# A SIMPLIFIED PROCEDURE FOR SANITIZING GLASSES AT SOFT DRINK STANDS

H. HELLMAN AND H. SHUVAL

*Division of Sanitation, Ministry of Health, Jerusalem, Israel*

(Received for publication April 8, 1955)

**A simplified method of sanitizing drinking glasses used in soft drink stands in Israel is described. A pressure spray device served as a pre-rinse and final rinse, while the brushing, detergency and sanitizing phases were combined into one operation by the use of a brush-container filled with a quaternary ammonium based detergent sanitizer. The contact time between the glasses and the sanitizer was from five to ten seconds and satisfactory low bacterial counts were obtained by the swab test method.**

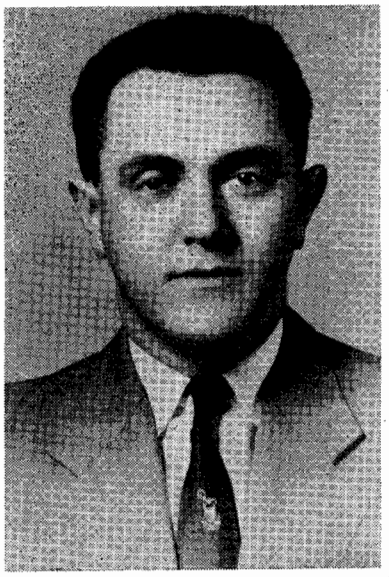
The object of this study was to develop a simplified yet effective method of sanitizing drinking glasses used in soft drink stands (kiosks) in Israel.

The common practice has been to "wash" glasses after each use by placing the glass over a pressure spray device (Figure 1) which sprayed the inside and outside of the glass with water. Former objections to this device as a plumbing hazard can be obviated by proper installation.

The obvious ineffectiveness of this spray method in sanitizing glasses was clearly demonstrated by a field survey run by the Division of Sanitation of the Ministry of Health. The standard swab rinse test (1) was used to test the bacterial densities on the glasses rinsed by the sprayer method. The median bacterial count found on 108 glasses at different soft drink stands in the City of Jerusalem was 3,120 bacteria per glass (Table No. 1), the maximum count being 38,500 and the minimum being 218. The standard count considered as acceptable is 100 bacteria per glass.

The problem of introducing an effective and practical method of glass sanitization was complicated by the limited space available in the soft drink stands, as well as the fact that stand operators have little time to wash glasses. The soft drink stands which are so popular in Israel are generally small booths, spacious enough to contain one operator who is usually hard pressed for time in his task of selling cakes, candy, cigarettes, newspapers, as well as soft drinks served in glasses.

The installation of a two basin hot water system (1) would be difficult from both a technical and financial point of view, and in addition difficulties would arise in the use of hot glasses. The standard three basin method (1), using a chemical sanitizer, was likewise not felt to be feasible for reasons of space and the difficulties in getting the operators to comply with the time consuming washing procedure. Under present day conditions in Israel single service paper drinking cups had to be ruled out on financial grounds.



Hillel I. Shuval received the B.S. degree in chemical engineering from the University of Missouri in 1948 and the M.P.H. degree from the University of Michigan in 1952. In 1949 the author was appointed as a sanitary engineer in the Ministry of Health of the newly formed government of Israel. He now holds the position of Asst. Director of the Division of Sanitation, of the Ministry of Health in Israel. In 1951 he was awarded a World Health Organization Fellowship in Environmental Sanitation.

## THE SIMPLIFIED TECHNIQUE

A series of experiments were carried out, both in the laboratory and in the field, in an attempt to develop a simplified, yet effective, method of glass washing and chemical sanitization. The importance of brushing the glass thoroughly in a detergent solution has been pointed out by both Mallman (2) and Andrews (3) and was of necessity to be included in the simplest of glass washing techniques. The need for sanitization of the glasses in addition to detergent and brushing action was also considered essential.

In the simplified procedure which was developed, the existing pressure spray, which is already in universal use, provides a first rinse which removes most traces of syrups which might remain in the glass. In

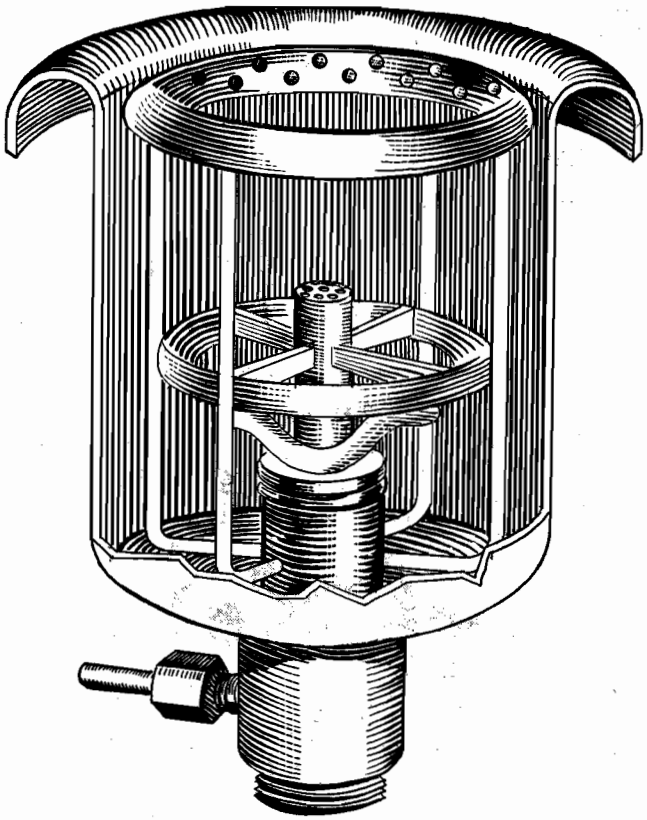


Figure No. 1 — Standard Pressure Spray Type Glass Rinser.

the second step, the brushing, detergency and sanitizing phases were combined into one operation. In cooperation with equipment manufacturers a single brush-container (Figure 2) was designed for this purpose. The container has removable brushes fixed to the inside, which give the glass a thorough brushing in a detergent-sanitizer solution both inside and out, when the inserted glass is twisted back and forth by the operator. The third step in the operation is a final rinse in the pressure sprayer.

This glass washing procedure required little space and could be installed with little cost. Furthermore it is simple enough and rapid enough to meet the needs of the average soft drink stand operator.

## HYPOCHLORITES

The problem of an adequate detergent-sanitizer presented certain difficulties. The first detergent-sanitizer studied was a hypochlorite based product combined with a non-ionic detergent. A solution containing 250 p.p.m. of active chlorine was initially prepared and placed in the brush-container which was installed in an operating soft drink stand. Swab rinse tests were made on the glasses after washing. It may be observed from the results shown in Table 2 that within one and one-half hours after the hypochlorite solution had been introduced, and after washing 64 glasses, the chlorine concentration had been reduced from 250 ppm to 30 ppm. During this same interval the bacterial counts per glass increased from acceptable densities during the first 40 minutes to numbers well in the hundreds.

TABLE 1 — SWAB TEST RESULTS FROM GLASSES RINSED BY PRESSURE SPRAY ONLY

| Glass number | Bacteria per glass | Glass number | Bacteria per glass |
|---|---|---|---|
| 1 | 218 | 15 | 4,560 |
| 2 | 272 | 16 | 4,750 |
| 3 | 560 | 17 | 6,080 |
| 4 | 580 | 18 | 7,000 |
| 5 | 700 | 19 | 8,460 |
| 6 | 840 | 20 | 8,750 |
| 7 | 1,000 | 21 | 10,000 |
| 8 | 1,710 | 22 | 10,000 |
| 9 | 1,900 | 23 | 10,500 |
| 10 | 1,900 | 24 | 16,800 |
| 11 | 1,900 | 25 | 24,500 |
| 12 | 2,090 | 26 | 28,000 |
| 13 | 2,280 | 27 | 38,500 |
| 14 | 3,120[a] | | |

[a]Represents the median value.

The reduction in the strength of the hypochlorite solution was at first associated solely with the addition of organic matter to the brush-container. However, it was noted in a laboratory study of this problem that a rapid reduction of the free chlorine content took place in the brushing container without any glasses being washed and with no addition of organic soil. The chlorine content in the brush-container dropped from 216 p.p.m. to 18 p.p.m. on standing seven hours (Table 3). The rapid loss of strength of the chlorine was not noted in metal or glass containers which did not contain the brushes into which the same hypochlorite solution was placed. It is felt that the chlorine demand of the brushes themselves may have contributed to the rapid loss of effectiveness of the sanitizing solution.

In addition to the above mentioned difficulty, hypochlorites were not considered a desirable sanitizing agent, in this case, since a definite chlorine taste was imparted to the glasses despite the final rinse.

## QUATERNARY AMMONIUM COMPOUNDS

The glass washing procedure as outlined above was used successfully with a Q.A.C. (quaternary ammonium compound) based detergent-sanitizer (polyalkyl naphthylene methyl pyridinium chloride) which had been tested for its bactericidal efficiency by the Weber and Black method (4).

The Weber and Black test results indicated that expected bacterial kills of 99.99% in 30 seconds were not achieved unless the Q.A.C. solution had a concentration of at least 600 p.p.m. of active ingredient. Hardness of the diluting water has been shown by Butterfield, *et al* (5) to reduce the bactericidal efficiency of quaternaries. The Jerusalem water used had a total hardness of 250 p.p.m. ($CaCO_3$), and could well account for the high concentration of sanitizer required to achieve the desired results.

## FIELD TESTS

In field tests of the new glass sanitizing procedure a concentration of 1000 p.p.m. of the Q.A.C. was used. This being done to insure that a minimum of 600 p.p.m. would remain at the end of a day's run and to ensure proper sanitization despite the short period of contact of five to ten seconds, which was the maximum obtainable in actual practice. The results of swab tests[1] taken from glasses washed under actual field conditions in soft drink stands which had installed the experimental glass washing technique conformed to acceptable standards. The median bacterial density was 25 per glass for 67 glasses from five stands participating in the field test. The maximum count was 116 bacteria per glass which was only slightly above the required standard of 100 bacteria per glass (Table 4). To date, several hundred soft drink stands in all parts of the country have installed the new glass washing procedure and preliminary field reports indicate that satisfactory results are being obtained consistently.

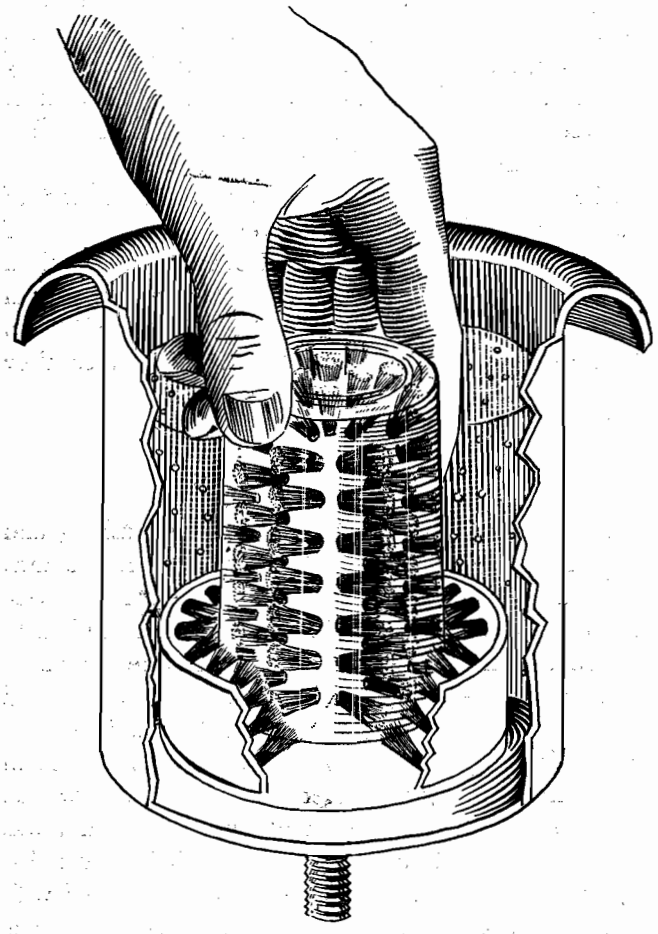


Figure No. 2 – Special Brush-Container Sanitizing Unit.

TABLE 2 – LOSS OF SANITIZING EFFECTIVENESS OF HYPOCHLORITES WHEN USED IN BRUSH-CONTAINER GLASS WASHER

| Elapsed time (min.) | Bacteria per glass | Available Chlorine (p.p.m.) |
|---|---|---|
| 0 | 23 | 250 |
| 10 | 3 | |
| 15 | 8 | |
| 20 | 5 | |
| 25 | 27 | |
| 30 | 30 | |
| 35 | 24 | |
| 40 | 25 | |
| 45 | 950 | 50 |
| 50 | 760 | |
| 55 | 380 | |
| 60 | 36 | 40 |
| 65 | 380 | |
| 70 | 475 | |
| 80 | 52 | |
| 90 | 950 | 30 |

## MECHANICAL REMOVAL

In order to determine whether the effects of mechanical removal with the aid of the detergent alone could produce the same low counts on glasses as was achieved with a detergent-sanitizer, an additional study was made. The procedure used for glass washing was identical to that used in the previous field tests, except that a detergent alone replaced the detergent sanitizer. The concentration of the detergent used was 600 p.p.m.

Swab tests taken from 56 glasses washed in the detergent solution gave a median bacterial density of 7,000 per glass with a maximum of 19,250 and a minimum of 2090 (Table 5). From a test made at the end of the run it was noted that the detergent washing solution was very heavily polluted with bacteria, which apparently had been built up during the washing procedure. Such a bacterial build-up did not occur when a detergent-sanitizer was used, and in fact the sanitizer solution was found to be free of bac-

[1]Asolectin was added to swab test solutions to serve as a deactivator for the quaternary.

TABLE 3 — COMPARISON OF AVAILABLE CHLORINE LOSSES IN BRUSH CONTAINER WASHER AND IN WASHERS WITHOUT BRUSHES

| Elapsed time (hr.) | Elapsed time (min.) | Available chlorine (p.p.m.) Glass container without brush | Metal container without brush | Metal container with brush |
|---|---|---|---|---|
| 0 | 0 | 216 | 216 | 216 |
| 0 | 15 | 216 | 216 | 189 |
| 0 | 45 | 212 | 216 | 182 |
| 1 | 15 | 216 | 216 | 151 |
| 1 | 45 | 216 | 216 | 126 |
| 2 | 45 | 216 | 216 | 105 |
| 3 | 45 | 216 | 216 | 74 |
| 4 | 15 | 216 | 209 | 31 |
| 6 | 0 | 212 | 205 | 22 |
| 7 | 0 | ..... | ..... | 18 |
| 11 | 0 | ..... | ..... | 18 |
| 13 | 45 | ..... | ..... | 12 |
| 25 | 45 | 209 | 175 | 2 |

TABLE 4 — RESULTS OF SWAB TESTS ON GLASSES WASHED WITH A DETERGENT-SANITIZER CONTAINING A QUATERNARY AMMONIUM COMPOUND

| Glass number | Bacteria per glass | Glass number | Bacteria per glass |
|---|---|---|---|
| 1 | 3 | 9 | 25[a] |
| 2 | 6 | 10 | 30 |
| 3 | 8 | 11 | 35 |
| 4 | 11 | 12 | 36 |
| 5 | 13 | 13 | 43 |
| 6 | 14 | 14 | 52 |
| 7 | 17 | 15 | 72 |
| 8 | 24 | 16 | 116 |

[a]Represents the median value.

TABLE 5 — RESULTS OF SWAB TESTS ON GLASSES WASHED WITH DETERGENT ONLY

| Glass number | Bacteria per glass | Glass number | Bacteria per glass |
|---|---|---|---|
| 1 | 2,090 | 8 | 7,000[a] |
| 2 | 2,660 | 9 | 8,750 |
| 3 | 7,000 | 10 | 8,750 |
| 4 | 7,000 | 11 | 10,000 |
| 5 | 7,000 | 12 | 10,500 |
| 6 | 7,000 | 13 | 10,500 |
| 7 | 7,000 | 14 | 19,250 |

[a]The median value is 7,000.

teria at the end of the run. Since this study was done in the laboratory with artificially polluted glasses the results are not felt to be fully indicative of what might be expected in the field. The glasses were polluted to a much greater extent than would be found under average field conditions. Controlled field studies on this aspect were not made therefore the results are not considered conclusive. The data do seem to indicate that bacterial build up in the detergent solution negated any significant mechanical bacterial removal obtained by brushing in the detergent solution. However, it is felt that more study should be made on this question.

## DISCUSSION

Generally it has been considered good practice to separate the cleaning and sanitizing phases of utensil washing so as to minimize the organic load in the sanitizing solution. However, in the case of glasses from soft drink stands being considered here, it appears that the pre-rinse in the pressure spray is sufficient to remove the major portion of any organic matter which might cling to the sides of the glass. The remaining soil is removed by brushing in a detergent-sanitizer and the resulting loss of bacterial efficency is not great as has been shown by field test results. The high initial concentration of detergent-sanitizer used, compensates for loss of strength during the day's run.

The period of contact between the glass and the sanitizer is considerably shorter than the two minutes which is generally specified for chemical sanitization. However, field tests clearly indicate that satisfactory results are being obtained with periods of contact between five and ten seconds. It would be desirable not to rinse the glass in the pressure spray after sanitizing so as to insure an even longer period of contact with the sanitizer, however, the question of the unknown toxicity of the Q.A.C. in the higher than usual concentrations being used indicated the final rinse as a precautionary measure. The public also required this rinse on esthetic grounds since they did not want "soap" in their drink.

## SUMMARY AND CONCLUSIONS

A simplified and effective method of washing and sanitizing drinking glasses used in soft drink stands in Israel was developed. A pressure spray device served as a pre-rinse and final rinse, while the brushing, detergency and sanitizing phases were combined into one operation by the use of a specially designed brush-container filled with a detergent-sanitizer. It is recognized that this device has been discredited in the United States in the past largely because it was so installed as to constitute a plumbing hazard and was used without detergent or sanitizer. When installed above a sink with an adequate air gap and used with detergent and sanitizer such objections are overcome.

A hypochlorite based detergent-sanitizer was found to lose its bactericidal efficiency in a short time in the brush-container even when no glasses were washed in

it. This phenomenon is apparently associated with the high chlorine demand of the brushes themselves. In addition, hypochlorites were found to be undesirable, in this case, due to the traces of odor that clung to the glasses.

A quaternary ammonium compound based detergent-sanitizer used with an initial concentration of 1000 p.p.m. was found to produce satisfactory results when used in the trial procedure. The contact time between the glass and the detergent sanitizer was from five to ten seconds. In a field test involving soft drink stands using the trial procedure the median density was found to be 25 bacteria per glass while a survey of stands rinsing glasses in the usual pressure spray device alone gave a median density of 3,120 bacteria per glass.

The same washing procedure using a detergent alone, instead of a detergent-sanitizer, did not produce satisfactory results.

The authors are grateful to Dr. W. Silberstein, Director of the Ministry of Health Central Laboratory, for his help and guidance, and to Dr. K. Rabinovitz and Dr. H. Drimer, bacteriologists, and to Mr. Meyer Rigby, chemist, who played such important roles in the laboratory phase of this study.

## REFERENCES

1. Ordinance and Code Regulating Eating and Drinking Establishments. Public Health Service Publication No. 3F. 1943.

2. Mallman, W. L., and D. Kahler. Studies on Dishwashing. Research Bul. No. 2, Nat. Sanitation Foundation. 1949.

3. Andrews, J. Methods of Sanitizing Eating and Drinking Utensils. Pub. Health Repts. **59**: 1103. 1944.

4. Weber, G. R. and Black, L. A. Laboratory Procedure for Evaluating Practical Performance of Quaternary Ammonium and Other Germicides Proposed for Sanitizing Food Utensils. Am. J. Pub. Health, **38**: 405. 1948.

5. Butterfield, C. T., Wattie, E. and Chambers, C. W. Bactericidal Efficiency of Quaternary Ammonium Compounds. Pub. Health Rep. **64**: 1039. 1949.