Monsanto

FROM (NAME & LOCATION) J.H. MAINPRIZE - RUABON.

DATE : 20th March, 1970.

SUBJECT : AROCLOR BIODEGRADATION.

REFERENCE : JHM/bjo'g.

TO : W.R. RICHARDS - ST. LOUIS.

cc: R.A. Baxter, Ruabon.
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This memo summarises the more recent results of our lab investigations into the biodegradability of halogenated biphenyls.

In all cases the inoculum has consisted of a pure culture of biphenyl degrading organism provided by Prof. W.C. Evans of Bangor University, and grown in our own lab. on biphenyl as sole carbon source.

Experimental procedures were as described in the review report of earlier work i.e. agitation of the halogeno-biphenyl in contact with inoculated media both in the presence and absence of added biphenyl. Control flasks were included to which mercuric chloride was added as inhibitor at a concentration of 100ppm; no significant losses of halogeno biphenyls were observed in the controls confirming that loss in the culture flasks was attributable to biodegradation.

A. Aroclor 1242.

Initial concentration 5ppm.

| | Sample | % Recovered after shaking for 7 days | 19 days |
|---|---|---|---|
| Peak 1 | A | 48 | Nil |
| | B | Nil | Nil |
| | C | Nil | 12 |
| Peak 2 | A | 86 | 68 |
| | B | 66 | 46 |
| | C | - | 36 |
| Peak 3 | A | 74 | 66 |
| | B | 64 | 46 |
| | C | - | 50 |
| Peak 4 | A | 78 | 60 |
| | B | 42 | 34 |
| | C | - | 22 |

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A 1242 + inoculum + media.

B 1242 + inoculum + media + 50ppm. biphenyl.

C 1242 + inoculum + media + 50 ppm. biphenyl initially and again after 7 days.

The results show significant reductions in all measured peaks, degradation again being accelerated in the presence of biphenyl.

B. Aroclor 1142 and 1130. Sample Nos OR 150618 (Blends #1 and #3)

These samples are blends of distillation cuts from Aroclor 1142 prepared by R. Munch. The chromatogram peaks (1 to 4) are identical with those measured in the 1242 work. Initial concentrations 5 ppm. shaken for 8 days.

| Sample | % recovered. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Aroclor 1142 | | | | Aroclor 1130 | | | |
| | Peak 1 | Peak 2 | Peak 3 | Peak 4 | Peak 1 | Peak 2 | Peak 3 | Peak 4 |
| Aroclor + inoculum + Biphenyl | Nil | 10 | 33 | 1 | Nil | 10 | 31 | 16 |

Owing to carry over of biphenyl with the inoculum from the stock culture no meaningful results are as yet available for degradation of the Aroclors when present as sole carbon sources. The above results show substantially complete loss of peak 1, 2 and 4 with an approximately 70% reduction in the more resistant peak 3.

C. Arobrom 1228. (Sample No. OR 116157) Initial concentration 5ppm.

Evidence of degradation of this material was based on the measurement of two predominant peaks in the chromatogram. Complete removal of these peaks occurred in the presence of biphenyl after shaking for 8 days. Again because of contaminate inocula no results are available for degration in the absence of biphenyl (the sampl itself also contains 31% biphenyl.) At this time the identity of the materials represented by the two peaks is not known but from the given composition are probabl mono bromo-biphenyls.

D. Sample No. OR 16884 (ex R.W. Weiss) Mixture of 82% 2,4' chloro bromo biphenyl and 18% 2,2' chloro bromo-biphenyl.

Initial concentration 5 ppm. shaken for 8 days.

| Sample | % Recovered | |
|---|---|---|
| | Peak 1 (2,2') | Peak 2 (2,4') |
| + inoculum + media | 62 | Nil |
| + inoculum + media + biphenyl | Nil | Nil |

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E. Other single isomers.

No measurable degradation was detected of 2,2',4,6 or 2,2' 4,4' tetra-chloro-biphenyls. Evidence for degradation of 4,4' chloro-bromo biphenyl (sample No. OR 16862) was probably not significant at 12%, this figure being obtained in both the presence and absence of biphenyl.

F. Mixture of 2,3,2' and 2,3,4' trichlor biphenyls.

This sample was previously examined for degradation using a mixed activated sludge culture and evidence obtained of the degradability of 2,3,4' isomer only. Using the pure culture as inoculum substantially complete degradation of both isomers has been achieved in the presence and absence of biphenyl.

The above results generally indicate the pure culture to have a greater activity than the preadapted activated sludge used hitherto. From the evidence available to date inferences have been drawn on the influence of the site of chlorination on degradability. We hope to confirm these observations by synthesisi pure isomers which, if our theorising is correct, should be degradable.

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