NEEDED: A RELIABLE FIELD DETERMINANT OF CLEANLINESS

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All milk and food safety and quality control statutes, ordinances, regulations and most operating instructions prescribe that the environment and the equipment in which edibles are produced must be clean prior to each use. Hence, "clean" is probably the most-frequently used word in the vocabulary of regulatory milk and food and industry sanitarians.

In spite of the frequency with which the word is used, concepts of the precise meaning of "clean" vary widely. Sanitarians are generally pragmatic and practical. The connotation of "clean", as applied to meat packing plant or fish cannery floors and walls, or to the supports and exteriors of processing or transport equipment, may differ materially from the concept of "clean" as applied to product contact surfaces of production, transport, processing, or service equipment. The widest differences in concept of "clean" occur between individuals. But varying concepts of "clean", in differing situations and at different times, are often to be noted in the same individual. Such differences in concept of the meaning of "clean" multiply the difficulties of precisely defining the term.

The concept of "clean", as the term is employed in this discussion, will be clarified if it is understood that it shall deal with means for determining the degree of cleanliness solely of equipment employed in the production, transport, storage, processing, or service of foods, beverages, dairy products, and other edibles. It is not to be misunderstood to pertain to the aspesis sought in pharmaceutical manufacturing establishments and in surgical operating rooms.

Consequently, the concept of "clean" as applied to equipment surfaces, for the purposes of this discussion, shall be: "completely free of soilage residual from any preceding use, as well as of extraneous contamination".

In the field of milk and food sanitation, "soilage" includes unremoved overflow or spillage of product; accumulation of unusable product or product parts, such as shells, husks, vines and seeds; accumulation of animal offal or excreta; results of ineffective drainage; rubbish; evidence of rodent and/or insect infestation; presence of soil or dust from the exterior. Soilage and accumulations of these natures is readily visible to those who know what to look for and where to look. In a category of cleanliness in which the objective is attained with tools such as push-brooms, shovels, and high-pressure hose streams, differences of opinion as to when or whether cleanliness has been achieved are unlikely to be pronounced.

Soilage of equipment in which milk or food are stored, transported, processed or served includes residues of product or of one or more of its ingredients or components, deposited water minerals frequently impregnated with milk solids or food particles, film of detergent or sanitizer chemical salts, human saliva and oral bacteria, and lipstick. Soilage of these types is not in all instances as readily visible as is lipstick.

Not readily visible soilage is frequently unnoted in its incipiency and tends to become cumulative. Most experienced sanitarians will probably concede that much of the milk and food equipment currently in routine service approaches technical cleanliness only in degree. In fact, a knowledgeable essay of the situation appears to warrant the conclusion that "relatively clean" is the most accurate term for the condition of much of the milk and food equipment currently in use.

After sixty or more years of progressive advancement in other phases of milk and food sanitation, what is the explanation of the absence of a standard of "technical cleanliness" in sanitation legislation, the attainment of which all regulatory and industry sanitarians aspire? Is it possible that the detergents employed are not sufficiently powerful? Are washing techniques to blame?

In the absence of widely-employed reliable field test procedures for the determination of technical cleanliness, no reference bank of experience has been accumulated to serve as the basis for concluding in the field whether the cleaning capacities of detergents or the washing techniques, or both, are to blame for the dilemma in which sanitarians find themselves. If that statement is subject to challenge, suppose we review the list of tests which have been developed for determining the cleanliness of milk and food equipment prior to use.

First, however, it is desirable that the implication that much milk and food equipment is NOT technically clean prior to use be established, as the premise for subsequent discussion. So long as the vast majority of the appraisals of the state of cleanliness, after washing, of milk and food equipment surfaces are predicated upon observations by the unaided vision of milk producers and operating or clean-up

1Adapted from a paper presented at the 51st Annual Meeting of the Chemical Specialties Manufacturers Association, Atlantic City, N. J., December 7, 1964.
personnel, or by the spectacle-supplemented vision of sanitarians, it must be conceded that a number of factors affect the reliability of the findings. Some of these factors are:

1. The accuracy of vision (whether unaided or whether augmented by spectacles) and perceptiveness in observation vary widely among individuals.

2. The intensity of lighting — natural or artificial — is usually inadequate and appraisals whether augmented by spectacles) and perceptiveness in observation vary widely among individuals.

3. Films of some product residues and even light encrustations of milkstone are masked when equipment surfaces are wet. Few regulatory inspections are prolonged or postponed so as to provide an opportunity for equipment to dry.

4. Films of components of some products (proteins, for instance) are not readily detectable visually even when equipment product-contact surfaces are dry.

Every visual appraisal of the state of cleanliness of equipment surfaces is subject to reduction of its reliability by one or more of the factors enumerated. Since regulatory inspection, on the average, occurs not more than once in 200 or more uses of equipment, it is quite apparent that claims or even assumptions of routine technical cleanliness of equipment prior to its every use are unsupported and possibly untenable.

What accounts for the relative lack of emphasis, by regulatory sanitarians, upon the maintenance of a closer approach to technical cleanliness of milk and food equipment? A thoughtful review of trends during a personal experience of nearly fifty years in milk and food sanitation leads to the conclusion that at least two causes may be said to have been contributory or responsible.

First, for more than a generation (since the late 1930's) the emphasis has been upon the sanitization of equipment to keep the total bacterial content within legal limits or of beverage service glasses to prevent the spread of oral infection. The effectiveness of the equipment washing operation was relegated to the status of a relatively minor factor in sanitation while progressively higher concentrations of sanitizing solutions were recommended.

Second, no officially-accepted practical method or device for the field demonstration of technical cleanliness is available to regulatory sanitarians and quality control personnel. Without such a test procedure conveniently usable anywhere in the field, and officially recognized to be reliable so that findings are acceptable as evidence in court, sanitarians are seriously handicapped in the assay of the state of cleanliness of equipment. This situation constitutes a rather pointed commentary on the progress made in more than half-a-century in a fundamentally-important aspect of milk and food sanitation — the washing operation.

The statement that there is a lack of convenient and reliable tests for cleanliness is made on the basis of the author's acquaintance with rather considerable literature on the general subject of the evaluation of the effectiveness of detergent solutions, for which various tests or measures have been devised. An analysis of the subject matter of forty or more papers indicates it to be classifiable as follows:

(1). Means for determining the comparative effectiveness of detergent solutions, employing for each series of tests blocks or discs of the same material, surface finish, and surface area. Proposed determinants of detergent effectiveness have included: (a) measurement of the amount of residual soil of various suggested compositions which had been dried or baked on the test blocks or discs, (b) estimation of the number of residual bacterial cells, a heavy inoculum of which had been dried on the blocks, and (c) in one proposal, estimation of the number of residual bacterial cells after washing and sanitization of the test blocks.

(2). Methods for assaying the “cleanability” of equivalent areas of materials of various composition and surface finish after soiling with typical milk or food products and then washing by a controlled procedure with a solution of a representative formulation of a typical detergent. In several procedures findings are also predicated upon the relative total counts of residual bacterial cells, either after washing or following washing AND bactericidal treatment.

A variant of this test procedure consists of the determination of the effect of detergent and sanitizing solutions upon the surface finish, distortion, and compound stability of sample blocks of plastic materials of different compositions.

(3). Methods for determining either the comparative effectiveness of detergent solutions or the cleanability of materials and surface finishes by radiological measurement. Isotope-tagged elements or bacterial cells are added to synthetic soils or to product normally processed and, after the washing of the surfaces, the residual radio-activity is determined with a Geiger Counter.

It must clearly be apparent that, although the radiological test procedure might have limited field application for the determination of equipment cleanliness in operations in which product of very high quality or of a pharmaceutical nature is prepared in large volume, neither it nor either of the other two types of test procedure outlined has the remotest practical application to the general field-testing needs of regulatory sanitarians.

As a matter of fact, sanitarians have developed on their own initiative a number of more or less reliable tests for the cleanliness of equipment surfaces. Armbruster (1) lists nine such tests. A number of the...
tests of cleanliness employed are really observable physical phenomena which may be noted either when surfaces are clean or are not clean, as the case may be. These may be enumerated as follows: (a) the water break in which the degree of cleanliness is indicated by the complete sheeting off of the rinse water without separating into rivulets; (b) the droplet test whereby droplets adhere to unclean surfaces; (c) the salt test utilizing salt sprinkled on wet surfaces to render more visible the adhering moisture; and (d) the carbonated water test whereby gas bubbles adhere to soil films on unclean surfaces.

The presence of actual soil still may have to be proven to the satisfaction of management or to the individual responsible for the washing operation and the value of such tests as admissible evidence in court is questionable.

In contrast to observable phenomena as indices of the presence of soilage, a number of methods have been advanced for the positive determination of the presence of residual soilage on washed surfaces by means of reproducible physical or chemical tests. However, because only completely negative findings of tests of this nature provide reliable evidence of technical cleanliness, incorrect or careless test procedure may provide findings which are not only misleading, but may also result in unjustified punitive action.

One such physical test makes use of the fluorescence of some organic matter under ultraviolet or "black" light. When the test is conducted in darkness and the residual soilage consists of matter which has fluorescent characteristics, contamination which might otherwise escape inexperienced observation is revealed. However, reliable findings are dependent upon the relative absence of light from other sources, the strength of the batteries used, and the wavelength of the ultraviolet light generated.

In the late 1940's E. Domingo (4) amplified the effectiveness of ultraviolet light in revealing the presence of residual soil, particularly on dishes and kitchen utensils, by first flooding the surfaces to be examined with a water-soluble fluorescent dye. Subsequently, dry powdered fluorescent dyes have been employed for dusting on surfaces to be examined under "black" light. The dye adheres to all types of contamination (after rinsing) and reveals its presence under less intensive ultraviolet light than is required when dye is not employed.

Within the past several years Armbruster and Ridenour (2) have devised a test procedure for determining the effectiveness of the washing-sanitizing of soda fount and tavern glasses, also making use of a dye. Washed and sanitized and drained dry glasses are dusted lightly with a mechanical mixture of talc (85%) and Safranin-O dye (15%). When wetted the dye becomes red. Dust ed glasses are subjected to a gentle rinse for 5 seconds, or until runoff is no longer red. Since the dye-impregnated talc clings tenaciously to residual organic matter on the glass, the appearance of red spots or areas on drained glasses is an index of ineffective washing.

Beck (3), who employed this test in a study comparing its findings with bacteriological swab counts on approximately 1300 soda fount glasses, is enthusiastic concerning the practicality of the test and its psychological and educational value. However, he warns against its use on plastic tableware or on cracked or eroded china. The 15% Safranin-O concentration of the applied powder makes the test extremely sensitive in the hands of all except color-blind individuals. The procedure is quite suitable for the testing of glasses, dishes, or other equipment or parts which can be dusted and flooded over a sewer-connected sink or wash vat. This test procedure, however, appears to be quite unsuited to field application to stationary equipment, such as farm milk cooling tanks, automotive transportation tanks, storage tanks, processing vats, and milk piping circuits. The talc-dye powder becomes air-borne in the slightest draught and adheres to all objects with which it comes in contact. Upon being wetted or becoming damp it becomes RED and this includes the hands, faces and starched shirts of test personnel and observers.

There remains for discussion only the bacteriological swab-count as a determinant of the approach of a washed surface to technical cleanliness. The bacteriological swab-count was devised as a means for approximating the numbers of micro-organisms residual on surfaces which have been washed and sanitized, and any number less than 100 per 8 in.² of swabbed surface has officially (5) been declared to be indicative of an acceptable degree of safety.

In recent years, however, an adaptation of the above-described equipment surface swab-counts has come into quite general use as a measure of the effectiveness of only the first of the components of the successive washing and sanitizing operation. The thesis is that completely effective washing should result in a technically clean surface on which few micro-organisms should be residual or could long survive, if residual.

Although this theory is plausible and is widely held, the literature is replete with data to the effect that no fixable relationship between the degree of cleanliness and the magnitude of the bacteriological swab-count of a washed surface appears to exist. The most recent data are those of Beck (3), who found that, of 723 soda fountain glasses with swab-counts of less than 100 per 8 in.², 240, or 33.2%, reacted positively to the talc-safranin-O test; and, of
necessary further to belabor the lack of a suitable
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more "cleanliness" of various material surfaces and finishes as determined by lab-
ory tests rather than upon the development of a practical field test for determining the degree of
Meanwhile, several manufacturers of sanitation de-
tergents are employing a recently-developed means
to determine the degree of cleanliness of equipment
in use or proposed, have been discussed and fault
has been found with all of them for field application.
algards for a practical field test for degree of technical cleanliness of milk
and food equipment surfaces? It would appear that
the desiderata should necessarily include the follow-
ing:
1. Test findings must be immediately determinable
and interpretable. This is fundamental, since it
avoids the need for a return to report the results
and to inaugurate remedial steps, if the need is indicated.
2. The test must be applicable to surfaces whether
wet or dry.
3. Test findings should be indicative of the degree
of the approach to technical cleanliness; i.e., they
should register the presence of residual soilage,
whether gross or normally invisible, of grease, oil,
proteins, water minerals, or "stone".
4. Test findings should be available in a form
which is subsequently demonstrable as evidence or
which may be kept as a record. Milk sediment test
discs are an example.
5. Re-washing of the tested area or equipment must
be unnecessary.
6. Testing equipment must be of a size, weight,
and shape to result in a minimum of inconvenience
in transport and use.
7. The test procedure must be uncomplicated.
8. The initial cost of the testing equipment must
be within the means of most regulatory agencies and
the cost of the test indicating material or medium
for each test must be nominal.
At this stage of this discussion, it should be un-
necessary further to belabor the lack of a suitable
and reliable means for field determination of the de-
gree of equipment cleanliness and simultaneously,
of the effectiveness of the washing operation to which
it has been subjected. In an effort to find an avenue
for the relief of this situation, a Task Committee
created by the 3-A Sanitary Standards Committees,
an organization which has been engaged for the past
twenty years in the development of sanitary stand-
ards for milk and dairy equipment, is currently en-
gaged in a study of the problem. However, as ap-
ears to be par for these studies, the emphasis again
is apparently to be on the "cleanability" of various
material surfaces and finishes as determined by lab-
oratory tests rather than upon the development of a practical field test for determining the degree of
"cleanliness".

The development of a practical and reliable means
for determining the degree of cleanliness of a surface
which also provides a record would be of great in-
terest and value to sanitarians in the milk and food
industry. The availability of such a test for "clean-
ness" can surely be expected to result in wider recog-
nition of deficiencies in equipment sanitation and a
proportionate improvement in equipment cleaning
techniques.
TIPS FOR EFFECTIVE MANAGEMENT

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Management, basically, is getting things done through people. People, therefore, are the most important resource available to management and the managing of people is one of the most important functions of management. The "tips for effective management" which are presented here are concerned primarily with management's dealings with subordinates. These tips, if followed, should help the manager do his job better in building an alert, effective, and responsible staff.

1. Emphasize skill, not rules, in your organization. Judge your own actions and those of your subordinates by their effects—effects in terms of increasing both the competitive strength of your business and the satisfaction of the human needs of the people who work in it. Go easy on pat rules for running a business. Doing it "by the book" isn't always the most satisfactory way. If an unorthodox solution works effectively and pleases the people who use it, don't discount it just because it doesn't seem exactly "according to Hoyle."

2. Set a high standard for your organization. If you are irregular in your work habits, late for appointments, fuzzy in expressing yourself, careless about facts, or bored in attitude, your subordinates probably will be, too. If, on the other hand, you set a high standard for the organization, in all probability your subordinates will be eager to follow your good example.

3. Know your subordinates and try to determine what is important to each. Continuous study of individuals is a "must" for getting things done through people. Motives and attitudes are important tools for the executive, and they can be determined only by study. Since security is the main drive in many people, giving recognition to the contribution of others and to their role in your concern is a useful starting point in getting the best from men of future executive caliber.

4. Give your subordinates objectives and a sense of direction. Subordinates should know where they're going, what they're doing, and why they're doing it, in order to plan their time intelligently and to work effectively. Good junior executives seldom enjoy working just day-to-day. Therefore, make clear the relation between their day-to-day work and the larger company objectives.

For example, don't merely ask people to analyze the variable costs of a particular department. Tell them also that it's part of a longer-range plan to provide leeway for salary increases, and that the knowledge they provide will strengthen the operating efficiency of your company.

5. Try to listen thoughtfully and objectively. The executive who knows his people—their habits, worries, ambitions, touchy points, and pet prides—comes to appreciate why they behave as they do and what motives stir them. The best and fastest way to know them is to encourage them to talk freely, without fear of ridicule or disapproval. Try to understand how others actually feel on a subject, whether or not you feel the same way. Never dominate a conversation or meeting by doing all the talking yourself if you want to find out where your people stand.

References
