DETERMINATION OF THE PHENOL COEFFICIENT OF DISINFECTANTS BY THE COVER-SLIP METHOD.

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Although we recognise that Rideal and Walker were right in the idea on which they based their method for determination of the effectivity of a disinfectant by determination of its phenol coefficient through comparative tests with a known solution of phenol and a corresponding solution of the disinfectant in question, we still think that in its details this method is encumbered with many difficulties and sources of error. This is evident also from the fact that practically all investigators who have worked with the method have found occasion to modify it in one or more respects.

In the original method of Rideal and Walker (1903: *J. Sanit. Inst.* **24**) the test time was inconstant, being merely set to fall within certain limits. Subsequently the authors modified the method in this regard. In its present form this method is the one now very generally used in Great Britain and the Dominions.

In 1930 we received from the Cooper Technical Bureau, London, a copy of *Details of the R-W*[1] *Test*, according to which the phenol coefficient is that dilution of disinfectant divided by the phenol dilution which gives life in 2·5 and 5 min., but no life after. In 1932, we received from the British Disinfectant Manufacturers' Association its *Standard Technique for Determining the R-W Coefficient of Disinfectant*, which does not bring any particular modifications of the method except that the period of subcultivation for *B. typhosus* is changed from 10 to 14 days (as given in the report of 1930) to 3 days.

In the R-W test as mentioned in the *System of Bacteriology*, **9**, 289, the period of subcultivation is only 24 hours.

Weyrauch (1927: *Ctrbl. f. Bakt.* **103**) says of the calculation of the phenol coefficient by the R-W method: "Hätte man die schwächste Verdünnung gefunden, welche die gleiche Arbeit leistet wie Phenol 1–100, d.h. in 5 Min. die Typhusbazillen abtötet, so dividierte man die Verdünnungszahl durch 100 und erhielt so den Phenolcoefficienten."

In the Chick-Martin method (1931: *Syst. of Bacteriol.* **9**, 282) the time is constant—30 min.—and the test is made in the presence of organic substance. Otherwise it resembles very much the R-W method. In a subsequent paper on the employment of the cover-slip method in tests involving the presence of organic substance, we shall further discuss this method.

[1] R-W denotes Rideal-Walker hereafter in the text.

While the R-W method prevails in England and Denmark, the Hygiene Laboratory method[1] (1912: Anderson and MacClintic, *Hyg. Lab. Bull.* No. 82) is the method most commonly employed in the United States. In principle it is the same as the R-W method, and it also implies a considerable uncertainty in the calculation of the phenol coefficient. Here, too, the numerous modifications constitute a not insignificant shortcoming. With the H-L method the calculation applies to the proportion between the phenol dilutions and the disinfectant dilutions which kill the test organism in $2\frac{1}{2}$ and 15 min., and the average of these values is taken as the phenol coefficient.

The present (revised) H-L method (1921, U.S. *Publ. Health Reports*, Repr. 675) calculates the phenol coefficient from the proportion between the phenol dilutions and the disinfectant dilutions which kill the test organism in 5–10–15 min. and takes the average of these values.

Wright (*N. Dakota Agric. Expt. Sta., Special Bull.* **2**, No. 19) has examined 19 strains of *B. typhosus* by tests in which he used modified H-L and R-W methods, and he says: "It would not matter if different strains varied equally in their relative resistance to different disinfectants. This is not the case, however; variations in the coefficient of over 200 per cent. can be obtained by the use of different strains of *B. typhosus*. The results of these tests show conclusively that phenol coefficients not obtained with the same strain are valueless."

Wright (1917: *J. Bacteriol.* **2**) has also made some experiments with bouillon culture media varying in their content of beef extract, of which he writes: "As the amount of meat extract was increased there was apparently a steady decrease in the resistance of the test culture, and as this was more pronounced in the case of the coal tar disinfectant than with phenol there was a corresponding increase in the phenol coefficient. This weakened resistance, however, is more apparent than real and is due largely to the fact that media containing large percentages of meat extract are sufficiently antiseptic to inhibit the growth of an organism which has been weakened but not killed by exposure to disinfectants."

Leonard (1931: *J. Infect. Dis.* **48**) reports a test that is made in addition to the H-L method, and which he calls "the transfer test." By transplanting a loopful from the 15-min. bouillon tubes, which show no growth, into tubes containing 40 c.c. fresh medium, it has been established that the ordinary methods are not serviceable for determination of the germicidal power of disinfectants which have a high bacteriostatic or growth-restraining action.

In the H-L method the tubes contain 10 c.c. of bouillon, whereas only 5 c.c. is used in the R-W method. According to the findings above 10 c.c. is not enough in the case of certain types of disinfectants, such as compounds of the heavy metals and dyes. Wright (1913: *N. Dakota Agric. Expt. Sta.* **2**, No. 18) has tested chinosol, which is a poor germicide but a strong bacteriostatic, when tested by the H-L method with 5 c.c. as well as with 10 c.c. of bouillon. He

[1] Hereafter referred to as the H-L method.

found that with 5 c.c. chinosol gave a phenol coefficient that was 30 per cent. higher than that obtained with 10 c.c. of bouillon, and he emphasises that the difference is due to the small amount of disinfectant carried over in the bouillon with the transplant.

In the R-W method the range of temperature, from 15 to 18° C., seems to be too wide. As Chick and Martin (1908: *J. Hygiene*, **8**, 670) write: "In any method of standardisation it is necessary that the test shall be carried out at a constant temperature, as the disinfection process has a high temperature coefficient. For any method to be of general application, it is also necessary that the temperature selected shall be adhered to in all determinations, since the temperature coefficient of disinfection varies for different disinfectants."

Discussing the phenol coefficients Tilley (1921: *Amer. J. Publ. Health*, **11**) says: "The R-W method as now used in England differs from the method as used in this country, and the H-L method as now used at the Hygienic Laboratory differs from that described in Bulletin 82. Indeed, lacking any authoritative definition of what R-W and H-L mean, anyone is at liberty to use any one of the several different forms of these methods and say that the resulting coefficient was obtained by the R-W method or H-L method."

OBJECTIONS TO THE R-W METHOD.

The employment of *B. typhosus* is objectionable because it is attended by risk of infection to the worker, and because the microbe is one of the least resistant to practically all disinfectants, so that the phenol coefficient will be a relatively high figure which in connection with the name "typhoid" will convey to the purchasing public a false feeling of security.

The method is not reliable, and the result is dependent on many collateral circumstances: (1) the individual properties of the strain itself (cf. Wright, cited p. 486), (2) the age of the culture, (3) the nature of the bouillon and, besides, (4) the method is always being modified by the various investigators, just like (5) the calculation of the phenol coefficient is extraordinarily disturbing. Furthermore, the phenol coefficient is calculated from the dilutions that give growth, whereas the germicidal power of a disinfectant must naturally express its efficiency. The beef extract bouillon—made up even with a very large amount of extract (2 per cent.) in the case of the R-W method—contributes merely to make the phenol coefficients still higher, although some habituation results from the transplant of the culture (formerly at intervals of 10–14 days, later 3 days, and now only 24 hours). But, as demonstrated by Wright (1913, 1917, cited p. 486), beef-extract is growth-retarding. (6) Lack of growth in the bouillon culture medium does not necessarily mean that the bacteria are killed, for some, though very small amounts of disinfectant are carried along with the transplant; and the introduction of the transfer test (cf. Leonard, 1931, cited p. 486) is unpractical and circumstantial, and then it is not positively decisive.

COVER-SLIP METHOD.

On the basis of the procedure described in Salomonsen's *Bakteriologisk Teknik* (1893), we have elaborated the cover-slip method by altering the original technique so that it can be employed for comparison of the disinfecting power of different substances.

This method offers the following advantages: (1) Employment of *Micrococcus aureus* as test organism. (2) Drying of the bacteria on cover-slips, which allows of (3) washing for removal of the disinfectant prior to the (4) transplant in veal broth. (5) Test time of 2 min., which simplifies the tests.

We employ *M. aureus* because its resistance is relatively great, corresponding to that of the sporeless bacteria encountered everywhere, and the result gives a more accurate expression of the practical serviceability of the disinfectant in question.

A great advance was made when Krönig and Paul (1897: *Z. f. Hygiene*, **25**) introduced the use of garnets as carriers of the test organisms, in that the garnets could be washed so that the disinfectant could be removed before the transplant.

Their round form makes the garnets a little unhandy, however, and we have preferred therefore to dry the bacteria on cover-slips of such a size that they stand on edge in the disinfectant and in the broth.

We use veal broth not only because it is cheaper than 2 per cent. beef extract bouillon, but no doubt it is also a far better substrate for practically all bacteria. A large amount of beef extract in the bouillon culture media will inhibit the growth of attenuated bacteria (Wright, 1917, *loc. cit.*).

In scientific tests it is a general principle not to vary more than one factor. We have varied the concentration and kept the time of the test constant, viz. 2 min.

We now pass to the technical details of our method and discuss the significance of its various factors. In conclusion we shall give the phenol coefficient of several disinfectants determined by the cover-slip method.

(1) *Requisites.*

(1) Water-bath with rack in which are twelve holes for
(2) Four flat-bottomed, sterilised and cotton-plugged, preparation glasses measuring 15 × 50 mm., and eight similar glasses, 15 × 70 mm.
(3) Rack with at least eight test-tubes, 15 × 160 mm., each containing 10 c.c. of veal broth.
(4) One sterile wide-necked bottle with a small funnel and cotton plug.
(5) One small flask with sterile physiological salt solution.
(6) One large flask with sterile distilled water for dilutions and for washing.
(7) A 24-hour culture of *M. aureus* on agar slant.
(8) Ten sterile cover-slips (12 mm. square) in a Petri dish with filter-paper at the bottom.
(9) One forceps, long and fine.
(10) A 5 per cent. stock solution of phenol cryst. Merck.
(11) Sterile pipettes, capacity pipettes and delivery pipettes of various sizes.
(12) One platinum wire loop, about 4 mm. in diameter.

(2) *Technique of test.*

On a 24-hour agar slant culture of *M. aureus* are poured a few c.c. of sterile physiological salt solution; after thorough shaking, the bacterial suspension is filtered into a wide-necked bottle through a small cotton plug in the funnel.

In a Petri dish with a layer of filter-paper on the bottom are the required number of square cover-slips (12 mm.).

A loopful of the bacterial suspension is placed with the platinum loop upon each cover-slip. The Petri dish is placed uncovered in the incubator at 37° C. for ½ hour.

In the water-bath, kept at 20° C., is a rack with twelve holes, in which there are four preparation glasses with 2–3 c.c. of phenol solutions of the strength 1 : 55, 1 : 60, 1 : 65, 1 : 70, and eight preparation glasses with a few c.c. of sterile distilled water. The glasses are placed alternatingly: one small and two large ones.

Every 30 sec. one of the cover-slips with dried culture is taken from the Petri dish with the forceps and placed in the phenol solution; thus in 1½ min. four cover-slips are placed in the respective phenol solutions. After ½ min.—*i.e.* 2 min. after the commencement of the test—the first cover-slip is taken out of the phenol solution 1 : 55 (the glass on the left end of the row), washed in the two portions of distilled water (glasses in the second and third holes from the left), and is transferred to a test-tube containing 10 c.c. of veal broth; and so on, until all four cover-slips have gone through the same process: 2 min. in phenol solution, then washing in distilled water and transfer into broth media. The test is made in the same manner with various dilutions of the disinfectant in question. The rack with the broth tubes is left in incubator at 37° C. for 48 hours, after which the result is read: growth, or no growth.

(3) *Calculation of the phenol coefficient.*

The cover-slip phenol coefficient is thus the ratio between the highest dilution of disinfectant divided by the highest dilution of phenol solution that can kill *M. aureus* in 2 min.

For example, we may take the test on izal:

24-hour agar slant culture of M. aureus *at* 37° *C.*

Izal	Time and temp.	Growth after 48 hrs. incub. at 37° C.
1 : 120	2 min. at 20° C.	0
1 : 140	,, ,, ,,	0
1 : 160	,, ,, ,,	+
1 : 180	,, ,, ,,	+
Phenol		
1 : 55	,, ,, ,,	0
1 : 60	,, ,, ,,	+
1 : 65	,, ,, ,,	+
1 : 70	,, ,, ,,	+

Phenol coefficient: 140/55 = 2·5.

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We may now consider the various factors involved in making tests by this method.

(4) *Choice of test organism.*

We suggest the employment of *M. aureus* because it is safe to work with and very commonly found: in wounds, on the skin, in hospitals, etc. Finally, it is rather resistant to disinfectants.

We have made tests with *B. coli*, *B. pyocyaneus* and *B. typhosus* against phenol, and found these organisms less resistant; consequently, as mentioned, comparison with a single disinfectant gave greater coefficients.

The cover-slip phenol coefficient in tests with the foregoing organisms was as follows: *M. aureus* 2·5, *B. coli* 7·8, *B. pyocyaneus* 3·0, *B. typhosus* 9·9.

We have tested 17 strains of *M. aureus*. They all fell within the four phenol dilutions given above.

11 strains were killed after 2 min. in phenol dilution 1 : 60,
5 ,, ,, ,, ,, ,, ,, 1 : 55,
1 ,, ,, ,, ,, ,, ,, 1 : 65.

(5) *Veal broth.*

Five hundred grammes of lean chopped veal are put in 1 litre of warm water, heated to boiling and kept boiling for 20 min. with frequent stirring. It is then filtered through cotton, on a wire screen, into a flask containing 10 g. peptone and 5 g. sodium chloride. When these substances are dissolved, by heating the flask on a wire screen, the fluid is made alkaline with 4 per cent. sodium hydroxide. It is then boiled for 45 min.

After filtration, the broth is tubed (10 c.c. per tube). The tubes are plugged with cotton and autoclaved for 15–20 min. at 115–120° C.

The *p*H of the finished broth must be *ca.* 7·5, with phenol red as the indicator.

(6) *Agar.*

It is essential that the reaction of the agar be adjusted to a *p*H of *ca.* 7·7–8. As on one occasion growth of *M. aureus* took place in the presence of phenol dilution in 1 : 55, it was assumed to be attributable to insufficient alkalinity of the agar, and consequently the following experiment was made.

Three portions of agar of different alkalinity were prepared so that the broth was adjusted with *N*/10 NaOH to a light blue colour with neutral litmus paper, and another portion adjusted to a red colour against phenolphthalein, while the third portion was made up by mixing equal parts of the other two. After addition of agar and autoclaving, the *p*H was determined colorimetrically with phenol red as the indicator, by addition of equal parts of distilled CO_2-free water and shaking; the clear watery fluid was poured off, and the *p*H determined in this fluid. 24-hour cultures of *M. aureus* were made on the different agar slants, and these cultures were tested in the usual way against the usual phenol solutions.

24-hour culture of M. aureus *at 37° C. on*

Agar slant, *p*H *ca.* 7·3		Agar slant, *p*H *ca.* 7·7		Agar slant, *p*H *ca.* 8	
Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.
1 : 55	0	1 : 55	0	1 : 55	0
1 : 60	+	1 : 60	0	1 : 60	0
1 : 65	+	1 : 65	+	1 : 65	+
1 : 70	+	1 : 70	+	1 : 70	+

(7) *Quantity of phenol solution.*

To ascertain whether the quantity of phenol solution means anything in this method, two series of tests were made with 2 and 3 c.c. of phenol solution, respectively. The result is evident from the following protocol:

24-hour agar slant culture of M. aureus *at 37° C.*

Phenol, 2 c.c. 20° C. 2 min.	Growth after 48 hr. at 37° C.	Phenol, 3 c.c. 20° C. 2 min.	Growth after 48 hr. at 37° C.
1 : 55	0	1 : 55	0
1 : 60	0	1 : 60	0
1 : 65	+	1 : 65	+
1 : 70	+	1 : 70	+

(8) *Dilution of bacterial suspension.*

In order to estimate the significance of the number of bacteria in the suspensions employed, we made the following experiment. As a rule we have made up our bacterial suspensions by suspending in about 3 c.c. of a 0·9 per cent. NaCl solution a 24-hour culture of *M. aureus* on agar slant in test-tubes measuring 15 × 160 mm. For this particular experiment we suspended such a culture in 5 c.c. of 0·9 per cent. NaCl solution. After filtration—as usual, through cotton—1 c.c. of this bacterial suspension was diluted with 1 c.c. of salt solution. To 1 c.c. of the latter suspension was added 1 c.c. of salt solution; and 1 c.c. of this suspension was again diluted with 1 c.c. of salt solution. Thus we had suspensions with the amount of bacteria varying in the proportions 1, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$. These bacterial suspensions were tested against phenol solutions in the usual way. From the results in the following protocol it is evident that it is not necessary to measure the volume of salt solution used in order to suspend the bacteria.

24-hour agar slant culture of M. aureus *at 37° C.*

NaCl suspension no dilution		NaCl suspension 1/2 dilution		NaCl suspension 1/4 dilution		NaCl suspension 1/8 dilution	
Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.
1 : 55	0	1 : 55	0	1 : 55	0	1 : 55	0
1 : 60	0	1 : 60	0	1 : 60	0	1 : 60	0
1 : 65	0	1 : 65	0	1 : 65	0	1 : 65	0
1 : 70	+	1 : 70	+	1 : 70	+	1 : 70	+

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(9) *Variations in the resistance of* M. aureus *to phenol at different stages of growth.*

As a rule it is easy to obtain a 24-hour culture of *M. aureus* to work with. Still, it is of interest to establish whether the resistance of this organism to phenol is different, for example, in an 18-hour culture or in a 30-hour culture. That there is no such difference to be taken into account is evident from the following protocol:

Agar slant cultures of M. aureus *at* 37° *C.*

18-hour culture		24-hour culture		30-hour culture	
Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.
1 : 55	0	1 : 55	0	1 : 55	0
1 : 60	+	1 : 60	+	1 : 60	+
1 : 65	+	1 : 65	+	1 : 65	+
1 : 70	+	1 : 70	+	1 : 70	+

(10) *Viability of* M. aureus *on test cover-slips when kept dry.*

M. aureus survived 1 to 3 weeks on the dried test cover-slips, as shown by the following phenol tests made in the usual way:

24-hour agar slant culture of M. aureus *at* 37° *C.*

Dried suspension ½ hour old		Dried suspension 1 week old		Dried suspension 3 weeks old	
Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.
1 : 55	0	1 : 55	0	1 : 55	0
1 : 60	+	1 : 60	+	1 : 60	+
1 : 65	+	1 : 65	+	1 : 65	+
1 : 70	+	1 : 70	+	1 : 70	+

(11) *Drying time.*

Petri dishes containing cover-slips on each of which one loopful of *M. aureus* suspension was placed, were left to dry in the incubator at 37° C. for ½, 1, 1½ and 2 hr. respectively. The cover-slips were subjected to the phenol test in the usual way with the following result:

24-hour agar slant culture of M. aureus *at* 37° *C.*

Drying time ½ hour		Drying time 1 hour		Drying time 1½ hours		Drying time 2 hours	
Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C.	Phenol 20° C. 2 min.	48 hr. at 37° C
1 : 55	0	1 : 55	0	1 : 55	0	1 : 55	0
1 : 60	+	1 : 60	+	1 : 60	+	1 : 60	+
1 : 65	+	1 : 65	+	1 : 65	+	1 : 65	+
1 : 70	+	1 : 70	+	1 : 70	+	1 : 70	+

(12) *Significance of temperature.*

In order to ascertain how much a minor variation in the temperature may influence the phenol coefficient by our method we made some tests with izal at 15, 18, and 20° C. The result, as shown in the protocol below, shows that the

germicidal power of izal varies considerably with temperature, whereas the germicidal power of phenol appears not to be influenced by variations in temperature within these limits. It is not difficult throughout the year to keep the temperature at 20° C. for the few minutes it takes to make the test, it seems best to adopt this as the temperature in all tests.

24-hour agar slant culture of M. aureus *at 37° C.*

	15° C.	Growth after 48 hr. at 37° C.		18° C.	Growth after 48 hr. at 37° C.		20° C.	Growth after 48 hr. at 37° C.	
Phenol									
	1 : 55	2 min.	0	1 : 55	2 min.	0	1 : 55	2 min.	0
	1 : 60	,,	+	1 : 60	,,	+	1 : 60	,,	+
	1 : 65	,,	+	1 : 65	,,	+	1 : 65	,,	+
	1 : 70	,,	+	1 : 70	,,	+	1 : 70	,,	+
Izal									
	1 : 120	,,	+	1 : 120	,,	0	1 : 120	,,	0
	1 : 140	,,	+	1 : 140	,,	+	1 : 140	,,	0
	1 : 160	,,	+	1 : 160	,,	+	1 : 160	,,	+
	1 : 180	,,	+	1 : 180	,,	+	1 : 180	,,	+

Phenol coefficient: 120/55 = 2·2. 140/55 = 2·5.

(13) *Phenol resistance of* M. aureus *in daily transplants.*

As is evident from the following protocol, the individual strain of *M. aureus* shows no variation in its resistance to the phenol solutions when it is transplanted on 5 successive days:

24-hour agar slant culture of M. aureus *at 37° C.*

Phenol 20° C. 2 min.	Day 1	2	3	4	5	6	Incub. time of subcults.
1 : 55	0	0	0	0	0	0	48 hr. at 37° C.
1 : 60	0	0	0	0	0	0	
1 : 65	+	+	+	+	+	+	
1 : 70	+	+	+	+	+	+	

(14) *Amount of culture employed in tests.*

By using the same platinum loop (*ca.* 4 mm. in diam.) it is easy to place the same amount of bacterial suspension on each cover-slip, a lentil-shaped drop.

(15) *Incubation time.*

The broth medium, into which the cover-slip with the bacteria is transferred after exposure to the disinfectant, must be left in the incubator at 37° C. at least 48 hours, as sometimes growth does not appear until the second day of incubation. On the other hand, we have never seen growth make its first appearance later than 48 hours.

(16) *Dilutions.*

Phenol cryst. Merck is employed in these tests, a 5 per cent. stock solution being prepared by weight.

Dilutions of the disinfectant to be tested are usually prepared from a 5 per cent. solution by means of a capacity pipette that is wiped off carefully with sterile gauze after filling. After emptying, the pipette is washed several times with the sterile distilled water which has been pipetted off beforehand. When

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it has been difficult to prepare a 5 per cent. solution of the disinfectant under analysis, we have made a 1 per cent. solution, and from this stock solution we have then prepared the other dilutions, using delivery pipettes for this purpose.

(17) *Apparatus.*

As already mentioned, the cover-slips used in these tests are 12 mm. square. The flat-bottomed preparation glasses are all 15 mm. in diameter, but two sizes are used to avoid errors from mistaking of disinfectant and water.

The test-tubes used for the broth culture medium are also 15 mm. in diameter.

With these dimensions the cover-slips stand on edge in the disinfectant dilutions as well as in the broth tubes, and thus they are easy to transfer with forceps from tube to tube. This arrangement gives the best possible conditions for the action of the disinfectant and for the growth of the test organism in the veal broth.

(18) *Cover-slip phenol coefficients.*

Alcorcin	43·4	Lysol verum (Medicinalco, Ltd.)	1·6
Alvesco	2·0	Lysol verum (Nörrebro Pharmacy)	1·3
Cresolution (R-W 10/12)* ...	2·3	Paramonochlorphenol ...	3·1
Cresolution (R-W 18/22)* ...	3·7	Phenosalyl (*ca.* 35 per cent. C_6H_5OH) (Pharmaceut. Ass. of Copenhagen)	2·5
Dakinol	1·0	Phenosalyl (*ca.* 40 per cent. C_6H_5OH)	2·8
Desol	3·8	Phenosalyl (*ca.* 50 per cent. C_6H_5OH) (Höechst) ...	2·3
Desol I	3·0	Phenosalyl (*ca.* 70 per cent. C_6H_5OH)	4·2
Douglas municipality fluid ...	2·9	Sublimate...	41·7
Izal (old)	4·0	Vika 101	1·7
Izal (new) (Nörrebro Pharmacy)	2·5		
Izal (latest)	2·2		
Kerol	2·7		
Kilcrobe	3·6		
Kilgerm	2·9		
Cresol soap	1·2		

* R-W coefficients given by the manufacturer.

The phenol coefficients of the following substances are less than 1·0:

Asterol	Resorcin
Benzoas natricus	Rivanol
Chinosol	Sagrotan
Chloramin	Sterisol B
Liquor Carrel-Dakin	Sublamin
Phenolosulfas natricus	Trypaflavin
Phenolosulfas zincicus	

These figures are considerably lower than those obtained by the Rideal-Walker method, but their sequence according to magnitude is about the same, and as far as we are able to judge the figures obtained by the cover-slip method correspond more accurately to the efficiency of the disinfectants in practical use.

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