Monsanto
TECHNICAL DATA SHEET

MCS 748
A PURIFIED CONCENTRATE OF SCAVENGER IN AROCLOR 1242

1. INTRODUCTION

Following General Electric Company (U.S.A.) developments in improving capacitor lives under severe ageing conditions by the incorporation of a scavenger in the Askarel impregnant (see references 1, 2, 3,) we have received requests from several capacitor manufacturers to supply the scavenger in a purified and concentrated form.

Monsanto Organic Research Department in St. Louis has perfected a method of producing a mixture of exceptionally high purity containing 50% of the scavenger. We have been authorised by the General Electric Company (U.S.A.) to distribute samples of this concentrate to interested capacitor manufacturers so that they may evaluate this in their own designs. Such trials will assist capacitor manufacturers to make a technical and economic assessment of the value of this development in relation to their particular commercial circumstances so that they will be better able to make an informed decision on licensing arrangements.

2. PROPERTIES

The samples consist of a mixture of Aroclor 1242 and vinylcyclohexene dioxide (commercially known as ERL4206 or Unox 206) in the proportion of 50:50 by weight. They have been subjected to careful purification so that the addition of the scavenger does not result in an unacceptable deterioration of the electrical properties of the final impregnant. Measurements of the electrical properties of diluted samples were made by Monsanto Organic Research Department and gave the following results:

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Sample	Dissipation factor at 100° C, 60Hz (%)	Resistivity at 100° C, 500V, 1 min electrification (T ohm cm)
Aroclor 1242 only	0.036	131
Aroclor 1242 + 0.3% scavenger	0.83	26
Aroclor 1242 + 6.0% scavenger	4.7	2.0

Note:

a. Dielectric test cells used to measure the electrical properties of samples containing the scavenger are much more difficult to clean than cells used to measure contaminated Aroclor having similar electrical properties caused by impurties.

b. Physical properties of a 0.3% w/w mixture are essentially the same as those of Aroclor 1242.

3. APPLICATION

The published information indicates that a scavenger content of 0.3% w/w in Aroclor 1242 provides a satisfactory level of protection. This scavenger content can be obtained by diluting one part by weight of the 50% concentrate with 166 parts by weight of pure Aroclor 1242. Since each sample bottle contains about 250 gms of 50% concentrate, it is capable of providing about 40 kg. or 30 l. of Aroclor 1242 with a scavenger content of 0.3% w/w.

Since the scavenger has a higher vapour pressure than Aroclor 1242 (about 200 times greater at 20°) it can be depleted by vigourous prolonged degassing treatment. Careful consideration should therefore be given to the degassing conditions: as low a temperature and as short a time as possible will favour the maximum retention of the scavenger in the Aroclor 1242.

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Treatment with fullers' earth or activated alumina removes the scavenger from the Aroclor. It is therefore necessary to carry out any such purification of the Aroclor 1242 before the addition of the scavenger. When flood impregnation is employed and the excess Aroclor 1242 which has been contaminated during the impregnation must be re-purified for further use, this purification treatment should be as short and at as low a temperature as possible to conserve the scavenger content of the Aroclor 1242. After purification the scavenger content should be estimated by the method given below and the quantity of concentrate which must be added to restore the desired scavenger content should be calculated.

4. ANALYTICAL METHOD FOR THE ESTIMATION OF THE SCAVENGER CONTENT OF AROCLOR 1242 -

4.1 General

Since the scavenger can be depleted by vacuum or earth treatment, it is necessary to have a readily available method of estimating the quantity present in the Aroclor 1242 at various stages of the impregnation process. The method given here is speedy and unlikely to be affected by the presence of the usual contaminants arising in capacitor impregnation plants.

4.2 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. (Reference 4).

4.3 Reagents

1) Glacial acetic acid.
2) Chloroform.
3) Perchloric acid solution - 0.1N in glacial acetic acid. (Standardize against potassium hydrogen phthalate).
4) Crystal violet 0,1% solution in glacial acetic acid.
5) Tetraethyl ammonium bromide solution - dissolve 100 g. in 400 ml. of glacial acetic acid.

4.4 Apparatus

1) 10 ml. buret
2) Usual laboratory glassware.

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4.5 Procedure

1) Weigh 2.5 to 3.0 g. of Aroclor 1242 to the nearest 0.05 g. into a 125 ml. erlenmeyer flask.

2) Add 10 ml. of chloroform, 40 ml. of glacial acetic acid and 10 ml. of the tetraethyl ammonium bromide solution and swirl to dissolve.

3) Add 1 drop of crystal violet indicator and titrate with 0.1 N perchloric acid to the greatest colour change (violet to green-blue).

4.6 Calculation

$$\text{Scavenger content (\%)} = \frac{7.01 \times T \times N}{W}$$

Where T = titre of perchloric acid (ml.)
N = normality of perchloric acid
W = weight of sample (g.)

4.7 Additional Notes

1) The titrant is very stable and does not require frequent restandardization.

2) No blank correction should be required if good quality reagents are used.

5. TOXICITY AND HANDLING PRECAUTIONS

Detailed information concerning the effects of Unox 206 can be seen in Union Carbide technical information bulletin F 40132E, July 1, 1961. Prolonged and repeated contact with the concentrated product may cause delayed and serious injury to the skin. When handling it protective gloves and eye shields should be worn to avoid the possibility of skin contact or splashes in the eyes. The inhalation of vapours or mists should be avoided. In the event of it getting on the skin, wash thoroughly with plenty of soap and water. If it gets on the clothes or shoes remove them and wash them thoroughly before wearing them again.

In the diluted state this product can be safely handled following the normal precautions listed on page 21 of Monsanto Technical Service Bulletin "Aroclor for Capacitors". However, the possibility of this scavenger becoming concentrated in certain parts of the impregnation plant such as filter beds or water cooled baffles should not be overlooked.

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6. REFERENCES

1. General Electric Company (USA). BP No. 986 950 of 20.8.63.

2. Henry M. Stahr et al. USP No. 3 242 402 of 22.3.66.

3. J. Coquillion. CIGRE Paper No. 1967-68-2.

4. R.R. Jay. Anal. Chem. 36, 667 (1964).

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