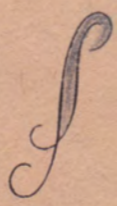
Suspensibility of Water-dispersible Powder Concentrates used for Malaria House-spraying Programs in Indonesia

By:
Donald R. Johnson.



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Suspensibility of Water-dispersible Powder Concentrates used for Malaria House-spraying Programs in Indonesia. [1])

By: Donald R. Johnson. [2])

The suspensibility properties of water-dispersible powder concentrates (wettable powder insecticides) in some shipments received by the Malaria Section of the Ministry of Health in Indonesia have been extremely unsatisfactory. These materials may have been (1) insufficiently pulverized by the producer, (2) unsuitable formulations (such as insufficient amount of wetting agent) may have been used, or else (3) the wettable powders deteriorated in some manner before they were utilized in insect control campaigns. Any of these conditions may result in poor coverage of the house walls sprayed, and possible erosion or clogging of sprayer parts. When an area is improperly sprayed, an entire malaria control campaign may fail. Materials, manpower, time, and money are uselessly expended when the insecticides are not in the proper physical condition. An efficient malaria control program is being carried out in Indonesia, as described by Soeparmo and Stoker, principally with modern insecticides, and it is vital that these materials be the best that are available. If unsatisfactory products continue to be shipped to Indonesia, the malaria control program with insecticides may be doomed to failure because such materials cannot always be made usable. Not only will malaria control fail, but public antagonism will be directed against the entire future program. Therefore, it is imperative that the specifications for the insecticides of choice be carefully chosen, particularly in regard to formulation, and the materials properly tested when received, before a control campaign is started.

The most commonly used chlorinated hydrocarbon insecticides, such as DDT (dichloro diphenyl trichloroethane), benzene hexachloride, and dieldrin, are insoluble in water. In order to use these materials in a water mixture, they usually are prepared either as an emulsion concentrate or as a water-dispersible powder concentrate. Formulations of the latter type are most commonly used in malaria control campaigns in Indonesia for residual house spraying operations. A concentrate of this type is prepared by grinding or pulverizing the insecticide, inert carrier, wetting agent, and other ingredients together into a fine powder suitable for mixing with water and using in a spray tank. If the particles are not pulverized sufficiently, the material will not remain in suspension in water. Similarly, if the wetting agent is not satisfactory or has deteriorated, the material may not stay in suspension in water. The ability of a wettable powder to remain in suspension in water and the resulting settling rate is commonly referred to as the „suspensibility" of the product.

Malaria is carried only by the females of certain species of *Anopheles* mosquitoes which usually can be controlled by DDT or other insecticides. The mosquito, in order to become infective, must first suck blood from a person who has the malaria parasites in his bloodstream. There is then an incubation period which may vary from 10-21 or more days depending upon

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[1]) The opinions or conclusions contained herein are those of the author and are not to be construed as official or reflecting the views of any government or other agency. Manuscript submitted 19 May, 1953.

[2]) Entomologist, Technical Assistant, United States Public Health Service, assigned to Malaria Section of Indonesian Ministry of Health, Djakarta, by U.S. Technical Cooperation Administration.

various conditions, during which time the parasite develops inside the mosquito body. At the completion of this incubation period, the mosquito is capable of transmitting malaria parasites to other persons. If the mosquito can be destroyed before the completion of the incubation period, no malaria parasites will be transmitted to other persons. Although it is wise to use a *combination* of various control measures for mosquitoes, only the adult control by spraying residual insecticides onto the walls of houses is referred to in this paper. The first spraying of this type was started in Indonesia in 1949, and up to the present time, no proven resistance of the *Anopheles* mosquitoes to DDT has been observed.

By spraying water mixtures of certain insecticides onto the inside wall surfaces of houses where the Indonesian species of *Anopheles* mosquito adults often rest, especially after blood meals, the mosquitoes usually will contact the insecticides and die, provided that the spraying operations have been properly executed with good quality products [3]). The death of infected mosquitoes breaks the malaria cycle by preventing transmission of the disease to non-infected persons. It is not unusual for one spraying of 40 milliliters of 5% DDT per square meter (= 2 grams of technical DDT/m^2) to be lethal to mosquitoes for as long as one year. However, if the insecticide is of unsatisfactory quality, the malaria control results can be very poor, because of the low mortality of the *Anopheles* mosquitoes.

In order to accomplish satisfactory coverage of the wall surfaces, the wettable powder insecticide must have good suspensibility properties. If the suspensibility properties are poor, the wettable powder will settle rapidly to the bottom of the sprayer tank. The discharge tube inside the sprayer leads from the bottom of the tank to the spray hose. The rapidly settling material therefore will be discharged with the first spray to leave the tank, resulting in a heavy concentration of insecticide on the surfaces sprayed first and much lesser amounts on the surfaces sprayed later.

Of the three previously mentioned causes for the unsatisfactory wettable powders (insufficient pulverization, unsuitable formulations, or deterioration), the deterioration factor has been the most troublesome, although the other two factors have also caused difficulties. Some of these difficulties have already been published as a communication from the writer to the editor of the U.S. publication, „Agricultural Chemicals". (This communication referred to wettable powders which were satisfactory in regard to suspensibility when received, but lost their desirable suspensibility after being stored in warehouses in Indonesia.) In certain shipments of DDT 75% wettable powder received in Indonesia, part of the material within a shipment has had good suspensibility properties and the remainder has been of unsatisfactory quality at the time of unloading from the ships. A possible explanation is that part of the material may have been exposed to unusually high temperatures or high pressures in transit from the country of origin to Indonesia, resulting in the deterioration of some ingredients. The high temperatures could be a result of stowage conditions aboard ships and perhaps could have been prevented by stowing the insecticides in cool sections of the ships. The high pressures could have been prevented if the insecticides had been

[3]) Water-dispersible powder concentrates are preferred in Indonesia because they (1) are much more cheaply and easily transported than a liquid (which usually has a lower concentration of the active ingredients), (2) are less toxic to humans, and (3) are not readily absorbed into the porous walls of the houses, thereby losing the effectiveness of the insecticide which must be on the surface where the mosquitoes may contact the material. Also the cost per kilogram of the actual active ingredient usually is lower when purchased as a water dispersible powder concentrate.

packed in suitable export drums rather than bags (in most instances, the unsatisfactory DDT was packed in paper bags). When a number of bags of insecticide are piled on top of each other, high pressures are exerted, especially on the lower bags. When in drums, outside pressure is prevented. High temperatures and pressures are factors taken into consideration in testing the chemical and physical requirements in specifications of water-dispersible powder concentrates as prepared by the Expert Committee on Insecticides of the World Health Organization.

The unsatisfactory suspensibility of finely ground wettable powder insecticides probably was caused by deteriorated or insufficient amounts of wetting agent and resulted in the agglomeration or flocculation of the wettable powder particles when added to water. These materials had been finely pulverized but the wetting agents did not function properly. When added to water, the wettable powder particles agglomerated into large clumps and gave the appearance of curdled milk. These clumps of particles did not remain in suspension but quickly settled to the bottom of the container. On the other hand, if the wettable powder had not been pulverized finely by the manufacturer and the wettable powder therefore was too coarse, then too the particles would not remain in suspension. The tests described below were developed during the studies of wettable powder insecticides which were made by the writer at the Malaria Section headquarters in Djakarta. When working in a spraying area where laboratory facilities are not available, it is often impossible to make complicated physical property tests because of lack of time, equipment, and trained personnel. The simple tests described here will enable persons concerned with insecticidal spraying to determine whether or not the materials available for a residual spraying campaign are in the proper physical condition. Furthermore, these tests dramatically enable any observer to see what actually happens to a water-dispersible powder when it is sprayed in field operations.

Preliminary Tests.

(a) In order to learn whether or not a material agglomerates, mix a few grams (use approximate concentration as should be used in field) of the wettable powder with water in a small glass container. After vigorous shaking, observe the material for several minutes. Flocculation is usually visible as soon as the agitation ceases. Large clumps are readily discernible and can be seen settling to the bottom, or sometimes rising to the surface if air bubbles are entrapped. If the material is too coarse, the rapidity of settling of the wettable powder is apparent, but is not necessarily in an agglomerating condition. Instead, the individual particles quickly build up a compact residue on the bottom.

(b) If a more exact preliminary test is desirable, use graduated glass cylinders and mix the material with water to obtain the precise percentage of insecticide concentration as is used in actual spraying operations. After thorough mixing with the water, observe the settling rates. The writer prefers to record the volume of sediment continuously during a two hour period (at the end of 0.5, 1, 2, 3, 4, 5, 10, 15, 30, 60, and 120 minutes). The settling rates are often very useful, particularly when comparing one particular formulation with another. For instance, "X" Brand or sample of DDT 75% wettable powder may settle much more slowly from the water suspension than "Y" Brand or sample of DDT 75% wettable powder. However, the addition of a wetting agent to "Y" may improve the suspensibility, and by repeating the test, the

possible improvement can be readily observed. Wetting agents are discussed in more detail below.

This test with glass cylinders is limited in usefulness, however. If some definite standards of rapidity of settling can be established, the test perhaps could be even more useful. On the other hand, the spraying test described in this paper would still be helpful to determine what actually happens to the wettable powder when used in a sprayer. The World Health Organization Expert Committee on Insecticides Fourth Report describes a related method of settling in glass cylinders for benzene hexachloride water-dispersible powder concentrates.

Some of the material from each shipment received in an area to be sprayed should be tested either by (a) or (b) above. It is suggested that samples from at least five or more bags or drums chosen at random be examined. As was previously mentioned, part of the shipment has sometimes proven to have good suspensibility, whereas the remainder was in an agglomerating condition. In a case of this sort, it may be necessary to test every container by (a) above, to separate the satisfactory material from the agglomerating material. This can be done very rapidly at the time the containers are opened for distribution to the spray-crews.

Spraying Test.

The material tested in a bottle or glass cylinder is not subjected to the high pressures necessary inside a sprayer tank, and this pressure may have some influence on the behaviour of water-dispersible powder suspensibility properties when in actual use.

The spraying test (see *Illustration 1.)* is a supplemental method to show what happens during spraying operations because discharge rates of the water-dispersible powder obtained during actual spraying operations can be readily observed. [4]) The spraying test is made as follows:

1. Obtain a number of uniform sized flat bottom glass bottles with an opening large enough to accommodate the nozzle of the sprayer. Empty quinine bottles may be used for this purpose, and are available in Indonesia.

2. Prepare a wettable powder-water mixture as follows :
   Weigh the amount of insecticide necessary to make one sprayer tank of mixture as is normally used in house spraying. Place the powder in a pail and pour in approximately one-half the required amount of water, stirring until the mixture is smooth. Allow mixture to remain in the pail for 10 minutes, mix again, and then pour through a fine wire sieve into the sprayer tank. Add the amount of water necessary to dilute to the proper concentration. Pump the sprayer to obtain 50-60 pounds (3 — 4 atmospheres) pressure per square inch (see directions which accompany sprayer.) With knapsack sprayers, continuous steady pumping is recommended.

[4]) This test as described is made with cylindrical Hudson compressed-air sprayers without agitators, but can be adapted for knapsack sprayers as well.

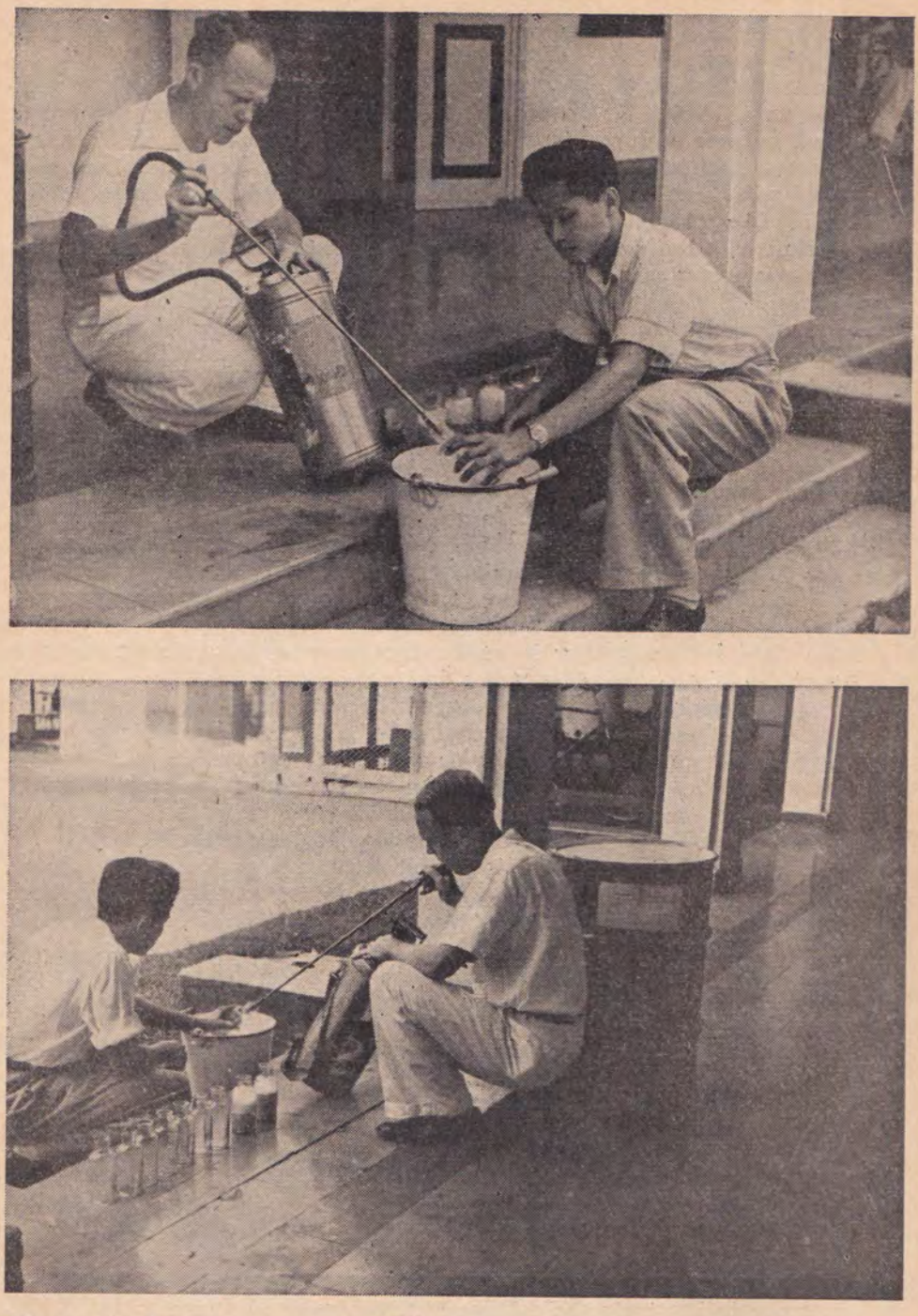

Illustration 1.

The spraying test for wettable powder insecticides requires only an insecticide sprayer, bottles, a pail, and two men. Notice that the spray tank is inclined in such a way that the opening of the discharge tube inside the tank is at the lowest position possible. This permits a maximum amount of the wettable powder to be discharged with the spray.

3. Agitate the sprayer thoroughly (10 complete inversions of tank) to obtain a suspension.
4. Open the discharge valve and direct the stream of spray into a pail. The valve should be left open during the entire test. Keep the sprayer tank inclined at approximately 60° so that the opening of the discharge tube at the bottom of the sprayer will be in a low location in the tank. This will permit a maximum amount of the sediment which settles inside the sprayer tank to be discharged with the spray. This position is similar to that in which a sprayer is carried when in actual use.
5. After one-half minute of spraying time, collect a sample of the liquid being discharged from the nozzle. (In a quinine bottle holding ± 300 ml., allow the bottle to fill to a depth of approximately 100 mm.).
6. Spraying is continued without interruption. After collecting the first sample, permit the spraying to continue into a pail and collect additional samples in additional bottles during each additional minute of spraying time. Each bottle should be numbered consecutively in order to indicate from which minute of spraying time the sample was collected.
7. After collecting the 3rd and 6th samples (therefore, after 3 and 6 minutes), pump the sprayer to maintain the pressure at approximately 50-60 pounds per square inch. Leave the discharge valve open during the pumping time also to facilitate ease of recording the time for sample collections. Additional shaking of the spray tank is not recommended, in order to keep the test uniform, and also because spray-crew men in the field seldom bother to shake the spray tanks after the tank is partially discharged, even when instructed to do so. (This paragraph does not apply to knapsack sprayers because pumping is continuous. However, the discharge valve should be left open the entire time with either a compressed-air sprayer or a knapsack sprayer.).
8. When the sprayer is empty, examine the bottom of the tank to determine if an excessive amount of sediment remains in the sprayer and take the nozzle apart to see if there is any clogging of the sieve.
9. Set the sample bottles aside to permit settling. If agglomeration occurs, the large clumps of particles can be seen falling rapidly to the bottom of the bottle or rising to the surface. If large amounts of the material rise to the surface, stir vigorously to dislodge entrapped air and permit settling. [5]) After 24 hours, record the *depth of the sediment on the bottom* (in millimeters), and also the *total depth of liquid plus sediment in the bottle.*
10. Calculate the depth of sediment in the bottle *on the basis of 100 millimeters total depth of liquid plus sediment* in the bottle, in order to have all figures on a comparative basis.
    Example: 21 mm. depth of DDT wettable powder sediment on bottom, 92 mm. total depth of liquid plus sediment in bottle. Divide 21 by 92, and multiply by 100. This equals 22.8, or in round figures, 23 mm. equals the corrected depth of the wettable powder sediment.

Typical Findings.

In order to illustrate the difference which may be found in DDT 75% water-dispersible powder samples, actual data from two different samples

[5]) This condition also may cause an unusually large amount of wettable powder to be discharged during the last minute of spraying time. A layer of floating material in the spray tank would be discharged particularly during the last few seconds of spraying time.

are presented below. Each sample was from a separate bag, but both were the same brand of DDT 75% water-dispersible powder and were from the same shipment. These tests were made within several weeks after the shipment was received in Djakarta. Sample "A" agglomerated but sample "B" did not.

When the spraying test procedure described above was used, the data shown in Table 1 were obtained.

Table 1.

Distribution of sediment obtained from two samples of DDT water-dispersible powder concentrate.

Minutes of Spraying Time	*Sample "A"* Depth of Sediment	Percentage above or below average	*Sample "B"* Depth of Sediment	Percentage above or below average
1	36 mm.	+ 71%	20 mm.	+ 18%
2	43	+ 105	22	+ 29
3	49	+ 133	20	+ 18
4	24	+ 14	18	+ 6
5	31	+ 48	18	+ 6
6	14	— 33	18	+ 6
7	11	— 48	17	± 0
8	6	— 71	15	— 12
9	5	— 76	13	— 24
10	6	— 71	10	— 41
11	2	— 90	—	—
Average	21 mm.		17 mm.	

When bar graphs are prepared using the data from Table 1, the results appear as in Figure 1.

Discussion.

The above figures readily demonstrate that there were large differences between the two samples. Sample "A" ranged from 2 mm. of sediment (90% less than the average) up to 49 mm. (133% more than the average). Sample "B" ranged from 10 to 22 mm. (41% less than average to 29% above the average). A perfect product, tested properly, theoretically would show results in which equal amounts of sediment would be present in each collection bottle. Results approaching perfection have been obtained with certain samples of both DDT and benzene hexachloride wettable powders, but most wettable powders received in Indonesia have not been of this type. However, even when satisfactory products are tested, there are usually variations during each minute of spraying time.

The writer has chosen the arbitrary figure of not more than 33% above or below the average as a standard of acceptability. Percentages can be easily determined from the average depth of sediment of all bottles in the test. The percentages above or below average are useful data to better determine the acceptability of a product. It must be assumed that the desirable amount of sediment to have in each bottle, is the average depth of sediments for all collections in any particular test.

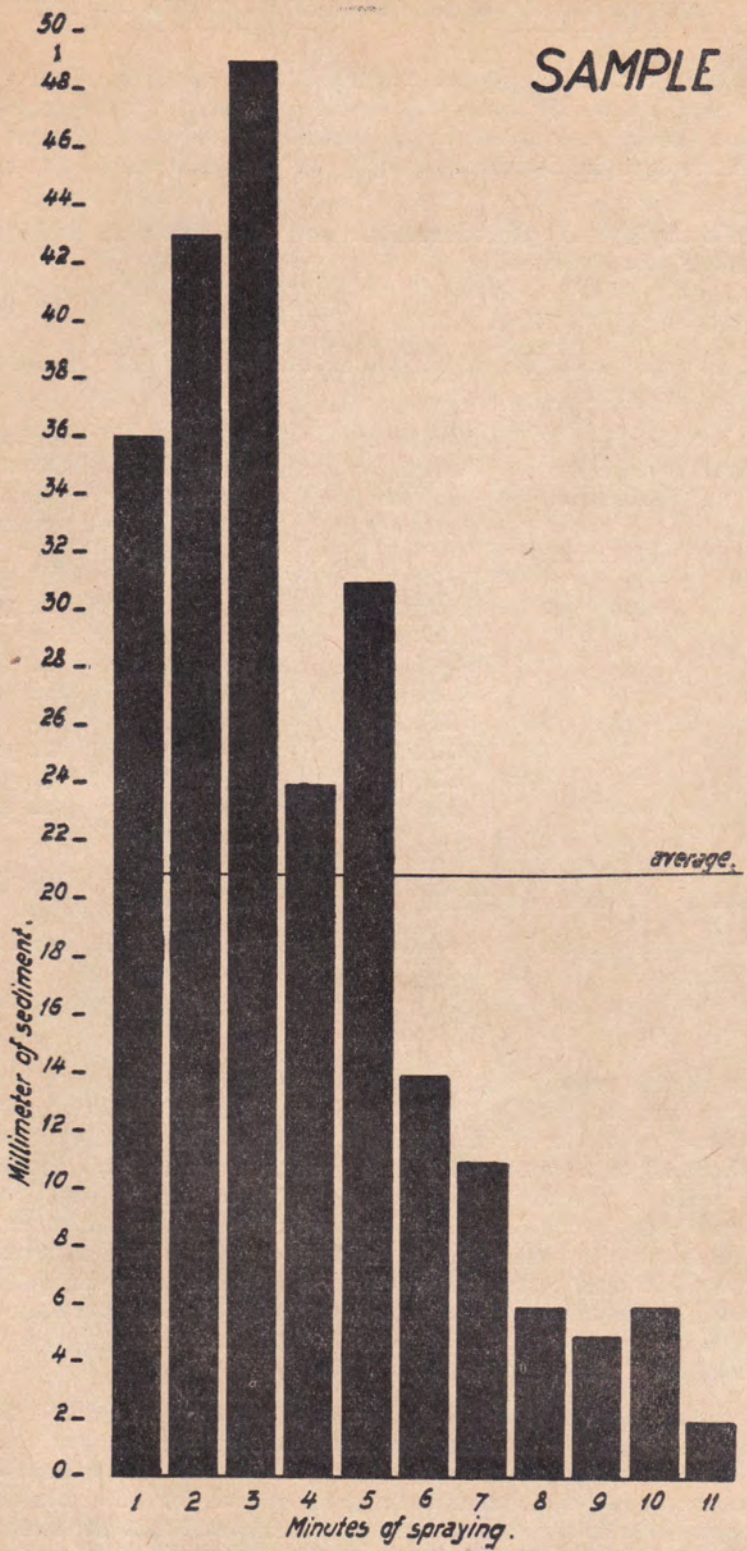

Figure 1a. „Graphic Representation of Data in Table 1".

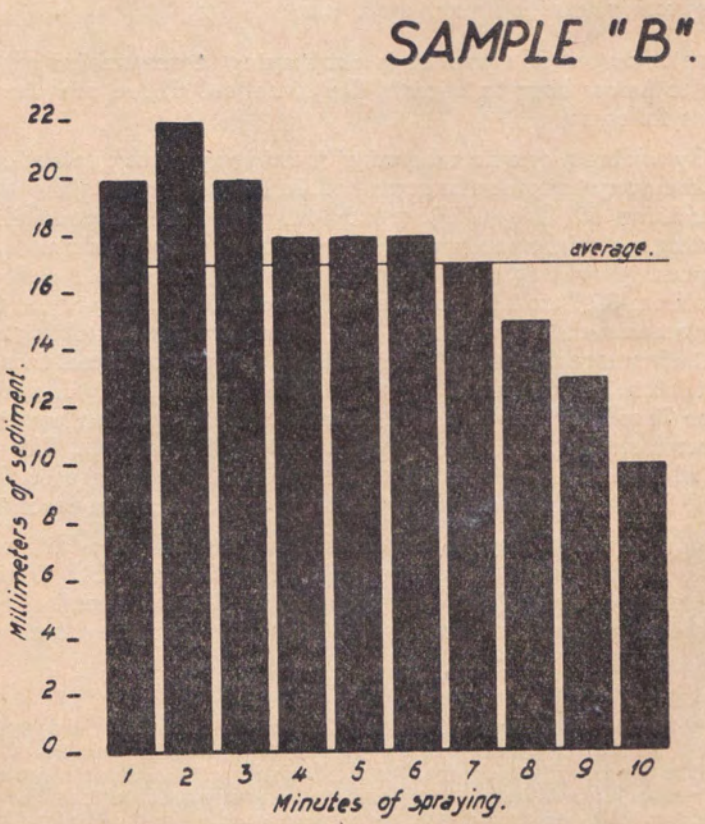

Figure 1b. „Graphic Representation of Data in Table 1".

During the 11 minutes of spraying with sample "A", four of the bottles contained too much sediment and five contained too little sediment, when judged on this basis. However, of the 10 minutes of spraying with sample "B", only one bottle contained too little sediment and the other nine were satisfactory. By preparing a bar graph, as illustrated in Figure 1, for each test showing the corrected depth of sediment collected during each minute of spraying time, the results can be visualized even more readily for reporting purposes.

Sample "A", therefore, represents a bag of wettable powder which definitely was unsatisfactory. Sample "B", however, represented a satisfactory bag of wettable powder, although one of the ten bottles showed too little sediment.

The spraying test will not show the actual percentage of DDT present in the bottle, but the comparative amounts of sediments collected will be shown. [6]) This is a good indication of the uniformity of the liquid being discharged from the sprayer during the spraying time. The particle size, rapidity of settling in a glass cylinder, and other similar data are useful to know, *but these data do not reveal what actually happens when a material is used under pressure in a sprayer.* Therefore, the spraying test is a practical test of what happens under simulated field conditions.

Methods of using unsatisfactory materials.

If a water-dispersible powder is not staying in suspension properly, it is important to know how to correct the situation. There are three general solutions as follows:

(1) By adding a certain amount of wetting agent or synthetic detergent, agglomeration frequently can be remedied. In laboratory tests, the writer found that the addition of „Teepol" [7]) greatly improved the suspensibility and an agglomerating material usually would return to an almost normal condition. By using various percentages of the commercially available 34% „Teepol" (variations from 0.1% to 1.0% of the commercial 34% „Teepol" in the mixing water are recommended) a person can learn how much of the material is necessary to improve the unsuitable wettable powder on hand. In seven liters of spray mixture, seven ml. of „Teepol" 34% concentrate will make a 0.1% mixture, or 70 ml. will make a 1.0% mixture. Other wetting agents (such as sodium lauryl sulfate, etc.) can also be tested, if available. The spray test described above may be repeated using various percentages of the wetting agent, until the most satisfactory uniformity of sediments is reached.

To illustrate what may be expected from the use of additional wetting agent, the following data are presented. When Sample "A" DDT wettable powder was mixed with water containing 0.1% „Teepol" (7 ml. of commercial 34% Teepol in 7 liters of water mixture), the spraying test was again performed.

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[6]) In this particular case, for example, only 75% of the solid material is technical DDT. Therefore, 25% of other materials are present, and this test does not show whether the DDT or the inert ingredients settle most rapidly, or whether all ingredients settle at equal rates. Chemical analysis would be necessary to determine the actual percentages, but DDT testing facilities were not available for these tests. Probably the sediment in every bottle was comprised of approximately the same proportions of DDT and inert ingredients as the dry wettable powder.

[7]) N.V. de Bataafsche Petroleum Maatschappij, Djakarta.

Table 2

Distribution of sediment obtained using Sample "A" DDT water-dispersible powder concentrate plus 0.1% commercial „Teepol".

Minutes of Spraying Time	Sample A + Teepol Depth of Sediment	Percentage above or below average
1	20 mm.	+ 33%
2	24	+ 60
3	24	+ 60
4	15	± 0
5	13	— 13
6	15	± 0
7	13	— 13
8	12	— 20
9	11	— 27
10	7	— 53
Average	15 mm.	

The data from Table 2 can be graphically shown as in Figure 2.

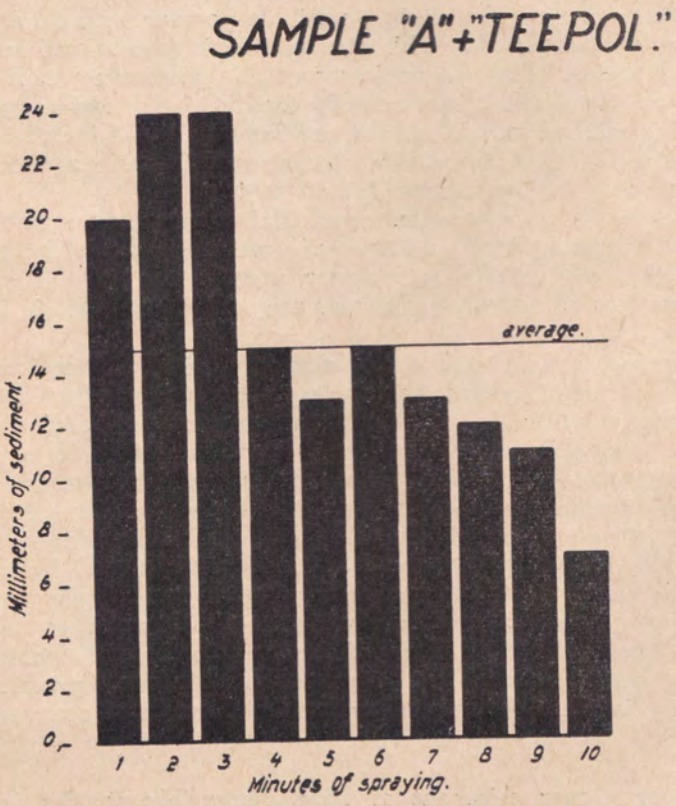

Figure 2. „Graphic Representation of Data in Table 2".

When these data are compared with the original results obtained from Sample "A", it is quite evident that the addition of the wetting agent has improved the suspensibility of this material. The range is now from a 53% deficiency to a 60% excess of the average depth of sediment. Seven of the 10 bottles contained amounts of sediment within the acceptable limits already discussed. Only one bottle (10% of the total number) contained less than the acceptable minimum. Therefore, after the addition of the wetting agent, it probably may be assumed that 10% of the wall surfaces would receive too little material, whereas, before the addition, 45% of the surfaces would have received an insufficient deposit. It is not detrimental if an excess of DDT deposit is on the walls, although it is unnecessary. When there is a 60% excess, as shown in Sample "A" with „Teepol", mosquito control should be satisfactory, but where there is a 53% deficiency it will be less effective.

It may be concluded, therefore, that the addition of the wetting agent makes it possible to utilize the agglomerating DDT wettable powder. It should be emphasized here, however, that this method is useful only when a material flocculates. If the particle size of the wettable powder is too large, the addition of wetting agent will not correct the situation.

„Teepol", and other wetting agents, will increase the cost of spraying. Also, some wetting agents are irritating to mucous membranes and eyes during the spraying operations, thereby being uncomfortable for the spray-crew men. However, a cloth mask worn over the nostrils and mouth will help to alleviate the discomfort.

One other possibility for the improvement of an agglomerating material is to mix one part of agglomerating wettable powder with an equal part of satisfactory wettable powder. This combination is then mixed in the normal manner with water. If the satisfactory wettable powder contains a sufficient amount of wetting agent it may remedy the deficiency of the agglomerating material. This mixture has solved the problem in limited tests made thus far. Therefore, if a shipment of wettable powder contains both agglomerating and satisfactory material, this mixture should be tried.

(2) If the wettable powder is unsatisfactory because it is *not finely ground* by the formulator, the addition of a wetting agent will not correct the condition. The only wholly satisfactory method for reconditioning coarse wettable powders is regrinding, but this may not be possible in Indonesia at present.

(3) The use of knapsack sprayers which have agitators inside to keep the wettable powder in suspension can sometimes be used with *either* types of unsatisfactory materials, but these sprayers are not readily available to the malaria control program and are somewhat heavy to use for house spraying programs in Indonesia. Also, when using a knapsack sprayer, it is necessary to use one hand for pumping the sprayer and the other for manipulating the spray wand. When using inexperienced laborers, this might prove to be too difficult to coordinate the movements of each hand. Therefore it may be necessary to use two men for each knapsack sprayer — one for carrying the tank and doing the pumping, and the other to do the actual spraying. However, if there is no other way to solve the problem, the use of knapsack sprayers should not be overlooked, because a product with poor suspensibility is often discharged uniformly from these sprayers.

Discussion.

Whenever a new shipment of water-dispersible powder insecticide is received, several samples of the material should be tested by methods similar

to those described above, before spraying campaigns are started. Otherwise, it is possible to complete an entire control campaign only to learn later that the desired results were not achieved, because some unsatisfactory materials have been used for long periods of time before the trouble was discovered. This has actually happened in Indonesia with DDT and dieldrin wettable powders which later proved to have poor suspensibility properties. [8]) Unless the sprayers are clogging constantly, the spray teams cannot realize that most of the insecticide is sometimes being discharged during the first minutes of spraying time and that during the remainder of the time almost nothing but water is being sprayed onto the surfaces requiring treatment. In experimental work and actual large scale control campaigns with water-dispersible powder concentrates in various parts of the world, there have often been conflicting results. Perhaps some of the difficulty in these instances has been caused by the failure of those doing the work to recognize the unsatisfactory suspensibility performance of the products which they were using. Pre-testing of materials received can prevent future discrepancies which might be caused by poor suspensibility.

Proper storage of insecticides is important. In order to keep a material in good condition, it must be kept as cool as possible and absolutely dry. The more quickly the material is used, the better the results, because deterioration may occur with prolonged storage. Subjecting the wettable powders to high pressures should be avoided. If the material is in bags, the piles of bags should be as low as possible to prevent excessive pressures upon the powder in the lower bags. For tropical countries such as Indonesia, water-dispersible powders packed only in strong, moisture-resistant, fiber or metal drums should be purchased, rather than materials packed in bags. Such drums are less likely to break open in transit or storage, can be more conveniently stacked without fear of excessive pressures upon the insecticide, and are moisture proof (particularly if the drum contains a hermetically sealed plastic liner.) The containers of insecticides should not be opened until suspensibility testing and spraying is to commence. This will help prevent moisture and foreign materials from entering the containers and contaminating the contents. By observing these important precautions, water-dispersible powder insecticides will be more likely to be in good physical condition when they are used for insect control programs.

Summary.

The testing of water-dispersible powder insecticides for residual spraying in malaria control campaigns is described. The suspensibility of some shipments received in Indonesia have been undesirable because (1) the material was not finely pulverized (2) the formulation may have been inferior, or (3) the product had deteriorated. The writer suggests that the failure of insect control using water-dispersible powder concentrates in various parts of the world, in some instances may have been due to the failure of those doing the work to recognize the poor suspensibility of the products used.

Tests which will enable a person to judge the suspensibility properties in relation to spraying operations are described. Two tests are principally to observe whether or not a water-dispersible powder has good suspensibility. The third test, simulating field operations, will show the relative amounts of wettable powder which are discharged from a sprayer during each minute of spraying time for any particular insecticide used.

[8]) The following statement is found in the Fourth Report of the Expert Committee on Insecticides, page 16: „Attention is drawn to the fact that it was impossible to include a suspensibility test for dieldrin water-dispersible powder concentrates owing to the unavailability of data on this subject". It is unfortunate that data of this type were not available because there was a serious suspensibility deficiency in the dieldrin wettable powder received in Indonesia. A large scale dieldrin house spraying experiment in Sumatra failed because of this.

Suggestions are made as to how certain unsatisfactory materials can be reconstituted to again make them usable: i.e., by regrinding, by the addition of a wetting agent, or by the use of a knapsack sprayer containing an agitator. Proper storage conditions such as keeping the material in a cool, dry place and the avoidance of excessive pressure on the stored product is emphasized.

Acknowledgment:

These studies were instigated at the suggestion of Drs. Soeparmo H.T. and W.J. Stoker, Chief and Deputy Chief respectively, of the Malaria Section, Ministry of Health. Their help and suggestions in this work and the preparation of this paper are gratefully acknowledged.

Thanks and credit are also due to Dr. W. Th. van Goor and Mr. J. G. Lodens with whom the author first developed the spraying test procedure.

Indonesian Summary.

Ichtisar.

Disini dibitjarakan tjara untuk mengudji obat² pembasmi serangga jang dapat didjadikan suspensi dalam air (water-dispersible powder insecticides), jang dipergunakan untuk pemberantasan malaria dengan djalan menjemprotkan pada dinding² rumah. Keadaan suspensi dari obat² tersebut, dalam beberapa kiriman jang diterima oleh Indonesia tidak memuaskan karena (1) bubukan tidak tjukup halus, (2) tjampuran dari bagian bahan²nja mungkin tidak baik, (3) bahannja mendjadi rusak. Pengarang mengemukakan, bahwa kegagalan pembasmian serangga dengan mempergunakan obat pembasmi serangga jang dapat didjadikan suspensi dalam air, jang terdapat dalam berbagai-bagai bagian didunia, dalam beberapa kedjadian, dapat disebabkan karena tidak baiknja penjelidikan tentang kekuatannja obat tadi untuk didjadikan suspensi dalam air.

Tjara mengudji untuk mengetahui apakah suspensi tersebut tjukup baik atau tidak berhubung dengan penjemprotan, diterangkan djuga disini. Dua tindakan, harus dikerdjakan untuk melihat apakah obat tadi mempunjai sifat suspensi jang baik. Tindakan ketiga supaja didjalankan bersama-sama dengan penjemprotan dilapangan. Tindakan ini akan menundjukkan banjaknja obat jang keluar dari alat penjemprot dalam setiap menitnja bagi sesuatu matjam obat pembasmi serangga jang dipergunakan.

Beberapa pendapat diadjukan supaja obat² jang tidak memuaskan tadi dapat dipergunakan lagi, seperti dengan djalan digiling lagi, atau dengan djalan menambahkan pembasah, atau dengan mempergunakan alat penjemprot jang memakai bulang-baling. Perhatian ditekankan kepada sjarat² untuk menjimpan obat² tersebut, misalnja ditempat jang dingin dan kering. Lagi pula obat tadi harus lepas dari tekanan jang luar biasa dalam tempat penjimpanan.

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