Proposed Method for the Bacteriological Examination of Flat Surfaces*

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THE development of modern sanitation methods in food and dairy plants has emphasized a need for a procedure which would allow the determination of numbers and types of organisms on flat, hard surfaces. Attempts have been made to develop such procedures but the results have not been entirely satisfactory.

Not only in food and dairy production plants has there been a need for a simple bacteriological test for this purpose, but more recently in the field of food dispensing, particularly in different types of eating establishments. In the latter case there has been a growing need for a procedure which could be used to determine quickly the degree of contamination on the surface of eating utensils. A review of the literature has revealed that various modifications of the swabbing technic have been most widely used in the bacteriological examination of eating utensils, and, in the dairy industry, an agar-disc method described by Hammer and Olson [1] has shown considerable promise as a means of determining the contamination of dairy equipment.

Different swabbing technics have been employed in making field tests in eating establishments, but it was felt that a more rapid and simple method was needed for determining the extent of contamination on flat surfaces. Since the swabbing methods require considerable equipment and technically trained personnel, they are not practical for most routine field work.

The Contact Plate—A modification of the agar-disc method proposed by Hammer and Olson [1] has been developed and has been termed the "contact plate" method. The preparation of contact plates is as follows:

1. Clean No. 2 ($3^{7}/_{16}$" in diameter) can covers whose concentric ridges have been flattened, are placed in clean Petri dishes so that the outside or top of the cover faces the bottom of the Petri dish.
2. The Petri dish and tin cover are sterilized in the hot air oven.
3. The sterilized Petri dish is inverted and the bottom of the dish raised by means of a suction cup, such as is used on automobile windshields to hold a heater in place, so that 16–17 ml. of the new standard agar can be pipetted into the tin cover and allowed to spread in an even layer.
4. The contact plates are then stored at a low temperature (below 7.5° C.) to retard drying and with the Petri dish cover up, to decrease the possibility of contamination. For best results these plates should be used within 3 weeks.

Tests with the contact plate on a flat surface are made as follows:

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TABLE 1

Counts Obtained by Consecutive Contact Plate Tests on a Selected Area of a Single Dinner Plate

Plate Number	Contact Plate Examinations						Total Counts	Per cent Obtained by First Contact Plate
	I	II	III	IV	V	VI		
1	12	6	14	6	4	4	46	26
2	90	39	16	5	10	10	170	53
3	75	50	20	14	10	13	182	41
4	115	147	25	23	19	12	341	34
5	215	50	25	20	18	12	370	66
6	122	7	8	6	7	7	157	78
7	232	163	8	20	25	15	463	50
8	50	25	30	32	10	24	171	29
9	16	4	14	1	0	0	35	41
10	15	15	10	5	5	5	55	27
11	181	130	92	74	52	..	529	34

1. The upright Petri dish containing the contact plate is placed near the surface to be tested.

2. The top of the Petri dish is removed and the contact plate is removed by means of the suction cup.

3. Examination of the agar surface will reveal the presence of contaminants and the depth of the agar layer, *i.e.*, whether it is above or below the level of the edge of the cover.

4. The contact plate is then placed on the surface to be tested and a slight pressure applied. If the surface of the agar is level or slightly above the edge of the cover, very little pressure is required; if it is below, more pressure should be exerted. However, if too great a pressure is applied, the agar may stick to the tested surface when the tin cover is removed. A contact period of approximately 4 seconds is given.

5. The contact plate is returned to the Petri dish and incubated at 32° C.

6. Whether or not a satisfactory contact has been made with the surface can be determined immediately after making a test by observing the tested area. A visible moist spot gives a good indication of the extent of the surface that has been in close contact with the agar.

RESULTS AND DISCUSSION

Six consecutive contact plates were tested on selected areas of 44 china dinner plates. It was found (Table 1) that approximately 44 per cent of the total number of colonies recovered by the 6 contact plates were picked up in one series of tests by the first contact made. In other words, approximately one-half of the organisms were removed by the first contact.

A similar distribution or pattern of organisms was often found on successive contact plates. This would indicate that some of the organisms on the dinner plates existed as colonies from which a number of cells were probably removed with each contact plate test that was made, or that minute particles of food were present which had numerous organisms on the surfaces. This would indicate also that a larger percentage of organisms was recovered by the first contact plate test than shown by the calculation, since the same colony would frequently contribute to the counts of succeeding tests.

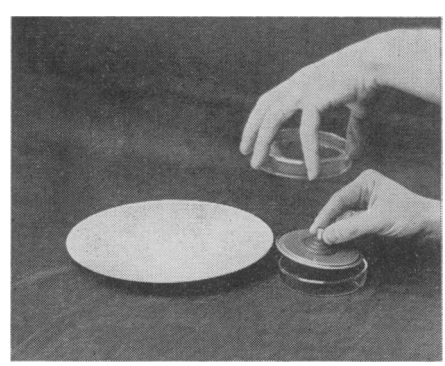

FIGURE 1—Removing contact plate from Petri dish prior to making a test on a dinner plate

About 50 field tests have shown that the contact plate is very useful in obtaining an indication of existing contamination on flat surfaced eating utensils prior to their use in food establishments. The simplicity of the method and the minimum amount of equipment necessary for the procedure have been a great asset in making tests in these establishments during busy periods of serving.

Relation of Counts Obtained by the Contact Plate Method and Various Swabbing Methods—Approximately 250 china plates were tested to compare the contact plate method with a slight modification of the swabbing technic proposed by Fellers, Levine, and Harvey.[2] These workers used a saline solution in the dilution tube and a wooden applicator swab. It was found that the contact plate consistently recovered more organisms from the surface of a plate than did this swab method.

The swabbing method proposed in the New York State Sanitary Code [3] was compared with the contact plate technic. This swabbing method differed from the wooden swab technic in that wire applicators were used in the swabs, a phosphate buffer instead of a saline solution was employed in the dilution tubes, and the dilution tubes containing the swabs were agitated more thoroughly before removing the swab prior to plating an aliquot sample.

It was found that in general the contact plate method recovered more organisms than did a flexible wire swab, testing an equivalent area on the same plate. However, when a stiff wire (63 gauge) swab was employed in testing approximately 40 plates, consistently higher counts were obtained than by the contact plate method (Table 2).

Finding that the stiff wire swab generally recovered more organisms than did the flexible wire swab, 12 tests were made in which the wooden swab method was compared with the stiff wire swab method. It was found (Table 3) that with one exception, more organisms were recovered by the stiff wire swab method.

These experiments indicate that the type of applicator used in the swab, the kind of solution used in the dilution tube, and the extent of shaking the tube before removing a sample are factors warranting consideration when employing a swabbing method for obtaining total counts.

Two possible explanations might account for the consistently higher counts obtained by the stiff wire swab method than by the contact plate method

TABLE 2

Comparison of Counts Obtained on the Same Plate Using the Stiff Wire Swab Method and the Contact Plate Method

Plate Number	Series A		Series B		Series C	
	Wire Swab	Contact Plate	Wire Swab	Contact Plate	Wire Swab	Contact Plate
1	416	115	432	65	248	agar stuck
2	300	101	372	68	100	243
3	280	176	60	21	20	8
4	464	115	160	67	32	7
5	72	5	600	64	148	4
6	388	30	3,860	165	1,712	140
7	84	37	748	too many	196	28
8	1,104	50	3,250	110	112	30
9	1,284	141	2,850	520	408	24
10	344	20	928	500	216	70
11	556	110	96	596	4,220	16
12	...	...	2,080	524	1,336	11
13	...	...	416	50	...	...
14	...	...	6,460	600	...	...
15	...	...	6,000	600	..	...

TABLE 3

Comparison of Petri Plate Counts Obtained from Dinner Plates by the Wooden Swab Method and the Stiff Wire Swab Method

Plate Number	Petri Plate Counts from Equivalent Areas Swabbed			
	Series A		Series B	
	Wooden Swab	Wire Swab	Wooden Swab	Wire Swab
1	69	268	138	867
2	25	116	115	216
3	48	268	spreader	104
4	61	632	47	96
5	420	256	320	too many
6	29	336	500	1,336

(Table 2). First, this type of swab insured a more thorough physical removal of organisms from the swabbed area and, second, the shaking of these swabs in the dilution tubes broke up the clumps of bacteria, resulting in a higher count on subsequent plating than when a contact plate test was made which would show only a single colony for each cell or colony that was touched.

The stiff wire swab method has its place where a total bacterial count is desired and where time and amount of equipment are not the primary factors to be considered. The contact plate method likewise has an important place in sanitary control work. The simplicity and ease with which this latter method can be used in field tests to obtain an indication of the extent of contamination on flat surfaces has been noted on numerous occasions. The speed with which the test can be performed has been of great asset when inspecting flat surfaced dishes in an eating establishment or the equipment in a dairy plant. The contact plate has been found useful in convincing food dispensing operators that the manner in which their dishes are washed has an important bearing on the type and number of organisms remaining on these utensils. Preliminary experiments have also shown the contact plate method to be feasible in determining whether flat surfaced dairy equipment has been cleaned properly.

The substitution of eosin-methylene-blue and Endo's agar for the new standard agar ordinarily used in the contact plate was found effective in differentiating colon organisms encountered on tested surfaces.

SUMMARY

1. A proposed method for studying the bacterial contamination on flat surfaces has been described.

2. The "Contact Plate" method has been compared with various swabbing technics and found to give consistently higher counts than either the wooden swab method or the flexible wire swab method.

3. The stiff wire swab method consistently gave higher counts than did the contact plate method. Possible explanations for this fact are mentioned.

4. The minimum amount of time and equipment required and the ease with which the test can be performed, have shown the contact plate method to be more practical for field tests than any of the swabbing procedures employed.

5. The contact plate method has been found to be a simple and rapid means of determining the efficiency of dishwashing operations on flat surfaced utensils.

REFERENCES

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