Monsanto

A-4

FROM (NAME & LOCATION): R. W. Weiss - Research Center

DATE: December 5, 1969

cc: Q. E. Thompson QTHOM
L. R. Stark LSTAR
J. F. Herber/JDS JHERB

SUBJECT:

REFERENCE:

TO: W. R. Richard - WRICH

Bill:

I revised the cost estimate for Bromo Aroclor from June 23, 1969.

This cost estimate was based on preparation of Bromo Aroclors by cohalogenation of Aroclor in batches utilizing current production facilities. Annual volume was 10M pounds. No bromine loss occurs in cohalogenation, equation (1), versus direct bromination, equation (2).

$$ArH + Cl + Br \longrightarrow ArBr + HCl \quad (1)$$

$$ArH + Br_2 \longrightarrow ArBr + HBr \quad (2)$$

For reasons discussed in the Monthly Summary, September 1968, i.e. bromine loss at high temperatures, corrosion at low temperature and increased time cycles, I feel that the assumption has become invalid.

The process for Bromo Aroclor production is revised as outlined in the Suggested Procedure P-1540 from October 20, 1969. To obtain complete utilization of bromine a recovery operation is necessary as in equation 3 and 4

$$2\,HBr + Ca(OH)_2 \longrightarrow CaBr_2 + 2\,H_2O \quad (3)$$

$$CaBr_2 + Cl_2 \longrightarrow Br_2 + CaCl_2 \quad (4)$$

Literature data and Monsanto work indicate that this is the best solution for bromine recovery and up to 99% bromine can be reclaimed. There are other ways, however, for recovery as:

a) high purity aqueous hydrobromic acid,

b) electrolysis - probably from KBr rather than $CaBr_2$,

c) returning the calcium bromide brine to an outside bromine supplier for credit.

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As you suggested, I calculated the following manufacturing costs for direct bromination of Aroclor (equation 2) assuming that all HBr is sacrificed. This gives a cost ceiling from which credit for bromine recovery must be subtracted.

Manufacturing cost for Bromo Aroclor by direct bromination with no HBr recovery:

I On basis of June 23 cost estimate:

The conversion factor of 4.5 for replaced chlorine is to be doubled to 9 since half the bromine is lost.

Raw Material and Total Manufacturing cost for example B: Bromo Aroclor 1242 produced from Aroclor 1232 will read as follows in ¢/lb:

	Aroclor 1242	Bromo Aroclor 1242	
		Cohalogenation	Direct Bromination (
Raw Matl. Cost	5.06	--	No HBr recov
Increment Cl	2.25	--	--
Others	2.81	2.81	2.81
Remaining Cl 2/3	1.50	1.50	1.50
Replaced Cl 1/3	0.75 x 4.5	3.37 x 9	6.74
Oxidizing Cl 1/3 x 1/4	--	0.18	--
Raw Matl Cost	5.06	7.86	11.05
Conversion Cost	1.79	1.79	1.79
Total Mfg. Cost	6.85	9.65	12.84
Increase over Aroclor	0	2.8	5.99

II Raw Material cost from Suggested Procedure P-1540 per 100 lb Bromo Aroclor 1242(X)

Aroclor 1232	86.6 lb	¢/lb 6.85	602
Bromine	31.1	16	497
Fe powder	0.04	100	4
$AlCl_3$	0.5	15.5	8
$Ca(OH)_2$	1.6	1	1
			11.12 ¢ per lb.

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Credit for bromine recovery, Raw Matl. cost:

Bromine out	14.8 (95%)	¢/lb	16	236
Chlorine in	6.9		2	14
$Ca(OH)_2$ in	7.2		1	7
Bromine credit:				2.15 ¢ per lb

(X) with no bromine recovery from HBr.

Conclusion: Raw material cost for production of Bromo Aroclor 1242 calculated by both methods in ¢ per pound:

a.	Conversion from Aroclor production	11.05
b.	Suggested Procedure P-1540 match rather well. Corresponding cost for Aroclor 1242	11.12 5.06
	Credit for bromine recovery based on P-1540 is	2.15

The Raw Material cost of Bromo Aroclor 1242 will increase over Aroclor 1242:

without bromine recovery to ¢ 5.99/6.06 per lb
with credit for Br recovery to ¢ 3.84/3.91 per lb.

R. W. Weiss

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