

US EPA ARCHIVE DOCUMENT

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INTEGRATED SUMMARY OF SOIL METABOLISM STUDIES

CHEMICAL: Metolachlor
FORMULATION: ¹⁴C-Radiolabeled Metolachlor
CITATIONS:

1. Kaiser, F. E. (1974) Soil Degradation Study of CIBA-GEIGY ¹⁴C-CGA-24705 Analytical Biochemistry Labs., Inc. September 6, 1974.
2. Dupre, G.D. (1974) Abbreviated Metabolism of ¹⁴C-CGA-24705 in Silt Loam Under Greenhouse Conditions: Report No. 73019-3. Received September 26, 1974 under 5G1553 (Unpublished report prepared by Bio/dynamics Inc. for CIBA-GEIGY Corporation, Greensboro, North Carolina; CDL: 94222-B).
3. Sumner, D.D.; Cassidy, J.E. (1975) The Degradation of CGA-24705 in a Field Soil: CAAC-75022. Received March 26, 1975 under 5F1606. (Unpublished report prepared by CIBA-GEIGY, Corp., Greensboro, NC. CDL: 94385-N).
4. Sumner, D.D.; Cassidy, J.E. (1974) The Uptake and Distribution of ¹⁴C-CGA-24705 in Field Grown Corn: GAAC-74022. Received March 26, 1975 under 5F1606. (Unpublished report prepared by CIBA-GEIGY Corp., Greensboro, N. C.; CDL:94385-C).

TRADE SECRET CLAIM: Yes
REASON FOR REVIEW: Generic Standard for Metolachlor
REVIEWED BY: Carroll W. Collier, C&E Division, OPP, EPA
TEST TYPE: Summary of all Soil Metabolism Studies

Minisummary of Individual Studies

1. Kaiser, F.E. (1974)

A laboratory study using ^{14}C labeled metolachlor (position of label unknown) on a sandy loam soil under aerobic and anaerobic condition showed minimal decomposition and/or binding over a 64 day period. At a maximum, a 10% conversion to other unidentified metabolites occurred and essentially 100% of the total initially applied ^{14}C metolachlor could be extracted from the soil by MeOH/H₂O. A retrospective review of this study, after considering the following three additional studies, suggests serious experimental difficulties. When compared with the other three cited studies.

2. CDL:9422-B

This laboratory study used ring labeled ^{14}C metolachlor on silt loam soil under both aerobic and anaerobic conditions. Experimental details were well defined and the results appear to be reliable. The study indicates that under non-leaching conditions, the quality and nature of degradation products under either aerobic (90 days) or anaerobic (30 days) followed by 60 additional days under anaerobic conditions have certain similarities. Non polar, solvent extractable, residues represented 42% and 46% for the anaerobic and aerobic studies respectively at weeks and non-extractable "bound" residues 53% and 40% respectively at the same time period. Since no attempt was made to identify the nature of the non polar, polar, and bound products, little information of utility in making a registration decision was obtained.

3. CDL:94385-C

This was a greenhouse study using ^{14}C ring labeled metolachlor in the presence of growing corn. The study shows loss of parent pesticide by metabolism but the exact rate of the loss and the nature of the products involved in confounded by a concomitant leaching of unidentified products into the lower soil profile. Large quantities of non-extractable residues are formed in the remaining unleached material in upper soil horizon. Up to 78.5% of the total radioactivity which remains behind in the 0-3 inch treated soil layer was found to be unextractable at the 16th week after initiation of the study. In addition, this upper soil layer contained 10% of an "unknown extractable" at the end of this same time period whereas the parent metolachlor was substantially reduced. No attempt was made to identify any of the products of degradation.

4. CDL:94385-N

This field study, using a silt loam soil treated at 2 lbs/acre with ¹⁴C ring labeled metolachlor confirmed the formation of substantial quantities of unextractables as in the previous study and suggested that with time a steady state is obtained. However, fractionation of the bound residues suggested that between the 16th and 52nd week, post-treatment the percentage of products in the fulvic acid and humic acid fractions decreased the aqueous and mineral fraction increased by a corresponding amount. This suggests that the degradation products of metolachlor are not incorporated into the soil organic matrix and therefore, may be releaseable, even though bound, over a long period of time. This in turn could signify appearance of residues in crops for multiple growing seasons. None of the residues, either the bound or the unbound portions, excepting for metolachlor itself, have been identified. With time, most of the extractable organic soluble residues were found to change from metolachlor per se to other products. On the basis of the above, it can be concluded that we know almost nothing about the nature or the soil metabolites of metolachlor under either aerobic or anaerobic conditions. Furthermore, since the products of leaching have not been identified it is impossible to estimate the relationship between losses of parent product by this mechanism vs. conversion to degradation products either polar or non-polar or bound and unbound.

Without specific identification of individual degradation products it must be concluded that insufficient information is available from any or all of the above mentioned studies to make an intelligent decision with regard to registration. The absolute amount of radioactivity in the 0-3 inch layer steadily declined over a one year period from 1.29 ppm at 0 weeks after treatment to 0.22 ppm at the end of one year. From the 16th week of the test through the 52nd week, about 80% of the total remaining residues remained as unextractable.

Composite Summary

Under leaching conditions, a continuous loss of total residues can be expected to occur in the upper 3 inch soil horizon. All movement of pesticide related products is downward with essentially no losses due to volatilization. The nature of the downward moving product has not been established and it is not known whether this substance is parent metolachlor or a metabolic product(s). With time, the nature of the remaining product in the upper 3 inch soil layer will change with bound residues increasing until a steady state equilibrium is reached with a ratio of non-extractables to extractables about 80/20 in favor of the bound residues. The preponderant species in the unextractable portion were found to be acidic in nature when subjected to ion exchange fractionation. No identification was made of any metabolite in any study under either aerobic or anaerobic conditions.