MONSANTO CHEMICAL COMPANY
At Dayton, Ohio

cc H. L. Hubbard-Res. 2-St.
R. L. Jenkins
R. A. Ruehrwein

Date November 11, 1954

To A. M. Ellenburg
At ST. LOUIS

Reference Your letter Nov. 2, 195[illegible]

Subject AROCLOR STABILITY

We are happy to say that the Aroclor report has been written and will be issued as soon as mimeographing is completed. Copies are being sent to you and H. L. Hubbard. Since it will be a few days before you receive your copies, we can summarize some of our conclusions.

The principle conclusion is that the loss of electrical resistivity is caused by the degradation of the chlorinated biphenyl molecule itself arising from the homolytic cleavage of a carbon-chlorine bond to give a free chlorine atom and an aromatic or aromatic substituted free radical. The free chlorine atom may either extract a hydrogen atom to produce hydrogen chloride or add onto the aromatic ring to produce an alicyclic unsaturated complex. Subsequent reactions can produce a compound bearing a chlorine on an aliphatic carbon which is capable of resonance stabilization and the formation of stable carbonium ions. We found that increased chlorination reduces the possibility of resonance stabilization by blocking the ortho-position. Thus the higher degree of chlorination, the more stable is the Aroclor to photo or thermal degradation. Aroclor 1254 is much more stable than 1242.

From the proposed mechanism of degradation, the loss of electrical resistivity is caused by the formation of (1) hydrogen chloride and (2) a chlorine addition compound which is capable of forming stable carbonium ions. Both of these products arise from the reactions involving the chlorine atom. Stabilizers must react with the chlorine atoms as they are formed if the resistivity level is to be maintained. Stabilizers which act as hydrogen chloride scavengers alone can only remove a small portion of the conducting material.

Since Aroclors will degrade photochemically regardless of purity and no purification process will eliminate this instability, the addition of stabilizers remains as the only solution. We found that tetraethyl lead was the most efficient stabilizer, however, this compound produced a slight turbidity during the Aroclor degradation. We attributed this haze to be due to the insolubility of the triethyl lead chloride formed after reaction with chlorine atoms. We are looking into the possibility of other lead compounds whose chloride should be more soluble in Aroclor. We have been in contact with the Ethyl Corp. for suitable lead compounds for trial.

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We would like to study more quantitatively the degradation process to learn what wave lengths are effective and the quantum yields. These studies could be done with chlorobenzene as a prototype.

We would appreciate any comments you may have on the report.

Best regards,

A. S. Kenyon

jgs