AROCLOR 1242 E1

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 1242 E1 consists of electrical quality Aroclor 1242 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 1242 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.

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 1242 E1 (see Table 1) are the same as those of Aroclor 1242 except for the following:

Scavenger Content: equivalent to 1.9 to 2.1 mg HCl/g

Dissipation Factor (tan δ) at 100 °C, 50 Hz: $< 3\%$

Resistivity at 100 °C, 500V, 1 min.: $> 1\ T\Omega\,cm.$

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Monsanto

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Table 1

Aroclor 1242 E1. Tentative Data

PROPERTY	TEST METHOD	UNITS	VALUE
Appearance	ASTM D 1702	—	clear liquid free from suspended matter and sediment.
Colour	ASTM D 1702	APHA	50 max.
Density at 20 °C	ASTM D 1810 & ISO/R 649	g/cm³	1,38 to 1,39
Refractive Index at 20 °C	ASTM D 1807	—	1.6250 to 1.6270
Kinematic Viscosity at 20 °C	ASTM D 446	cSt	55 to 71
Flash Point	ASTM D 92	°C	153 min.
Fire Point	ASTM D 92	°C	none to boiling point.
Pour Point	ASTM D 97	°C	−18 max.
Neutralization No.	Monsanto	mg KOH/g	0.01 max.
Inorganic Chlorides	ASTM D 1821	ppm	0.05 max.
Water Content	ISO/R 760	ppm	30 max.
Hydrolyzable Chlorides	ASTM D 2441	ppm	1.0 max.
Scavenger Content	Monsanto (Appendix 1)	mg HCL/g	1.9 to 2.1
Volume Resistivity at 100 °C, 500V, 1 min.	Monsanto	T Ω cm	> 1 min.
Dissipation Factor (tan δ) at 100 °C, 50 Hz	Monsanto	%	< 3 max.
Relative Permittivity at 100 °C, 50 Hz	Monsanto	—	4.7 to 4.9

A suitable method for estimating the scavenger content is given in Appendix 1. 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 1242 whose dissipation factor is already known. If this measurement is satisfactory, the cell is then rinsed twice with Aroclor 1242 E1 and the measurement proceeds in the usual way.

This product should be treated from the toxicity and safety aspects in the same way as Aroclor 1242 (see Appendix 2). For further information contact Monsanto at 10–18 Victoria Street, London SW1H 0NQ, Telephone 222 5678 or at Place Madou 1, 1030 Brussels, Telephone 19.11.01.

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Appendix 1

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 restandardization.
(b) No blank correction should be required if good quality reagents are used.

Appendix 2

Toxicity and Safe Handling

1. Avoid skin contact. Protect the hands, preferably by oil-resistant gloves.
2. If skin contact should occur, wash off with soap and water.
3. If hot Aroclor must be handled in a closed or confined area provide exhaust ventilation or wear an approved respirator.
4. If Aroclor gets in the eyes, flush with large amounts of water. In the event that irritation persists refer the patient to a Physician.
5. Exposure to vapours or mists should be avoided.

If these precautions are neglected acne may develop and excessive exposure may cause liver damage.

Caution

Aroclor is composed of polychlorinated biphenyls, which some studies have shown may be an environmental contaminant. Extreme care should be taken to prevent any entry into the environment through spills, leakage, use, disposal, vaporization or otherwise.

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