

not reversed, is very similar to a photograph with silver salts, the action involved is, of course, quite different. First it must be emphasized that it is not due to the iron content of the haemoglobin or to a bleaching process. Indeed, the haemoglobin contributes very little or not at all to the process, so that a plate made of haemoglobin and agar is completely ineffective. What, in fact, causes the phenomenon described is a destruction of the membrane and/or stroma of a varied number of red cells according to the amount of light they are exposed to, and diffusion of the haemoglobin so liberated over the whole plate.

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¹ Meyerstein, W., *J. Physiol.*, **99**, 510 (1941).

Sorption of Solid Insecticides by Dried Mud

In the course of experiments on the persistence of deposits from aqueous suspensions of different particle sizes of volatile insecticides, it has been found that the residual toxicity of particles of any one size is influenced considerably by the type of material to which they are applied.

Most striking results have been obtained on mud blocks made from 'murrum', a lateritic ironstone, used in the construction of walls of houses in Uganda. Crystals of all insecticides used rapidly disappear from the surface of these blocks when they are kept at 78° F. (25° C.), and even those of DDT, which is usually regarded as a contact insecticide with a long residual life, are no longer visible after only a few days. As would be expected, the larger the particle the longer it persists; but for any given size-range the insecticides used can be arranged in order of increasing persistence, thus: 'Aldrin', gamma isomer of benzene hexachloride, 'Dieldrin' and DDT.

When DDT and 'Dieldrin' crystals are no longer visible on the surface, the mud blocks lose their toxicity to mosquitoes (*Aedes aegypti*, L.) exposed to them for long contact periods. On the other hand, blocks treated with the gamma isomer of benzene hexachloride or with 'Aldrin' continue to be effective for a considerable time, after the disappearance of the crystals, against mosquitoes resting on the surface.

Chemical tests have shown that with 10–20 micron particles of DDT and gamma-benzene hexachloride, almost the whole of the dosage applied can be recovered from the interior of the block. At a dosage of 25 mgm. of these particles per sq. ft., almost all the DDT is sorbed in the top tenth of an inch, suggesting that considerably higher dosages could be applied before the block becomes saturated. Dosages of 10–20 micron gamma-benzene hexachloride particles of the order of 200 mgm. per sq. ft. do, in fact, disappear from the surface in 24 hr. at 78° F. The rate of disappearance from the surface decreases as the relative humidity of the atmosphere increases. This may be explained by competition between water vapour and the insecticide vapour for the adsorbing surface. An interesting effect observed is that under absolutely dry conditions the sorbed DDT is catalytically decomposed to the ethylene derivative, the soil used having a high iron content. This again suggests that the insecticide is present in the block as a highly active surface layer.

The gamma isomer of benzene hexachloride and 'Aldrin' have, in contrast to DDT and 'Dieldrin', a

marked fumigant action against *A. aegypti*, and there is ample evidence to show that the residual toxicity after the disappearance of crystals from the surface of blocks treated with these insecticides is due to the fumigant effect from the material inside the block. Desorption of the volatile insecticides takes several months for completion as compared with a few hours for the sorption process.

Crystals of gamma-benzene hexachloride persist for a much longer time on non-absorbent materials, such as glass and metal plates, than on mud blocks; but toxicity is completely lost as soon as the crystals disappear from the surface. Sorption of gamma-benzene hexachloride occurs on such materials as plaster fibreboard and unpainted wood, but to a much less extent than on mud blocks.

Commercial wettable powders and oil-bound suspensions of these insecticides behave in the same way as the pure materials on Uganda mud. Similar results are obtained with soil from Taveta in Kenya and with Oxford, Weald and Gault clays from Britain. It is intended to test other soils used in the construction of houses in other tropical countries as soon as the materials are available.

These results are of obvious practical importance in the control of adult mosquitoes in houses the walls of which are constructed of dried mud. The difference in effectiveness of DDT and benzene hexachloride wettable powders against *Anopheles gambiae*, Giles, in houses with mud walls in Africa may be accounted for partly, at least, by the rapid sorption of both insecticides into the wall, resulting in one case in a complete loss of toxicity and in the other a persistent fumigant effect. Residual effects obtained with DDT wettable powders in houses of this type may be due only to the deposit on the roof. Variations in the persistence of insecticides on different types of material may help to explain the conflicting results reported in field-trials against malaria vectors in different parts of the world. Sorption of insecticides may be of significance in treatments against soil insects and in soil fumigation.

It is intended to publish a full report on these experiments.

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DDT and BHC as Residual Insecticides in Malaya

AN earlier report¹ described the effects of the residual insecticides DDT and BHC ('Gammexane') on *Anopheles maculatus* and *Culex fatigans* entering experimental huts fitted with window traps, following the method employed by Thomson². *A. maculatus* was killed by wettable powders of both DDT (200 mgm./sq. ft.) and BHC (40 mgm. gamma isomer/sq. ft.) for at least twelve weeks after application. DDT killed few *C. fatigans*, the majority being irritated and driven out of the hut without feeding; BHC had the same effect but also killed large numbers for several weeks. Owing to reduced numbers of mosquitoes entering the huts over the later weeks of the experiment, no information was obtained on how long these doses of DDT and BHC would continue to kill *A. maculatus*. For this reason the experi-