UNPUBLISHED PRELIMINARY DATA

Protection Branch Report of Test No. 15-65

Comparison of the Level of Microbial Contamination on Stainless Steel, Aluminum, Glass, and Lucite

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Prepared by:

Dorothy M. Portner

DOROTHY M. PORTNER
Decontamination Section
Protection Branch

Approved by:

Robert K. Hoffman

ROBERT K. HOFFMAN
Chief, Decontamination Section

Herbert M. Decker

HERBERT M. DECKER
Chief, Protection Branch

Charles R Phillips

CHARLES R. PHILLIPS
Chief, Physical Defense Division

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Physical Defense Division
Fort Detrick, Frederick, Maryland

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This study was undertaken for the National Aeronautics and Space Administration to determine the number of microorganisms that can be recovered from various surfaces after exposure to room air for a given period. Stainless steel, which has been used extensively in this Laboratory for studies to determine the contamination level obtained from aerial fallout [1,2], is one of the surfaces purposed by NASA to be used for monitoring microbial contamination in clean rooms where spacecraft will be assembled. Kereluk [3] reported that the level of microbial contamination collected on such materials as stainless steel, aluminum and glass was about one-tenth that obtained on Lucite. Since it is important when monitoring, to use a surface that will give an accurate index of the microbial contamination present, a comparative study of the contamination level on stainless steel, aluminum, glass and Lucite was undertaken and the results are reported herein.

MATERIALS AND METHODS

For each of three tests in this study, ten stainless steel, ten aluminum, ten glass, and ten Lucite (acrylic plastic) strips (1 x 2 inches) were washed in detergent, rinsed in distilled water, and dried. Then they were grouped in four rows on a tray and sterilized with ethylene oxide gas. Subsequently, the tray of strips were exposed to room air for 20 days. Each strip was then placed in 50 milliliters of 0.05 per cent Tween 20 solution, shaken, and 25 milliliters of the sample assayed for viable microorganisms by the pour plate method. The sample, cultured in tryptose agar, was incubated at 37 C for 48 hours before colony counts were made.

RESULTS AND DISCUSSION

The results given in Table I were statistically analyzed. There was no significant difference in the microbial recovery from the four surfaces in any one test, but significantly different levels of surface contamination were obtained from test to test, each exposed to environmental conditions for a 20-day period. The relative humidity during the three tests ranged from 30 to 60 per cent.

It is suspected that the relative humidity was low in the room used in Kereluk's tests. Under this condition, "electrical static charges on dielectric materials or parts can cause problems due to particle attraction at relative humidities below 30%" [4]. As a consequence, the Lucite samples in Kereluk's tests could act as electrostatic precipitators and considerably more microorganisms would be attracted to the charged surface resulting in a higher contamination. In our second test, five strips of each surface were rubbed with silk to deliberately induce an electrostatic charge before the strips were placed on the shelf for the 20 day exposure. The first five microbial recoveries listed under Test 2 (Table I), which were obtained from strips that were deliberately charged, did not differ appreciably from the last five recoveries obtained from strips that were not charged. However, since these tests were conducted at a high ambient relative humidity, the induced electrostatic charge would not be retained.

The change in level of surface contamination from test to test can probably be attributed to the following circumstances. Local construction work was in progress during the periods when Test 1 and Test 2 were conducted. The significantly higher level of contamination obtained in Test 1 was due to the phonememal increase in mold population that occurred during the late summer months when the test was conducted.

The data indicate that microbial contamination on all four surfaces, stainless steel, aluminum, glass and Lucite, was essentially the same. Therefore all four surfaces would be satisfactory for monitoring microbial contamination in any clean room that meets the Federal Specification [4] since these rooms are required to have a moderate relative humidity.

References

1. Protection Branch Report of Test No. 1-64: Microbial Contamination Obtained on Surfaces Exposed to Room Air or Touched by the Human Hand. Physical Defense Division, Fort Detrick, Md. 22 July 1963.

2. Protection Branch Report of Test No. 11-65: The Level of Microbial Contamination in a Clean Room During a One Year Period. Physical Defense Division, Fort Detrick, Md. 4 December 1964.

3. Kereluk, K. Presentation to the North Central Chapter of the American Association of Contamination Control, Chicago, Illinois. January 20-21, 1965.

4. Federal Standard No. 209: Clean Room and Work Station Requirements, Controlled Environment. December 16, 1963.

Table I.

Microbial Contamination Obtained on Various Surfaces
Exposed to Room Air for 20 Days

	Microorganisms/Square Foot											
	Stainless Steel			Aluminum			Glass			Lucite (Acrylic Plastic)		
Strip	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
1	15,000	4,800	6,600	9,800	5,000	1,400	26,000	4,500	2,200	31,000	5,200	2,700
2	9,800	3,500	2,400	13,000	6,300	1,000	15,000	4,000	3,300	32,000	4,500	1,700
3	7,600	4,500	1,700	34,000	6,800	3,200	23,000	4,900	4,600	33,000	5,600	1,900
4	23,000	5,200	1,600	34,000	6,200	1,700	28,000	3,900	1,400	44,000	6,300	3,600
5	28,000	4,600	1,300	28,000	4,600	2,900	34,000	4,800	1,300	43,000	5,600	6,300
6	53,000	10,900	860	47,000	5,900	1,000	38,000	7,100	1,700	46,000	7,200	1,700
7	30,000	5,200	2,700	38,000	4,500	1,300	37,000	6,800	1,400	50,000	11,000	3,300
8	43,000	7,900	1,700	37,000	4,300	1,000	50,000	5,000	1,200	21,000	3,900	2,900
9	26,000	4,900	1,700	26,000	5,900	1,400	26,000	3,500	2,600	29,000	4,200	1,600
10	46,000	6,600	2,300	34,000	5,200	4,300	27,000	5,900	2,000	28,000	4,600	2,000
Avg.	28,000	5,700	2,300	30,000	5,500	1,900	30,000	5,000	2,200	36,000	5,800	2,800

Note: Each entry is computed from results obtained from a two square inch area strip.