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SUBSTITUTE FOR SHELLAC

According to the Z. angew. Chem. it has been found that naphthol resin can be used as a substitute for shellac and that the products of condensation of a and b-naphthol have a number of characteristics in common with shellac, such as capacity for taking a polish and suitability for use as an alcohol varnish, and as an insulating material. The substitutes are particularly useful if the residues are cleaned by filtering from an alcoholic solution, the alcohol being distilled from the filtrate.

CHEMICAL WARFARE RESEARCH.

The Bureau of Mines started a research laboratory in gas warfare about a year and a half ago. On July first, 1918, that was taken over by the War Department, but the organization as it stands at present is practically the same as that developed by the Bureau of Mines. The outward signs of the change are that Major General Sibert is the official head instead of Mr. Manning, and that Mr. G. A. Burrell is now Colonel Burrell. On the other hand, Dr. E. P. Kohler, who had charge of all the offense problems, holds the same position in the new organization without having put on a uniform.

The term "war gas" is a flexible one. The substance may be a liquid, a solid, a vapor, or a true gas. However, it must have some pretty striking characteristics; it must be poisonous; or produce tears (lachrymatory); or must give rise to nausea, sneezing, or blisters; have a foul smell, though otherwise harmless; or be a smoke with obscuring powers. Of course it may have any or all of these properties combined. Under any of these circumstances we call it a war gas. It must also have certain other characteristics. It must be pretty good in its class. Nowadays no one would consider as a toxic substance anything which did not kill dogs in thirty minutes at a concentration of 1 mg. per liter. It is that effective concentration which is overlooked by people who suggest new gases or methods of using old ones. In the case of lachrymatory substances they should be effective at concentrations as low as 0.01 mg. per liter. The best are much better than that.

Another determining factor in the use of any gas is the availability of raw materials. Where thousands of tons may be needed, there is no use in considering a substance of which the available output per year is a gram, a ton, or a hundred tons.

A good method of manufacture should be at hand. If the substance is good enough, it will be made by any method, however wasteful; but this is not true in most cases. I could cite an instance where a substance would be used if a good method of manufacture were available. The present method of making this substance is so wasteful that its good qualifications do not counterbalance the disadvantages, and it is not used either by our Allies or by ourselves.

A substance must be stable, or fairly stable. It must not polymerize rapidly, hydrolyze too rapidly, be too inflammable, or go to pieces on detonation. Our problem is different from that of the Allies because the Allies can use their material within 2 or 3 months after loading the shells, whereas in our case shell loading here must take place from 3 to 6 months before firing, and consequently our limits as to stability against polymerization must be more rigid than those of the British and French; and as a matter of fact the French are using certain substances which we shall not use, just because of those conditions.

How do we start with any given substance. We may take a substance already used by the Germans or the Allies, or we may get a suggestion from outside, or the staff may think up something from a search of the literature, from analogy, or from pure inspiration. Then steps are taken to see whether it can be considered as a toxic substance. First, the Offense Research Section, under Dr. Lauder Jones, makes the substance. If it is a solid, it is sent to the Dispersoid Division, Dr. R. C. Tolman in charge, and they work out methods of disintegrating it.

When this is done, or if it is a liquid or vapor, it is sent to the Toxicological Section, Dr. A. S. Loevenhart, and tested to determine degree of toxicity, concentration producing lachrymation, or any other of the delightful characteristics. If their report is favorable, the substance is turned over to a number of different sections.

The Offense Research Laboratory works to improve the laboratory method of making. After they have worked this out on a laboratory scale, the substance is turned over to the Chemical Production Section, Mr. W. S. Rowland, and they work it out on a larger scale, from 50 pounds to a ton, depending entirely on the nature of the substance. It then goes outside of the Research Division, either to Large Scale Production (Colonel Dorsey) for further development, or direct to Colonel Walker, at Edgewood, for commercial production either there or to be assigned to some manufacturer somewhere in the country. While the Offense Research Section is working out an improved laboratory method, the substance is sent to the Analytical Section, under the charge of Mr. A. C. Fieldner. They de-

velop methods for determining its purity. They also analyze mixtures in air. It is sometimes difficult to determine substances at the dilution in use. They also make tests to find out whether the canisters will stop the substance.

It is also sent to the Pyrotechnic Section under Mr. G. A. Richter to determine stability when fired in shells, that is, whether it goes to pieces under the detonating charge.

At the same time the Defense Research Section, under Dr. A. B. Lamb, is working to determine whether any change in the ingredients put in the canister is necessary. If the substance is not absorbed, some new mixture or compound must be developed which will stop it. This Section also takes up the question of methods of detecting toxic substances in the field. That might be considered to be a problem for the Analytical Section, but our whole system is pretty flexible, and as a matter of fact that work has been done by the Defense Research Section, of course working in cooperation with the Analytical Section. The Defense Research Section also develops ointments to protect against the effect of the action of the toxic or blistering gases of the skin.

At the same time the substance will be referred to the Mechanical Research Section under Mr. Fogler, because a change in the ingredients may make it necessary to change the type of canister. That becomes important if dealing with smokes instead of vapors. The question of protective clothing may have to be taken up.

The defensive results are then transmitted by Dr. W. K. Lewis, of the Institute in charge of all defense problems to the Gas Defense Division, which is not a part of our Division, but is under Colonel Dewey, and has charge of the commercial production of all defense materials.

While all this is being done, the same substance is sent to the Pharmacological Research Section under Dr. E. K. Marshall, and they study the question of the effect produced and the general question of susceptibility. Certain men may be 100 times as susceptible as are other men. It is very desirable to make preliminary tests, and to keep out of the factory men who are extremely susceptible, because they are sure to be casualties.

The substance is also studied by the Pathological Section under Dr. Winteritz, and they go into painful details as to the way in which the various organs are attacked by war gases.

At the same time it is sent to the Therapeutic Section under Dr. Underhill, of Yale, and they take up the desirable but very difficult task of finding methods of treatment to revive men who have been gassed more or less severely.

While all this is going on, all these various sections are making reports twice a month on all the substances that they are working with, so that there is an enormous amount of pseudo-literary material piling up. All of this material comes to the Editorial Section, of which Lt. Col. Bancroft is in charge. They condense it as much as possible, and get out semi-monthly reports, which are sent to a selected list of people in this country and abroad. These reports deal with many different topics, and if someone wanted to look up about a certain substance he would have a fearful task ahead of him. Consequently, as fast as possible we are writing monographs on each particular gas, canister ingredient, etc., which shall contain everything that is known in the literature, everything that we have been able to get from the Allies or from captured German reports, and everything that has been done in this country. We hand out the desired monograph to the inquirer, and tell him to read it. Of course he does not do it, but the thing is indexed pretty thoroughly, and he can look over the various sections which interest him more particularly, and thereby post himself on what is known in regard to that substance in a relatively short time. In this way the information in our files is made fairly accessible.

Now this whole system of handling toxic substances is a very flexible one. Whenever necessary we increase or decrease the number of sections. At one time Dr. J. F. Norris was in charge of all the chemical research. That grew to be more than one man could possibly handle. The Offense Research was left under Dr. Norris, and the Defense Research was given to Dr. Lamb. Since other sections were interested in the offensive work, it became necessary to tie things together again, and Kohler was put in charge of all the problems of Offense.

We began with one Physiological Section. Now there are Pharmacological, Pathological, and Therapeutic Sections, and the Pharmacological Section has recently been subdivided into testing and research.


The Mechanical Work was split into two sections. When conditions changed, this work was put back into one section. Any section can be changed or rearranged in any way desirable to get results, and this has worked well in practice.

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