AROCLOR 1342 E1

BY Monsanto

It is well known that the working life of a.c. paper capacitors impregnated with askarels can be extended by the addition to the askarel of small amounts of suitable epoxy compounds, known as 'scavengers'. This effect is especially beneficial in the case of capacitors operating under arduous service conditions, such as those subjected to frequent surges.

However, some epoxy compounds have been found to be very difficult to control under the practical conditions obtained in existing capacitor impregnation plants.

Aroclor 1342 E1 consists of electrical quality Aroclor 1342 to which a specially purified epoxy compound has been added at just above the concentration at which it will be used. This product has been developed to provide convenient processing in the capacitor impregnation plant as well as sufficient activity to give an effective scavenging action in the finished capacitor.

The vapour pressure of the additive itself is very much lower than that of Aroclor 1342 so that the concentration of the additive will not be reduced during the degassing stage of the process when this is carried out over the usual ranges of temperature and pressure.

The concentration of the additive will be slightly reduced by a batch treatment process with Fullers' earth or other adsorbent. In order to allow for this reduction, the initial concentration of the additive has been set at a slightly higher level than would otherwise be necessary. In this way, after a batch treatment with an adsorbent of normal activity at a concentration up to about 1% by weight, the final concentration of the additive will be sufficient to give protection to the capacitors.

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If the impregnant is purified by percolation through a refining column the additive will be initially heavily depleted by the adsorbent. However, the adsorbent later becomes 'saturated' with the additive whilst continuing to remove ionic impurities from the impregnant. The volume of impregnant required to saturate the adsorbent depends upon its mass and activity.

The properties of Aroclor 1342 E1 (see Table 1) are the same as those of Aroclor 1342 except for the following:

Scavenger Content: equivalent to 1.5 to 1.8 mg HCl/g
Dissipation Factor (tan δ) at 100°C, 50 Hz: <0.04
Resistivity at 100°C, 500V, 1 min.: >10 G ohm.m

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Tentative Sales Specification

TABLE 1

Property	Test Method	Limits
Colour	ASTM D 1702	50 max.
Clarity	ASTM D 1702	Clear
Density at 20° C (kg/m³)	ASTM D 1810/ISO R649	1365 – 1385
Refractive Index at 20° C	ASTM D 1218	1.6230 – 1.6266
Viscosity at 20° C (Cst)	ASTM D 445	41 – 61
Fire Point	ASTM D 92	None to boiling
Pour point (° C)	ASTM D 97	– 18 max.
Neutralisation number (mg. KOH/g)	Monsanto	0.01 max.
Inorganic Chlorides (ppm)	ASTM D 1821	0.1 max.
Water content (ppm)	ASTM D 1533/ISO R760	30 max.
Hydrolisable Chlorides (ppm)	ASTM D 2441	1.0 max.
Thermal Chemical Chloride Stability (ppm)	ASTM D 1936	0.5 max.
Penta and higher chlorinated Biphenyls (%)	CIGRE Method	3.5 max.
Volume Resistivity at 100° C 500 V, after 1 min. (G ohm.m)	Monsanto	10 min.
Dissipation Factor at 100° C and 50 Hz	Monsanto	0.04 max.
Permittivity at 100° C and 50 Hz	Monsanto	4.7 – 5.1
Scavenger Equivalent (mg HCL/g)	see below	1.5 – 1.8

A suitable method for estimating the scavenger content is given on page 4. It has sometimes been found difficult to clean the dielectric test cells that are used to measure the dissipation factor and resistivity of epoxide-containing askarels. We have found that it is helpful first to standardize the cell with pure Aroclor 1342 whose dissipation factor is already known. If this measurement is satisfactory, the cell is then rinsed twice with Aroclor 1342 E1 and the measurement proceeds in the usual way.

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TEST METHOD FOR DETERMINING THE QUANTITY OF HYDROGEN CHLORIDE SCAVENGING ADDITIVE IN AROCLOR

1. Principle

The method involves titrating the oxirane oxygen in glacial acetic acid with a standard perchloric acid solution to a crystal violet end-point. The titration is carried out in an excess of quaternary ammonium bromide, which, on contact with perchloric acid, produces hydrogen bromide. The hydrogen bromide, in turn, reacts with the oxirane oxygen.

2. Reagents

(a) Glacial acetic acid
(b) Chloroform
(c) Perchloric acid solution—0.1 N in glacial acetic acid (standardize against potassium hydrogen phthalate).
(d) Crystal violet—1% solution in glacial acetic acid.
(e) Tetraethyl ammonium bromide solution—dissolve 100 g in 400 cm^3 of glacial acetic acid.

3. Apparatus

(a) 10 cm^3 burette
(b) Usual laboratory glassware

4. Procedure

(a) Weigh 2.5 to 3.0 of the askarel to the nearest 0.05 g into a 125 cm^3 Erlenmeyer flask.
(b) Add 10 cm^3 of chloroform, 40 cm^3 of glacial acetic acid and 10 cm^3 of the tetraethyl ammonium bromide solution and swirl to dissolve.
(c) Add 1 drop of crystal violet indicator and titrate with 0.1 N perchloric acid to the greatest colour range (violet to green-blue).

5. Calculation

$$\text{Hydrogen chloride equivalence (mg/g)} = \frac{36.5 \times T \times N}{W}$$

where T = titre of perchloric acid (cm^3)
N = normality of perchloric acid
W = weight of sample (g)

6. Additional Notes

(a) The titrant is very stable and does not require frequent re-standardization.
(b) No blank correction should be required if good quality reagents are used.

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Storage, Handling and Disposal of Aroclor

CAUTION

Aroclor contains POLYCHLORINATED BIPHENYLS (PCBs) which some studies have shown may be persistent, an environmental contaminant and, possibly, injurious to certain forms of bird, aquatic and animal life.

DRUMS

Inside storage is recommended to prevent contamination of the product by water. If the drums have to be stored outside they should be stacked on their sides to prevent water accumulating around the bungs and being breathed into the drum during severe ambient temperature changes.

Drum storage areas should be organised so that any leakages are collected for safe disposal.

Partially emptied drums should not be left open to the air.

BULK

The supply of Aroclor in bulk tank car loads, offers many advantages to medium and large volume users, compared with drum deliveries. Unloading, storing and transferring to the production unit is safer, easier, faster and cheaper. Material losses due to spillage and incomplete emptying of drums are eliminated. The possibility of product contamination during handling is greatly reduced.

Even where storage and handling facilities are not at present available, the economics of bulk handling may quickly pay for the tanks and piping systems required.

A booklet indicating the type of system necessary for the efficient handling of Aroclor in bulk is available from Monsanto.

As soon as a changeover to bulk delivery is contemplated, experienced Monsanto personnel will be available for site discussions regarding the most efficient type of installation for the particular location and an offloading procedure appropriate to that particular installation.

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Handling Precautions

Aroclor drums and containers carry the following label which gives general instructions for handling:

IMPORTANT CHLOROBIPHENYLS (42%-54%) (or 60%) (PCB)

This product contains POLYCHLORINATED BIPHENYLS (PCBs) which some studies have shown may be persistent, an environmental contaminant and, possibly, injurious to certain forms of bird, aquatic and animal life.

PREVENT ANY ENTRY INTO THE ENVIRONMENT THROUGH SPILLS, LEAKAGE, DISPOSAL, VAPOURISATION, RE-USE OF CONTAINERS OR OTHERWISE.

SPILLS, LEAKAGES AND WASTE PRODUCTS MUST BE COLLECTED.

Use of this product must be restricted to applications which can be controlled so that entry into the environment does not occur and to applications in which it cannot come into contact with food, animal feedstuffs or pharmaceuticals.

HARMFUL SUBSTANCE IF TAKEN INTERNALLY OR IF IN PROLONGED CONTACT WITH THE SKIN.

CAUSES IRRITATION OF SKIN AND EYES.

DURING SHIPMENT AVOID SPILLS AND LEAKAGE INTO INLAND WATERWAYS AND THE SEA.

Store away from food, animal feedstuffs and pharmaceuticals.
Keep container tightly closed.
Do not eat or smoke when using.
Avoid breathing vapours, mist or fumes.
Do not wear contaminated clothing.
Wash product from skin with soap and water.
Wash eyes by flushing with water.

In addition to the foregoing we can add that:

1. Animal toxicity tests (small mammals) indicate that acute oral toxicity is low but that acute dermal toxicity may be moderate.

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2. When handling the fluid minimise contact with the skin and wash any off with soap and water. People with sensitive skins should wear gloves resistant to chlorinated solvents or apply a silicone hand cream.

3. Should Aroclor accidentally splash or be rubbed into the eyes, they should be rinsed thoroughly with water for a few minutes. It is suggested that all operators be provided with safety glasses as Aroclor will cause pain if it gets into the eyes.

4. Elementary rules of hygiene should be applied – such as not smoking, eating or drinking during handling and contaminated clothing should be discarded.

5. Aroclor should be handled at ambient temperatures in well ventilated areas. If hot Aroclor has to be handled, a respirator with an active carbon canister should be worn.

Disposal of Empty Drums and Waste Aroclor

Handling Aroclor in bulk will minimise the problems associated with handling of drums. Waste Aroclor should be disposed of by special high temperature incineration at 1000° C minimum with a residence time of 1.5 seconds or longer or alternatively by a method conforming to local regulations. Empty drums should not be re-used for anything except scrap Aroclor. If this is not possible each drum should be rinsed twice with kerosene and the washings incinerated as above. Drums should then be crushed and buried on an approved toxic dump in accordance with local regulations.

Care must be exercised during such disposals and the ultimate use of Aroclor to avoid pollution particularly of sewers and waterways.

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The information, recommendations and suggestions made herein are offered in the light of prevailing legislation and on the basis of present scientific information (1975) available to Monsanto.

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