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AROCLORS* As Used in Chlorinated Rubber

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AROCLORS, chlorinated biphenyl and chlorinated poly-phenyls, are effective plasticizers and resins for chlorinated rubber base lacquers, varnishes and paints.

These protective coatings are used where flame resistance, corrosion resistance, chemical resistance, i.e., resistance to acids, alkalies and water, and good electrical insulating properties are required.

Some of the important applications for these protective and decorative coatings for wood, metal, brick, stone, concrete and fabric surfaces include:

1. Wood and metal used in the construction of yachts, barges and other marine craft.
2. Structurel steel for bridges, buildings, roofs and power-line structures.
3. Structural materials used at chemical plants, pulp and paper mills, textile mills, petroleum refineries and gas works where protection against acid fumes, alkalies and gas is essential.
4. For the protection of tank cars and other rolling stock and construction machinery against corrosive materials and weathering.
5. To protect equipment used in electroplating and as stop-off lacquers in this industry.
6. Masonry floors and walls. Concrete swimming pools and traffic paints.
7. As cable coatings requiring nonflammability, chemical resistance, water resistance and excellent electrical properties.
8. Coatings for cloth to impart "waterproofing" qualities as well as chemical and flame resistance.

*Aroclor-Reg. U.S. Pat. Off.

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AROCLORS As Used in Chlorinated Rubber
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MIXED SOLVENTS

70 : 30	Acetone : hexane
97 : 3	Acetone : mineral spirits
83 : 17	Benzene : isopentane
41 : 7 : 35 : 17	Cellosolve : ethanol (anhydrous) : ethyl acetate : xylene
30 : 70	Cellosolve : turpentine
18 : 59 : 23	Cellosolve : turpentine : mineral spirits
64 : 36	Ethyl acetate : isopentane
30 : 30 : 40	Ethyl acetate : isopropyl acetate : Troluoil
40 : 60	Methyl isobutyl ketone : Troluoil
30 : 70	Hi-Flash solvent naphtha : turpentine
70 : 30	Methyl acetate : isopentane
85 : 15	Shell TS-28 : xylene

IV. AROCLOR AND CHLORINATED RUBBER, PLASTICS FILMS

The resinous Aroclors 1262 and 5460 show good miscibility with chlorinated rubber films as laid down from toluene solution containing 20 per cent of the plastics, using 2 : 1 and 1 : 1, Parlon : resin, ratios. Similarly, the plasticizer type Aroclor 1242, 1254 and 1260 show good miscibility in chlorinated rubber.

The properties of films derived from the following formulations containing either Parlon and resinous Aroclors 1262 or 5460, or Parlon and the plasticizer type Aroclors 1242, 1254 or 1260 were studied.

RESINOUS TYPE AROCLOR FOR PARLON PLASTICS

Ingredients	Parts by weight					
Parlon, 20-cp.	16	16	16	12	12	12
Aroclor 5460	8	8	8	12	12	12
Dibutyl phthalate		4			3	
Tung oil, Thermolyzed, 976			5			3.75
Xylene or butyl acetate	76	72	71	76	73	72.25

PLASTICIZER TYPE AROCLORS FOR PARLON PLASTICS

Ingredients	Parts by weight		
Parlon, 20-cp.	20	20	20
Aroclor 1254 or 1260	4	7	20
Xylene	76	73	70

Examination of the films cast from these lacquers revealed the following characteristics imparted by the Aroclors:

Adhesion: — Unplasticized chlorinated rubber films have very poor adhesive qualities. The lacquer film containing Aroclor 5460 gave good adhesion to aluminum, bare steel, primed steel, galvanized iron and Transite surfaces. Other commercially available resins, particularly oil modified alkyd resins, tested in similar films gave better adhesion than Aroclor 5460 to such surfaces as glass, tin, copper, sealed wood and cellophane.

The lacquer films plasticized with Aroclors 1254 or 1260 gave good adhesion to Transite, cellophane, galvanized iron and primed steel surfaces. Some of the other commercially available plasticizers tested in similar films gave better adhesion than the Aroclors to aluminum, tin, bare steel, copper and sealed wood surfaces.

Aroclors, alone, possess pronounced adhesive qualities. Doubtless, where the objective is to produce adhesives, by varying the Aroclor content or by using a mixture of Aroclors in the chlorinated rubber lacquers, much better adhesion to all of the surfaces would be accomplished than was the case with the type of plastics films studied.

Resistance to Aqueous Solutions:— Aroclors 1254 or 1260 used as plasticizers and Aroclor 5460 used as a resin in chlorinated rubber produced plastics films possessing satisfactory resistance to 10 per cent hydrochloric acid, 5 per cent sodium hydroxide, 5 per cent sodium chloride solutions and to water spot tests.

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Film Hardness:— Using Aroclor 5460 in ratios of 5 : 10 and 10 : 10, Aroclor : Parlon, decidedly softer films were produced than when other commercial resins were similarly used. Likewise, Aroclors 1254 or 1260 used in ratios of 2 : 10 and 5 : 10, Aroclor : Parlon, gave softer films than obtained from other commercial plasticizers, used at these concentrations. This indicates the strong plasticizing action of these Aroclors on chlorinated rubber.

Cold-Check Resistance:— Regarding cold-check resistant qualities imparted to chlorinated rubber films, Aroclor 5460 is somewhat superior to Bakelite type resins, but not as good as long-oil modified alkyds. Aroclor 1260 used as a plasticizer rates, in terms of cold-check resistance, somewhat better than Aroclor 1254 and nearly as good as the best of the other plasticizers studied for this property.

Miscellaneous Properties:— Parlon plastics films containing Aroclors 5460, 1254 or 1260 have entirely satisfactory sanding and polishing characteristics.

Weatherability:— Pigmented chlorinated rubber finishes containing Aroclors have consistently shown good outdoor weatherability. However, similar unpigmented finishes, regardless of the plasticizer or resin used and also in the absence of these additives, have been found to give poor outdoor weathering. Relatively poor resistance to ultraviolet light is a weakness of chlorinated rubber.

Most pigments, with the exception of ultra-marine blue are usable with Parlon finishes and are recommended when the coating is to be subjected to outdoor weathering or exposed to ultraviolet light. However, there is considerable variation regarding the protection offered by different pigments. Inspection of Parlon-fortified alkyd enamels showed the weatherability varied from 63 months for the enamel pigmented with chrome green to 4 months for enamel pigmented with a titanium dioxide-iron blue combination.

V. USES FOR AROCLORS IN CHLORINATED RUBBER COATINGS

A. Finishes for Alkaline Surfaces:

Aroclors, as well as chlorinated rubber, are highly resistant against alkalies and moisture. Because of these properties paints based on Aroclor and chlorinated rubber combinations are used in large quantity for application to concrete floors, walls, swimming pools, etc. Examples of this type of paint are given in Table IV.

TABLE IV. AROCLOR PLASTICIZER IN CHLORINATED RUBBER PAINTS FOR ALKALINE SURFACES

(Examples of starting formulas)

Materials	Formula 1 for basement floors	Formula 2 to meet Fed. Spec. TT-P-91	Formula 3 for swimming pools
	(Parts by weight)		
Parlon, 20-cp. type	18	18	14.6
Aroclor 1254	10	10	4.4
Rezyl 869	8		
Aroclor 5460 or Cumar P10		6	
Beckosol 31			2.9
Tung oil, Thermolyzed, 976			4.4
Titanium dioxide	16	16	19.7
Zinc oxide	2	2	6.5
Silica flour	3		
Carbon black	0.2	0.5	
Xylene	42.8	47.5	
Hi-Flash naphtha			47.5
Totals	100	100	100

B. Acids and Alkali-Resistant Finishes:

Particular care must be exercised in the choice of resins and plasticizers for use in chemical resistant paints. For this purpose, Aroclors are outstanding and are being used successfully in the acid and alkali-resistant chlorinated rubber formulations given in Table V.

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TABLE VII. RESINS AND PLASTICIZERS MISCIBLE IN PARLON

RESINS

Amberol 801, 806P, ST-137, F7
Aroclor 1262, 5460
Aroplaz 920, 930, 935, 940
Bakelite XR-3180, XR-4503, XR-4006, BR-2963, XJ-9868, BR-1329, BR-3360
Beckacite 1112
Beckamine P-138, P-254
Super-Beckamine 3501
Beckopol 1400
Beckosol 1 (solid), 18, 31, 34, 40, 1329
Beetle Resin 227-8
Clorafin 70
Copal
Cumar P10
Dammar
Duraplex C-45-LV, C-48, C-49, C-50-LV, C-51, C-62, D-61, D-62, E-71, E-71-A, E-73
East India gum
Ester gum
Ethyl Methacrylate
Esterol 750
Formvar
Gelva 2.5
Glyptal 1247, 2450, 2454, 2458, 2464, 2466, 2500
Lewisol 2L, 28, 33
Methyl Methacrylate Polymers
Neville R-3, R-10
Pentalyn A, G, M, X
Petrex 1, 130H
Phenac 633-M
Rezyl 116, X315, 412, 775, 803, 807, 829, 869, 880, 1103
Rosin
Santolite MHP
Staybelite Ester 1, 2, 10
Staybelite resin
Super-Beckacite 1001
Syntex H1, H3, H12, 17, 213, 22, 28, 29, 32, 36
Teglac 15, Z-152
Velsicol AD6-3
Vinsol

PLASTICIZERS

Amylchloro naphthalene
Amyl oleate
Amyl stearate
Aroclor 1242
Aroclor 1254
Aroclor 1260
Butyl myristate
Butyl stearate
Camphor
Castor oil, raw
Castor oil, dehydrated
Castor oil fatty acid esters
Cellosolve phthalate
Coconut fatty acid esters
Diamyl naphthalene
Diamyl phthalate
Dibutyl phthalate
Dibutyl sebacate
Diethyl phthalate
Dimethyl phthalate
Fish oil
Hercolyn
Linseed oil
Methyl cellosolve oleate
Monoamyl naphthalene
Naftolen
Neville heavy oil No. 2
Nevillite oil
Oiticica oil
Palm fatty acid esters
Perilla oil
Polyamyl naphthalene
Resinous Products C-24
Santicizer B-16
Santicizer M-17
Sextol phthalate
Sextol stearate
Soya bean fatty acid esters
Soya bean oil
Thermoil A
Tributyl phosphate
Tricresyl phosphate
Triethyl citrate
Triphenyl phosphate
Tung oil, Thermolyzed, 976

The strong points and limitations of the resins and plasticizers given in Table VII relative to the properties they impart to chlorinated rubber are known. None give the important over-all desired qualities attained by the use of Aroclors. If occasion arises to consider the use of these materials in specific applications for chlorinated rubber, then more detailed information about them will be given.

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The Aroclor compounds impart the following advantages to the films cast from these lacquers:

Adhesion

Unplasticized chlorinated-rubber films have very poor adhesion. The lacquer film containing Aroclor 5460 adheres well to aluminum, bare steel, primed steel, galvanized iron, and Transite surfaces. The lacquer films plasticized with Aroclor 1254 or 1260 give good adhesion to Transite, cellophane, galvanized iron, and primed-steel surfaces.

Though compounds with an Aroclor alone possess pronounced adhesion qualities, better adhesion to all of the surfaces results if mixtures of Aroclor or varied contents are used.

Resistance to Aqueous Solutions

Chlorinated-rubber films with Aroclor 1254 or 1260 (plasticizers) and Aroclor 5460 (resin) show satisfactory resistance to solutions of 10-per cent hydrochloric acid, 5-per cent sodium hydroxide, 5-per cent sodium chloride, and water-spot tests.

Film Hardness

Softer films are produced with Aroclor 5460 in ratios of 5:10 and 10:10 (Aroclor and Parlon) than with other commercial resins in similar mixtures. Likewise, softer films result from Aroclor 1254 or 1260 in ratios of 2:10 and 5:10 (Aroclor and Parlon) than with other commercial plasticizers at these concentrations. These tests show that Aroclor compounds have strong plasticizing action on chlorinated rubber.

Cold-Check Resistance

Aroclor 5460 is superior to phenol-formaldehyde resins in cold-check resistance imparted to chlorinated-rubber films, but not as good as long-oil-alkyd modification. Aroclor 1260 is a somewhat better plasticizer than Aroclor 1254.

Weather Resistance

Pigmented chlorinated-rubber finishes containing Aroclor have consistently withstood outdoor weather tests, but unpigmented finishes do not weather well regardless of the resin or plasticizer used.

Poor resistance to ultraviolet light is also a weakness of chlorinated rubber. Most pigments (except ultramarine blue) are usable with Parlon and are recommended if the coating is to be subjected to outdoor weather or ultraviolet light. However, pigment protection varies considerably. Inspection of alkyd enamels fortified with Parlon showed weatherability varied from 63 months with chrome green to 4 months for titanium dioxide-iron blue combinations.

Sanding and Polishing Properties

Plastic films compounded with Parlon and Aroclor 5460, 1254, or 1260 have showed satisfactory sanding and polishing characteristics.

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