The bleaching tests were conducted on the earths in the following way. Fifty cc. of cotton seed oil were placed in a flask immersed in boiling water. Then 2.5 grams of earth added and the mixture stirred for three minutes, then filtered through filter paper in a steam jacketed funnel.

Conclusions. The oxidizing properties of the earths are roughly proportional to their bleaching powers. That is, Filtrol and Pikes Peak are the best bleaches, and they show the highest oxidizing power, while Floated Silica, which is the poorest bleach, shows a very low oxidizing power. The intermediate earths check up fairly well as shown in the following table.

OXIDIZING POWER OF BLEACH EARTHS—GRAMS OF $FeSO_4$ OXIDIZED BY 5 G. OF SAMPLE

Earth	Cold	Hot
XXF	0.0405	0.0542
—975	.0085	.0416
XL-000	.0199	.0445
Pikes Peak	.0875	.1372
Filtrol	.0434	.0750
Floated Silica	.0072	.0100
X-897	.0546	.0722
X-898	.0884	.1250
Georgia Fuller's Earth	.0107	.0552
Filter Clay	.0294	.0567
Tonsil	.0352	.0612
Unknown Quantity	.0436	.0655

The experimental work and results obtained during the research suggest the following conclusions.

1. Fuller's earth does oxidize different earths to a different extent.
2. The bleaching of oils by Fuller's earth is not due to oxidation alone.
3. The oxidizing power of the earth *is* a measure of its bleaching power.
4. The bleaching property of Fuller's earth is due to a combination of adsorption and oxidation. Dr. Wesson has suggested that the coloring matter is first oxidized and then adsorbed. This is, I think, a better explanation of its action than the straight adsorption theory.

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THE DISINFECTING POWER OF SOAPS

FROM "HANDBUCH DER SEIFENFABRIKATION"
BY DR. WALTER SCHRAUTH—5TH EDITION, 1921, PAGES 59–63
TRANSLATION BY L. W. BOSART

The opinions of the early authors differ widely concerning the disinfecting value of soaps. That soap can act as a disinfectant is nevertheless quite positively known at present, and recent research has established the conditions under which this disinfecting power is exerted and its extent.

The disinfecting power of soap was first established by Robert Koch,[1] who found in his investigations that ordinary soft soap in a dilution of 1:5000 could check and in a solution of 1:1000 could entirely inhibit the development of anthrax spores. Then in the year 1890, Behring[2] investigated some 40 different kinds of soap and showed that a "solid laundry soap" in a dilution of 1:70 in bouillon could kill anthrax bacilli within two hours. In 1894, M. Jolles[3] was likewise able to verify the disinfecting power of soap. In his tests, 3% solutions of 5 different soaps, whose content of fatty acid, alkali and free alkali was determined, killed cholera germs in 10 minutes; with increasing concentration and temperature, the disinfecting power likewise increased. Also in his later investigations[4] in which he made use of typhus and colon bacilli, he came likewise to the result that soap solutions possessed a considerable disinfecting power in themselves and that soap, therefore, was the most suitable and natural cleansing medium for soiled and infected laundry.

A. Serafini[5] also ascribes to ordinary laundry soaps and, indeed, to the pure fatty acid salts as such, a considerable disinfecting power and emphasizes the fact that all additions which reduce the amount of such salts in commercial soaps, likewise reduce the disinfecting action. But on the other hand, Konradi[6] in his investigations of the bactericidal action of soaps, using anthrax spores, arrived at the result that no appreciable disinfecting action can be ascribed to the soap substance, indeed rather, that any disinfecting action, if present at all, is due to certain additions, above all to such odor-bearing materials as terpineol, vanillin, cumarin, heliotropin, etc. His results were confirmed by tests from several other sources, but in general, later authors inclined again to the view that an antiseptic action can be ascribed to soap. Thus reported A. Rodet,[7] in 1905, concerning the disinfecting power of a pure soda soap (Marseilles Soap) free from excess alkali, whose effect he tried on staphylococci and typhus bacilli. In both cases, he was able to establish beyond question an antiseptic action. On adding soap to a culture medium, he checked the growth of bacteria even in weak concentrations, without, however, entirely suppressing it with very much larger additions. But with pure soap solutions, both kinds of bacteria were killed, indeed the more sensitive elements of staphylococci in a few hours with a 1% soap content, the typhus bacteria in a few minutes. With increasing concentration

[1] Robert Koch, *Mitt. Kaiserl. Gesundheitsamt*, **1**, 271 (1881).

[2] Behring, *Z. Hyg. Infektionskrankh.*, **9**, 414 (1890).

[3] M. Jolles, *Ibid.*, **15**, 460 (1893).

[4] *Ibid.*, **19**, 130 (1898).

[5] A. Serafini, *Arch. Hyg.*, **33**, 369 (1898).

[6] Konradi, *Ibid.*, **44**, 101 (1902); *Zentralbl. Bakt.*, **36**, 151 (1904).

[7] A. Rodet, *Rev. Hyg.* **8**, 301 (1905).

and rising temperature, in conformity with the observations of earlier authors, a swifter and more energetic action was likewise noticeable.

Finally C. Rasp[8] from his own experimental studies emphasized particularly the varying disinfecting action of commercial soft soaps and brought out the fact that neither the chemical analysis with regard to the alkali content, nor the chemical-physical investigation (conductivity) nor the identification of the fatty acids by means of the Hübl iodine value could fully account for these variations. Owing to the increased effect as a result of increased temperature, he believed, however, he might suggest dissociation and closed his work with these words: "Tests with soap made from chemically pure substances, might well add a further contribution to the theory of the action of soap."

Soon after that appeared the work of Reichenbach, in which this thought was made an actuality, the extensive experimental material of which now offers an almost complete explanation of the foregoing question. Reichenbach employed for his experiments the chemically pure alkali salts of all the acids which are usually found in soaps, neglecting almost entirely all commercial preparations, and was able in this manner to determine that the potassium soaps of the saturated fatty acids quite generally possess a very considerable disinfecting power, while the salts of the unsaturated fatty acids are scarcely worth considering as far as the disinfecting action of soaps is concerned. Above all other salts, potassium palmitate possesses an especially noteworthy disinfecting power. A N/40 solution (0.72%) was able to destroy B. coli in less than 5 minutes, something which would not be accomplished with an aqueous solution of 1% carbolic acid in 20 minutes. On the other hand, a N/10 solution of potassium oleate showed no appreciable action at all, and it required one hour for a N/2.5 solution to bring about even a partial destruction of the bacteria tested.

These experiments alone will explain a great part of the contradictions in the literature, for they show that it is very probable that *a soap possesses greater disinfecting power the more strongly it is hydrolyzed in aqueous solution.* Moreover this theory gains in importance, because it can be supported by an entire series of further observations. Reichenbach found further, that the disinfecting action of the alkali salts of the fatty acids diminishes with the decreasing molecular weight of the fatty acids as does also the hydrolysis. The only exception in this series is the stearate, which in spite of its higher molecular weight shows a somewhat weaker disinfecting power, but, at the same time, it shows a somewhat lower hydrolysis than the palmitate. Furthermore, corresponding to the conclusions drawn from the above statement, it could be shown among other things, that the disinfecting power of a soap solution diminishes at a lower

[8] Rasp, *Z. Hyg. Infektionskrankh.*, **58**, 45 (1908).

rate with increasing dilution than the corresponding dilution would anticipate. Since, namely, with increasing dilution, the hydrolysis of a soap solution increases, and, indeed, in such a manner, that the absolute amount of the hydrolyzed components is diminished but the percentage of the decomposed salt continually increases, therefore a portion of the result of the dilution must be counterbalanced by the relative increase of the products of hydrolysis.

In spite of the fact that the above explanation corresponds completely with the experimental data actually found, on close consideration the conclusion must nevertheless be reached, that the more or less hydrolyzed fatty acid salts alone cannot be the determining factor for the disinfecting value of commercial soaps. The results already obtained by Robert Koch, who, from his investigations made on fish oils and vegetable oils, ascribed to soft soaps made from these very oils, which are composed principally of unsaturated fatty acids, a high disinfecting power, cause one to presume that in this process of disinfection there are other contributing factors, which make it possible that a greater effect can sometimes also be ascribed to the soaps obtained from the unsaturated fatty acids.

It is only natural to think first of the excess alkali content of the soaps, especially since it appears obvious, in agreement with the views of the earlier authors (Behring, etc.) to ascribe the disinfecting power of the soap principally to the alkali soap freed by hydrolysis. In fact, Reichenbach also obtained strongly disinfecting liquids by combining a potassium oleate solution (with scarcely any disinfecting action) with a potassium hydrate solution, which likewise had only a weak action, and indeed the maximum of disinfecting value was attained with a mixture of $^1/_6$ oleate (N/50) with $^5/_6$ caustic potash (N/50). But contrary to the above hypothesis, as he himself was able to show and as other authors before him have already declared,[9] it would be quite wrong to consider the action of soap purely as an effect of the alkali, since soap solutions in most cases possess a stronger action than can be exerted under the most favorable circumstances by alkali alone. The significance of the excess potash would appear to lie less in its own disinfecting power than in its supplementing the disinfecting action of the fatty acid salts, and so Reichenbach summarizes the result of his investigations thus: "Alkali and fatty acid salts acting together bring about a mutual increase in their disinfecting power, and, indeed, a greater increase than would be produced by the same amounts in a solution of like strength of the same material."

The question of what causes this increase is left open, but its explanation should not be too difficult, if the process of disinfecting itself is considered.

For the effectiveness of a disinfectant, a certain fat solubility (lipoid

[9] See c. G. Serafini, *Loc. cit.*

solubility) of the same is necessary, and, indeed, it must be such that the disinfectant, because of its solution affinities, is given up with the greatest ease from an aqueous solution to the lipoid medium (the bacteria cells). It will therefore be understood that on the one hand, the acid salt, which is lipoid-soluble to a considerable extent, and which is produced together with the alkali by the hydrolysis of the saturated fatty acid salts, which acid salt is soluble with comparative difficulty in the aqueous medium, can easily go over to the bacteria cells, and that on the other hand also, the neutral salts of the unsaturated fatty acids which are easily soluble in water, will develop an activity if by being salted out of their aqueous solutions by electrolytes they now receive an increased solution affinity for lipoids. Again briefly summarized, *the disinfecting power of aqueous soap solutions is* therefore *dependent upon the relationship existing at the time between the alkali salts of the saturated and unsaturated fatty acids and upon the purity of the soap itself*, in that the action of the saturated soaps runs parallel to the relative amount of hydrolyzed fatty acid (or acid salt), but the action of the unsaturated soaps is essentially determined only by the salting-out power of electrolytes present at the same time. The combined alkali or alkali in excess which is present in soap solutions is, moreover, aside from its not very great disinfecting power, still of significance in that, on the one hand, owing to the kind of alkali, differences occur in the lipoid solubility of the acid salts of the saturated acids, on the other hand, owing to the kind and amount of alkali, changes occur in the physical properties of the soap solution itself (suppression of hydrolysis, influence on the micro-structure of the colloidal soap particles).

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ABSTRACT FROM ANOTHER JOURNAL

Government Publications.—One of the most valuable Government publications to the oil industry which has appeared recently is *Trade Information Bulletin* No. **322** of The Department of Commerce. This is entitled The Vegetable Oil Industry of France and has been prepared by Chester L. Jones, American Commercial Attaché at Paris and Wesley Frost our Consul at Marseille. It is not therefore a mere compilation of data culled from trade papers and miscellaneous sources, but a first-hand report of present-day conditions in the oil trade of France. The pamphlet of 21 pages, contains a general discussion of the Oil Supplies, Foreign Trade and Raw Materials of the French Oil Industry, an enumeration of the manufacturing centers and brief descriptions of the condition in which the oil-bearing seeds and nuts reach the French oil mills followed by tabulations of the imports and exports showing source and destination. One might wish that those portions of the report which cover the methods of pressing and refining the various oils had been made a little more complete but this has been so well handled in the earlier bulletins by Thompson that perhaps it is unnecessary, unless French practice has materially changed during the past ten years. H. S. B.