MONSANTO
CHEMICALS — PLASTICS

AROCLOR 1221 1232 1242

For Polyvinyl Acetate Emulsion Adhesives

Monsanto Technical Bulletin No. O-111 November, 1955
Monsanto Chemical Company, Organic Chemicals Division, St. Louis 1, Mo.

INTRODUCTION

Monsanto *Aroclor** chlorinated polyphenyls are a series of compounds serving a variety of needs. Each *Aroclor* can serve as a plasticizer for many of the synthetic resins. Properties imparted vary with the *Aroclor* chosen. In this respect the family of *Aroclor* compounds is analogous to a series of phthalate esters.

Aroclor 1221, 1232 and 1242 are three compounds especially suited for plasticizing polyvinyl acetate (PVA) emulsion adhesives.

These are important advantages of the *Aroclor* plasticizers specified —

1) Excellent tack and strong bonding power are imparted to PVA adhesives.

2) The compounds are low in cost.

3) The plasticizers are light colored.

4) *Aroclor* 1221, 1232 and 1242 are mobile liquids at room temperature. Plant handling is simplified since no pre-melting is required.

5) The plasticizers are readily blended with PVA emulsions by simple stirring.

6) The hardness desired in various adhesive applications can be varied by choice of *Aroclor* plasticizer without materially changing other properties of the adhesive.

7) The three *Aroclor* plasticizers recommended for PVA emulsion adhesives are comparable to *ortho*-Nitrobiphenyl (a widely used PVA plasticizer), with regard to tack and fiber-tear, as indicated by tests on a porous yellow paper and a melamine-coated Kraft stock.

8) *Aroclor* compounds are readily available.

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*Monsanto trademark. Reg. U. S. Pat. Off.

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COMPATIBILITY

Monsanto Tests — November 1955

Tests conducted by Monsanto show *Aroclor* 1221, 1232 and 1242 are each compatible with PVA at the evaluation level of 11 parts of plasticizer in 100 parts of polyvinyl acetate emulsion. Each of the *Aroclor* plasticizers should blend with *ortho*-Nitrobiphenyl, if blending is desirable. Add liquified ONB to the emulsion, then add the *Aroclor*.

INTRO
LABORATORY DATA

Several PVA adhesive formulations using different plasticizers were made up and evaluated in our laboratories. The basic formulation consisted of 11 parts of plasticizer in 100 parts of polyvinyl acetate emulsion. Data tabulated below will allow the adhesive formulator to choose the most suitable plasticizer for the adhesive properties desired.

A COMPARISON OF POLYVINYL ACETATE PLASTICIZERS

Formulation Properties	ortho-Nitro-biphenyl	Dibutyl Phthalate	Aroclor 1221	Aroclor 1232	Aroclor 1242
Shore Hardness, A-scale	82	69	66	86	97
Low Temp. Flex., °C.	+2.2	−10.2	−5.9	+4.0	+5.3
Volatility (% plasticizer lost after 24 hrs. at 86° C.)	3.8%	4.0%	4.8%	4.3%	4.0%
Kerosene Extraction, (% plasticizer lost after 24 hrs. at room temperature)	3.2%	4.1%	4.5%	3.8%	4.2%
Viscosity of Formulation* (Centipoises) Initial	2160	2420	2240	2160	----
1 day	----	2460	----	----	----
3 days	2200	----	2200	2060	----
4 days	----	2520	----	----	----
5 days	2280	----	2200	2040	----
7 days	2340	----	2180	2020	----
10 days	2460	----	2260	2060	----

*Initial viscosity of the polyvinyl acetate emulsion tested was 1500 centipoises.

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TYPICAL PROPERTIES AND SPECIFICATIONS

Property	Aroclor 1221	Aroclor 1232	Aroclor 1242
Color, APHA max. (Specification)	100	100	100
Acidity, max. (mg. KOH/gm.)	0.014	0.014	0.015
Specific Gravity, 25/15.5° C. (Specification)	1.182-1.192	1.270-1.280	1.381-1.392
Pounds Per Gallon	9.85	10.55	11.50
Distillation Range*, ° C.	275°-320°	295°-355°	325°-360°
Flash Point, C.O.C., ° C.	141°-150°	149°-152°	176°-180°
° F.	286°-302°	300°-305°	348°-356°
Fire Point, C.O.C., ° C.	176°	212°	None**
° F.	349°	415°	----
Pour Point, ASTM-D-97, ° C.	Crystals at 1°	—35.5°	—19°
Refractive Index, nD^{25}	1.615-1.616	1.618-1.620 (Specification)	1.624-1.626 (Specification)
Viscosity, S.U.S. 210° F.	30-31	31-32	34-35
(ASTM-D-88) 130° F.	35-37	39-41	49-56
(Specification) 100° F.	38-41	44-51	82-92

*ASTM-D-20 (modified).

**No fire point up to boiling temperature.

TOXICITY AND SAFE HANDLING INFORMATION

The acute oral toxicity of *Aroclor* 1242 shows it to have an LD_{50} to rats of 4.15 ml./kilogram. Presumably the other two *Aroclor* compounds are in the same toxicity range. Repeated or prolonged skin contact with these compounds is to be avoided. Inasmuch as their processing in this use does not require the use of elevated temperatures, there should be no hazard from vapor exposure.

SHIPPING INFORMATION

Shipping Classification (U.S.A.)	— Synthetic Resin
Shipping Regulations	— None
Standard Containers	— 55 gal. black iron, nonreturnable, lacquer-lined drums containing 500 lbs., net, (Aroclor 1221 and 1232) or 600 lbs., net, (Aroclor 1242).

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ARCOLOR 1221, 1232, and 1242
For Polyvinyl Acetate
Emulsion Adhesives

TYPICAL PROPERTIES AND SPECIFICATIONS

Property	Arcolor 1221	Arcolor 1232	Arcolor 1242
Color [illegible] (Specification)	100	100	100
Acidity [illegible]	[illegible]	[illegible]	[illegible]
Specific Gravity [illegible] (Specification)	[illegible]	[illegible]	[illegible]
Pounds Per Gallon	[illegible]	[illegible]	[illegible]
Distillation Range*	[illegible]	[illegible]	[illegible]
Flash Point [illegible]	[illegible]	[illegible]	[illegible]
Fire Point [illegible]	[illegible]	[illegible]	None**
Pour Point ASTM-D-[illegible]	[illegible]	[illegible]	[illegible]
Refractive Index [illegible]	[illegible] (Specification)	[illegible] (Specification)	[illegible]
Viscosity [illegible]	[illegible]	[illegible]	[illegible]
ASTM-D-[illegible] (Specification)	[illegible]	[illegible]	[illegible]

*ASTM-D-[illegible]

**No fire point up to boiling temperature.

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CHEMICALS—PLASTICS

TOXIC [illegible] For further information on the products described in this bulletin contact the nearest Monsanto office.

MONSANTO CHEMICAL COMPANY

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