

# A SUGGESTED LABORATORY "USE TEST" FOR COMPARING THE CLEANABILITY OF VARIOUS MATERIALS <sup>1</sup>

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The advent of new plastics and rubber-like materials for use in direct contact with milk has raised a question as to their cleanability with respect to removal of bacteria. Past experience has indicated that 18-8 stainless steel with a No. 4 finish can be cleaned satisfactorily with relative ease. This material, therefore, has become somewhat of a standard by which to gauge the cleanability of various new materials, but a standard "test" for evaluating the cleanability and making the comparison is not available.

Standard Methods For the Examination Of Dairy Products (1) does not specifically indicate the testing procedure to be followed but suggests a maximum tolerance of 12.5 colonies per square inch of surface when the Swab Contact Method is used to evaluate the cleanability of dairy equipment. This study, therefore, was undertaken to describe a soiling, cleaning, sanitizing, and testing procedure which could be used to make comparative cleanability studies on materials used in direct contact with milk. Emphasis was placed on simulating the operations as they might be carried out in ordinary plant practices.

## PROCEDURES

The test procedure described below evolved from a number of preliminary trials in which circular discs of the test material were compared with strips. Because of the manual and technical difficulties involved in manipulating the flexible strips in making swab counts, the more rigid discs were selected as test models; discs were also easier to handle on an agar plate for the direct plating of the flat surfaces. Soiling by spraying milk over the test surfaces and by immersing the materials in milk for 10-15 hours were compared. Since no difference in soiling was detected, the latter system was used as it was simpler. Circulation-type washing and hand-brushing were compared, but the former technique was inadequate under our specific laboratory conditions as even the stainless steel discs were unclean after treatment. Hand brushing was, therefore, adopted for the cleaning technique.

## Test Panels

Four rubber-like materials were used in this study. The test materials were made up in discs 1" diameter by  $\frac{1}{8}$ " thick. Type 18-8 stainless steel discs with a finish equivalent to a No. 4 finish were used for comparative purposes. Prior to making the first test, all discs were thoroughly scrubbed using a commercial dairy cleaner at twice the level used throughout the study. This was undertaken to remove "shop soils" which often adhere to new surfaces.

## Soiling

All discs were boiled in water for five minutes before each soiling trial in order to standardize the initial bacterial load by eliminating environmental contaminants which might collect due to dust contamination while the materials were stored between trials. After boiling, the discs were placed in about a gallon of poor quality raw milk containing a few pieces of hay. The discs were allowed to soak in this milk for 10-15 hours at 60-90 F.

## Cleaning and Sanitizing

The soiled discs were rinsed free of milk by flushing with water at 100 F. for two minutes and immersed in a solution of chlorinated alkaline dairy cleaner at 125 F. The detergent <sup>2</sup> was used at one-half the minimum recommended level prescribed for circulation cleaning. Cleaning was accomplished by hand brushing each flat surface eight times with a circular motion using a twisted wire brush 0.5 inches in diameter. The pressure applied in cleaning was standardized as much as possible by the operator. After brushing the top and bottom surfaces, the side surface was cleaned by grasping the flat surfaces and rotating the brush around the disc using short 1-inch strokes; this was repeated once making a total of two brushings on the side. After scrubbing, the disc was replaced in a basket compartment suspended in the detergent tank to equalize the exposure period of all discs to the hot cleaning solution. Following washing, the discs were flushed thoroughly with water at 125 F.

<sup>1</sup> Michigan State Agricultural Experiment Station Journal Series No. 2283.

<sup>2</sup> The detergent used contained 43.0% total alkalinity (as  $\text{Na}_2\text{O}$ ), 4% available chlorine and no organic wetting agent.

and placed in clean tap water at room temperature until ready to sanitize and swab test. The discs were kept wet to prevent the destruction of residual bacteria by desiccation. Sanitization was undertaken by immersing each panel individually for 1 minute in a solution of 100 ppm of chlorine.

#### Testing

The swab contact method was modified slightly to permit swabbing the smaller area involved. The swab stick was moistened with sterile nutrient broth, wrung out, and one flat surface was swabbed by constantly rotating the swab stick and rubbing it three times over the surface. The swab was then immersed and swirled in 10 ml of sterile nutrient broth, wrung out and the other flat surface swabbed in a similar manner. The swab stick was broken off in the nutrient broth and the tube shaken to insure mixing. Two milliliters of the swab solution were immediately plated in duplicate using plate count agar. Incubation was at 35° C for 48 hours. The bacterial count was calculated on the basis of 10 ml of broth. Since the total test area was 1.5 square inches the bacterial estimate should be converted to a 1 square inch basis for comparison with the maximum recommendation of 12.5 per square inches.

#### Impression plate

Following swabbing the flat surfaces of each disc were momentarily pressed against the surface of a Petri plate containing solidified plate count agar. In early trials the discs were allowed to remain on the agar surface, but they often slipped and smeared the plate making counting impossible. The colonies developing on the area of the impression, which was clearly visible on each plate, were counted and calculated on the basis of one square inch.

#### RESULTS AND DISCUSSION

The results obtained using the Swab Contact Method on the four rubber or rubber-like materials and 18-8 stainless steel are summarized in Table 1. Each sample investigated was tested 24 times; the range of the count over these 24 trials is given in parenthesis.

TABLE 1 — SWAB COUNT AFTER BRUSHING AND SANITIZING

Product	No. of trials	Actual count per 4 ml soln.		Calc. No. per sq. in. of surface	
		Range	Aver.	Range	Aver.
1	24	(0-3)	1.0	(0-5)	1.8
2	24	(0-13)	1.9	(0-23)	3.2
3	24	(0-3)	1.2	(0-9)	2.1
4	24	(0-6)	1.3	(0-14)	2.2
Stainless Steel	24	(0-4)	0.9	(0-7)	1.6

No correction was made for the counts obtained on the 58 agar control plates; the counts on these controls ranged from 0 to 2 colonies and averaged 0.5 per plate.

With product No. 2 a count of 23 per sq. in. was obtained only once; the next highest count was 10 per sq. in. on this material. With product No. 4 the highest count was 14 per sq. in. which only occurred once; the next highest count was 7. With the exception of these two instances, all counts were less than 12.5 per sq. in. when the swab contact method was used. With the impression plate procedure, the highest count obtained in any trial was 3 per sq. in. of surface; in most instances no recovery was possible.

It is impossible to duplicate exactly the soiling, cleaning and sanitizing techniques as they are carried out under field conditions, since all of the variables in every day plant practices cannot be duplicated in the laboratory. A complete evaluation of the cleanability of any surface should consider the advantages and disadvantages of the laboratory tests and "field" trials. The laboratory "use" tests described above represent a simple method for comparing the cleanability of one material with that of another under identical conditions of soiling, complete wetting, and cleaning. The soiling, hand brushing and sanitizing procedures are designed to approximate field conditions thereby making direct evaluation of data as feasible as possible.

#### REFERENCES

1. Standard Methods for the Examination of Dairy Products, 10th Edition, 1953, pp. 50.