Specific Gravity at 25°/25° C.	1.543 to 1.550	1.646 to 1.653
Pounds per Gallon at 25° C.	12.86	13.71
Decimal fraction of gallon bulked by 1 pound at 25° C.	0.0778	0.0729
Coefficient of Expansion (Average for range indicated; cc./cc./°C.)	0.000661 From 25° to 65° C.	0.000640 From 25° to 90° C.
Flash Point (Cleveland Open Cup Method)	None	None
Fire Point (Cleveland Open Cup Method)	None	None
Refractive Index at 20° C. (for D-line)	1.6407 to 1.6410	1.6501 to 1.6517
Volatility, average loss at 163° C. (A.S.T.M. Method DS-27)	1.06 to 1.28	0.48 to 0.56
Solubility	*Soluble* in almost all of the common organic solvents; *insoluble* in water and glycerine; readily soluble in the mixed solvents commonly used in lacquers.	

Aroclors 1254 and 1262 are supplied in 30-gallon drums containing 350 lbs. net and in 50-gallon drums containing 500 lbs. net. Aroclor 1262 is supplied, if desired, as a solution in toluol containing 90% Aroclor and 10% toluol. This solution can be readily poured at 0° C.

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A Brief Description of Other Aroclors

In addition to Aroclors 1254 and 1262 there are a series of Aroclors varying from water-white mobile liquids and pale yellow viscous oils to light amber resins and opaque crystalline solids.

Non-Flammability

The viscous Aroclor oils and the resins do not support combustion. Most of the Aroclors flux readily with resinous and pitch-like materials to give a product having a decreased fire hazard.

Electrical Properties

The Aroclors have excellent electrical characteristics; high electrical break-down, dielectric constant and resistivity, low power factor.

Solubility

The Aroclor oils and soft resins are easily soluble in most of the common organic solvents and drying oils. The hard resinous Aroclors and the crystalline Aroclors are in general less soluble than the oils or soft resins. The hard resins can be used without difficulty in most drying oil-solvent combinations.

Adhesiveness

The Aroclor resins adhere strongly even to polished or lacquered surfaces.

Thermoplasticity

The Aroclor resins are thermoplastic, and undergo no condensation or hardening upon repeated melting and cooling. The Aroclor resins are now being produced with softening points up to a temperature above 100° C., and the crystalline Aroclors with melting points above 100° C.

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Non-Drying Properties

The Aroclors are non-drying, and when they are exposed to the air no noticeable oxidation or hardening takes place.

Toxicity

The Aroclors, so far as is known, have no harmful physiological action. When they are applied to the skin, there is no evidence that they are vesicants. The vapors, at elevated temperatures, however, will cause temporary irritation of the membranes of the nose and throat.

Odor and Taste

The Aroclor viscous oils and resins are almost without odor and taste at ordinary temperatures.

Stability

The Aroclors in general are stable on long heating at 150° C. and are not affected by boiling with sodium hydroxide solution.

Corrosiveness

The Aroclors have no corrosive action when applied to metallic surfaces at atmospheric temperatures. (The action at elevated temperatures is negligible.) Specific data have been determined covering the exposure of various metals to Aroclors at 280° C. to 390° C.

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Swann Products

Abrasives

- Aluminous Abrasive, Grinding Wheel Grain
- Aluminous Abrasive, Polishing Grain
- Aluminous Abrasive, Anti Slip
- Aluminous Abrasive, Specially Prepared
- Silicon Carbide, Grinding Wheel Grain
- Silicon Carbide, Polishing Grain

Refractory Materials

- Aluminum Oxide
- Bone Ash, Copper Molding
- Bone Ash, Cupel
- Fused Alumina
- Silicon Carbide (Fire Sand)
- Silicon Carbide, Refractory Grade

Special Chemicals

- Magnesium Ammonium Phosphate
- Mono Magnesium Phosphate
- Mono Potassium Phosphate, Sulphate Free
- Mono Potassium Phosphate, Technical
- Mono Sodium Phosphate, N.F. IV
- Potassium Ammonium Phosphate
- Sodium Ammonium Phosphate

Industrial Chemicals

- Calcium Pyrophosphate
- Calcium Sulphate, Anhydrous
- Di Ammonium Phosphate, Food Grade
- Di Ammonium Phosphate, Technical
- Di Sodium Phosphate, Anhydrous, Food Grade
- Di Sodium Phosphate, Anhydrous, Technical
- Di Sodium Phosphate, Crystalline, Food Grade
- Di Sodium Phosphate, Crystalline, Technical
- Mono Ammonium Phosphate, Food Grade
- Mono Ammonium Phosphate, Technical
- Mono Calcium Phosphate, Food Grade
- Mono Sodium Phosphate, Anhydrous, Technical
- Mono Sodium Phosphate, Dihydrate, Technical
- Mono Sodium Phosphate, Food Grade
- Muriatic Acid
- Phosphoric Acid 50%, Food Grade
- Phosphoric Acid 75%, Food Grade
- Phosphoric Acid, Sulphate Free
- Phosphoric Acid, Low Iron
- Phosphoric Acid Paste (Sugar Refining)
- Precipitated Bone
- Slag
- Sodium Acid Pyrophosphate
- Sodium Meta Silicate
- Tetra Sodium Pyrophosphate, Anhydrous, Technical
- Tetra Sodium Pyrophosphate, Crystalline, Technical
- Tetra Sodium Pyrophosphate, Recrystallized
- Tetra Sodium Pyrophosphate, Recrystallized Anhydrous
- Tri Calcium Phosphate (Dentifrice Grade)
- Tri Calcium Phosphate (Salt Filler)
- Tri Sodium Phosphate, Crystalline
- Tri Sodium Phosphate, Globular
- Tri Sodium Phosphate, Monohydrate

Organic Chemicals

- Aroclors (Viscous Liquids to Thermoplastic Resins)
- 2 - Chlorodiphenyl
- 4 - Chlorodiphenyl
- 4-4′ Dichlorodiphenyl
- Diphenyl
- Diphenyl Monosulfonic Acid
- Monoaminodiphenyl
- Mononitrodiphenyl
- Orthohydroxydiphenyl
- Para Hydroxydiphenyl

Ferro Alloys

- Ferrophosphorus—17-19%
- Ferrophosphorus—23-26%
- Ferrosilicon—15%

Pigments

- Lamp Black

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