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PROGRESS REPORT

TECHNICAL SERVICES DEPARTMENT

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JOB NO:- 82220/243

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DATE:- 7th September, 1973.

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TITLE: AROCLOR 1242 - LOW PENTA AND HEXA GRADE.

PERSONNEL: H. DISLEY, R. THOMAS (A.C. NETHERCOTT)

SUMMARY: This report summarises work to date on this job up to the production of a request for Capital Expenditure to install permanent manufacturing facilities.

R Thomas

R. THOMAS

T.S.D.

FT/VMP.

MONS 057055

DETAILS

Report No. 1, dated September 5th, 1972, reviewed progress since the first meeting on August 9th, 1972.

A plant trial was carried out in November 1972. Two batches were produced of Aroclor 1242 and samples were taken of these at different stages. The first batch was chlorinated at the normal rate, but the second batch was chlorinated at a constant rate throughout (500 lb. per hour).

These two batches were distilled on the plant and samples of the same material were also distilled in the laboratory.

A meeting was held on November 24th to discuss the results of the first two trial batches. It was decided that a further two batches would be produced on the plant but some changes in operating procedure were specified. These were:-

Batch 3

(a) Half the normal catalyst charge will be used, i.e. 1.1 lb. or ½ kg.

(b) The batch would be chlorinated at 500 lb./hour chlorine throughout.

Sampling would commence at a batch S.G. of 1.330 at 65°C. and be taken at .005 intervals to completion at normal S.G.

The batch would be segregated in the airblowers and still as for previous batches and would be distilled separately during a 1142 distillation run (emptying previous bottoms etc.). It would not be distilled as a first batch after distillation of other grades of Aroclor.

Batch 4

Normal catalyst level would be charged on this batch. The chlorination rate would be 500 lb./hour, but the chlorinator temperature to be reached and maintained throughout would be 125°C. Sampling would be as batch 3 to normal completion.

Batch temperature would then be raised to 150°C. and the batch completed to a higher aroclor batch to counter the possibility of production of lower stability material. This material would be distilled and treated normally once it is made into the higher aroclor.

Results are appended.

Batch No.	Sample	R.I. at 25°C.	S.G. 20/ 15.5°C.	Fixed Chlorine	[illegible]
1	S.G. 1.330				2.55
	S.G. 1.344				3.33
	S.G. 1.349				3.77
	Plant Distilled	1.6250	1.390	44.75	3.14
	Lab.Dist. (93%)	1.6242	1.385	43.51	2.62
2	S.G. 1.330				1.89
	S.G.1.334				2.12
	S.G. 1.343				3.13
	Plant Distilled	1.6248	1.387	43.94	3.53
	Lab. Dist. (94%)	1.6236	1.379	42.88	1.98
3	S.G. 1.330				2.22
	S.G. 1.336				2.55 *
	S.G. 1.339				2.77
	S.G. 1.342				2.[illegible]
	Lab.Dist. 1.330 (85%)	1.6222	1.361	41.57	[illegible] *
	Lab.Dist. 1.330 (96%)	1.6234	1.369	43.15	1.72 *
	Lab.Dist. 1.342 (85%)	1.6228	1.373	42.67	[illegible] *
	Lab.Dist. 1.342 (96%)	1.6238	1.379	44.36	2.16 *
	Plant Distilled. -	1.6235	1.378	43.45	2.41 *
4	S.G. 1.329				2.43 *
	S.G. 1.343				2.53 *
	Lab.Dist. 1.329 (86%)	1.6217	1.358	41.63	1.11 *
	Lab.Dist. 1.343 (85%)	1.6228	1.373	43.89	1.45 *
	Lab.Dist. 1.343 (95%)	1.6236	1.377	42.51	2.[illegible] *

MONS 057057

A meeting was held on December 20th 1972 and the following programme was agreed:-

1. The laboratory distillation on Batch 1 to 85% level would be repeated.

2. Laboratory distillation of a normal production batch of Aroclor 1242 would be carried out (Samples would be provided from the plant).

3. Plant distillation of current normal 1142 production would be carried out cutting and sampling at 85% level.

   It would be necessary to:-

(a) Ensure that the batch is not a first batch after a higher Aroclor.

(b) Calibrate the still level recorder to see whether this will be an effective measurement of the amount taken off.

(c) Send samples of the crude used to the laboratory.

(d) Have laboratory to distil to 85% level.

(e) Have plant to cut and sample at 85% level.

(f) Have laboratory to estimate the chlorine content of laboratory and plant produced material at 85% take off. XRF results would be compared with Parr bomb results.

4. Two normal chlorination batches would be run but with double the normal catalyst charge.

Results

Parr Bomb

Batch	% Hexa/Penta	Chlorine
3 (low S.G. Lab.Dist.)	0.96	40.19/40..
3 (high S.G. Lab.Dist.)	1.33	41.25/41.2[illegible]
4 (high S.G. Lab.Dist.)	1.45	41.38/41.6[illegible]

A hexa/penta level close to 1% could be obtained from material having an acceptable chlorine level (40.3% plus).

Sample	Distillation	% Hexa/ Penta	% Chlorine (Par
Special Batch 1 S.G. 1.344 (Crude)	Lab. to 85%	1.45	41.35/41.[illegible]
Routine Production 1242, S.G. 1.344 (Crude)	Lab. to 85%	1.55	41.77/42.00
Routine Production 1242 Plant Batch 23.	Plant to 85%	1.64	40.8/40.9
Routine Production 1242 Plant Batch 23.	Lab. to 85%	1.76	41.68/41.80
Routine Production 1242 Plant Batch 12.	Plant to 83%	1.34	40.85/40.85

Conclusions

1. To achieve 1% Hexa/Penta levels, plant chlorination conditions will have to be modified in line with work done on batches 2, 3 and 4. Such low chlorination rates may not be necessary.

2. Simple 85% distillation of routine 1242 will not do much better than 1.5% Hexa/Penta.

3. A satisfactory level of chlorine, i.e. greater than 40.5% can be achieved with 85% distillation level.

Modified Aroclor 1242 (1342)

	Plant Dist. Batch 12 (83%)	Plant Dist. Batch 23 (85%)
Power Factor at 100°C.	0.0144	0.0127
Volume Resistivity at 100°C. (ohms/cm.)	4.1×10^{12}	12.4×10^{12}
Dielectric Constant @ 100°C.	4.98	4.96
Hydrolysis Stability (ppm Cl)	0.32	0.28
Thermal Chemical Chlorides (ppm Cl)	0.28	0.26

Both of these samples are within the 1242 specification except for the power factor, which is slightly high. As these samples were not treated with porocel this is to be expected.

A Tentative Process Amendment was produced to cover the operations involved in the production of Aroclor 1342 (No. 1242/73/1). This was produced by A.H. Vodden in May 1973.

Estimates were produced for the Trichlorobenzene Storage System in mid-June.

Estimates for modifications for production of Aroclor 1342 were also produced in mid-June.

A Capital Appropriate Request for provision of facilities for the production of Aroclor 1342 was prepared and submitted for approval in August.

The method of cutting to 85% on the distillation of crude Aroclor 1142 was decided on because it was preferable from a cost point of view to do this rather than chlorinate at a lower rate, which could also produce a less stable product.

A statement explaining the need for this new product, and a description of the new process is appended.

Aroclor 1342

Polychlorinated biphenyls containing five or more chlorine atoms per molecule are the persistent components in the environment.

A limit of 3% penta/hexa content is proposed within the O.E.C.D. countries for capacitor askarels and Monsanto have set a control limit of 2%. Liquid Aroclors have already been withdrawn from 'open system' applications. Use of these Aroclors which continue to be sold is restricted to 'closed system' applications such as transformer fluids and capacitor application. Although capacitor application is a 'closed system' with all capacitor sealed for a long life at manufacture, the possibility of leakage arises when the components are eventually scrapped. To guard against accumulation in the environment a dielectric fluid with the minimum persistence is therefore necessary.

A product, meeting a specification of 2% maximum of persistent penta/hexa chlorobiphenyls has been made at Newport. This can be produced using existing facilities with a minimum capital expenditure on extra equipment.

New Process Description

Biphenyl is chlorinated to the normal crude Aroclor 1142 end point. This is airblown and distilled over lime but only 85% of the batch is taken off as distillate instead of the usual 98% of current Aroclor 1242. The 15% residue in the still, called undistilled residues is accumulated, further distilled to remove lime and then further chlorinated to a higher Aroclor.

Intermediate storage is needed to hold the new product,so use will be made of the present trichlorbenzene storage. An alternative storage vessel for trichlorbenzene will be needed and there isa redundant vessel near the plant that can be used for this.

Aroclor 1342 will be pumped through the normal 1242 porocel treatment system into existing storages.