J. Hyg., Camb. (1976), **77**, 199
With 3 plates
Printed in Great Britain

Coated bedpans: their cleaning and disinfection

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(*Received* 18 *December* 1975)

SUMMARY

This paper reports on tests of cleaning and disinfection of stainless steel bedpans which have been coated with either a silicone grease or polytetrafluoroethylene (PTFE). The coatings were applied manually using an aerosol spray (silicone grease and PTFE), and by an industrial process (PTFE). Soils used comprised (i) British Standard Soil (B.S., 1966), (ii) human serum albumin labelled with technetium-99m (HSA-Tc), and (iii) a suspension of *Streptococcus faecalis* in broth. Tests of cleaning and disinfection were carried out in automatic washing and steam disinfector machines. Results show that aerosol spraying impairs the cleaning process but that bedpans coated by the industrial process with PTFE are superior to uncoated bedpans.

INTRODUCTION

In recent years some hospitals have begun to use disposable bedpans, but these are by no means universally acceptable. Installation of total destructible disposable units is acceptable only if an adequate drainage system is provided. Horizontal runs of soil pipes above ground level should not exceed 7 m. and they should have a fall of 1 in 40 (Studies by DHSS Engineering Division). In addition there are bacteriological hazards of disposable bedpan systems (Gibson, 1973, 1974). Therefore the use of bedpan washers/disinfectors and consequently the problems of cleaning/disinfection of non-disposable bedpans will remain. Adequate preliminary cleaning is a prerequisite of good disinfection (Darmady *et al.* 1959, 1961; Gibson, 1974). There appears to be room for improvement in the performance of bedpan washing machines and in the design of bedpans themselves; these points were discussed at a recent seminar held at Guy's Hospital (see editorial under 'Tomorrow's Bedpans' in *B.M.J.* 1974; Ayliffe, Collins & Deverill, 1974; Mostafa & Chackett, 1976*a*). Among other suggestions was one made by Miss A. Viant of Bristol Royal Infirmary that the spraying of bedpans with an aerosol PTFE appears to be a simple way to improve cleaning. We have therefore carried out tests on bedpans coated with PTFE, and also with silicone grease, deposited from an aerosol spray. We have also tested bedpans which were coated with PTFE by an industrial process, which is known to produce much thicker and more

strongly adherent layers. Results of these latter tests were very favourable and therefore we arranged for these bedpans to be used routinely on hospital wards for a trial period so as to assess their 'cleanability' in actual use.

MATERIALS AND METHODS

Soiling materials

As in our previous work (Mostafa & Chackett, 1976*a*) three kinds of soil were used: (i) soil of British Standard (B.S. 1966), about 10 g. of which was smeared over the coated surface of the bedpan under test. (The nigrosin component of the mixture was omitted for the tests on the industrially coated bedpans, as the coating on these rendered them black.) (ii) Human serum albumin labelled with Tc-99m, approximately 3 mg. samples of which, incorporating about 300 microcuries of Tc-99m, were spread over the coated surface. (iii) *Streptococcus faecalis*, approximately 10^9 organisms per sample in broth, were spread over the coated surface of the bedpans and allowed to dry before treatment in disinfectors.

Coating of bedpans

Eight standard stainless steel bedpans were cleaned manually and dried at room temperature and then sprayed inside and out with a PTFE aerosol (Pampus Fluorplast Ltd). The coating was built up in four thin layers, each being allowed to dry before applying the next. The completed PTFE coating adhered to the stainless steel surface fairly firmly but during a washing process, small amounts of deposit came off the surface where the water jets impinged. After tests of cleaning, these bedpans were scrubbed with steel wool to completely remove the PTFE deposits, washed thoroughly, dried and sprayed in a similar way with a silicone aerosol (Smith Brothers Asbestos Co. Ltd). This treatment resulted in a soft greasy layer on the surface. A large part of this was removed during the washing process from areas where the water jets impinged. Finally six of these bedpans were cleaned of the previous deposits and sent for industrial coating. They were coated only on the inside; the coating was black and closely resembled the familiar 'non-stick' frying pan.

Cleaning processes and assessments

Tests of cleaning and disinfection were carried out using Dent and Hellyer automatic machines. Visual inspection was deemed sufficient for the assessment of cleaning of the B.S. soil. Radioactive measurements of the deposited HSA-Tc soil before cleaning and of the contamination remaining after cleaning were made using a re-entrant ionization chamber (Mostafa & Chackett, 1976*a*).

Two series of tests were carried out using B.S. soil on the bedpans after aerosol spraying with PTFE and silicone; in the first there was no delay between soiling and cleaning; in the second the bedpans were allowed to air-dry for 1 hr. before cleaning. Between tests bedpans were sprayed as necessary.

Similar tests were adopted for the industrially coated bedpans. Additional tests were also made with a 5 hr. drying period.

Table 1. *Cleaning and disinfection of coated and uncoated bedpans*

(Figures in parentheses are number of bedpans tested.)

	Cleaning and disinfection result				
	B.S. soil		Radioactive soil	Bacteriological soil* Organisms recovered	
Bedpans	Immediate	Delayed	% activity remaining	Washer	Steam Disinfector
Standard stainless steel	No visible soil (6)	Traces of soil with 1 hr. delay (6)	$5{\cdot}8 \pm 1{\cdot}1$ (18)	$3{\cdot}0 \times 10^4$ (7)	Mean 8, range 0–22 (8)
Aerosol PTFE coated	No visible soil (6)	Traces of soil with 1 hr. delay (5)	$44{\cdot}0 \pm 8{\cdot}0$ (18)	—	—
Aerosol silicone coated	No visible soil (7)	No visible soil with 1 hr. delay (7)	$9{\cdot}0 \pm 2{\cdot}0$ (13)	—	—
Industrial PTFE coated	No visible soil (12)	No visible soil with 5 hr. delay (12)	$5{\cdot}7 \pm 1{\cdot}7$ (18)	$2{\cdot}5 \times 10^3$ (7)	Mean 5, range 2–12 (8)

* Approximately 10^8 organisms recovered from each untreated control bedpan.

Bacteriological tests

These were carried out only on the industrially coated bedpans; the surfaces of the aerosol sprayed bedpans were so soft that difficulty was experienced in spreading the *Strep. faecalis* preparation over them. After disinfection, a rinse technique was used to recover test-organisms from the coated surface of the bedpans, using 100 ml. of Tween 80 broth (Mostafa & Chackett, 1976*a*).

In all the above tests at least one uncoated bedpan was included as a control.

RESULTS

The results of cleaning and disinfection tests are summarized in Table 1. All the bedpans were adequately cleaned, as far as visual inspection of the B.S. soil could show, if they had been washed without delay after soiling. A 1-hr. delay, however, resulted in visible stains on standard bedpans and on the PTFE-sprayed bedpans (see Plate 1*a*, *b*), although the silicone-sprayed and the industrially coated bedpans showed no residue soil. The industrially coated bedpans were also adequately cleaned after the soil had been allowed to dry for 5 hr.

The tests with HSA-Tc showed relatively poor cleaning of trace soil for the aerosol silicone-sprayed bedpans. Cleaning of aerosol PTFE-sprayed bedpans was very poor, the residual soil being as high as 50 % (in some cases). The industrially coated bedpans, however, performed at least as well as the standard bedpans, and furthermore cleaning was not impaired by a 5-hr. delay period.

Disinfection of the industrially coated bedpans in a steam-disinfector was

https://doi.org/10.1017/S0022172400024621 Published online by Cambridge University Press

excellent and resulted in a reduction in the number of organisms by a factor of 10^7, on average only about 5 organisms being recovered from a bedpan. This figure, however, was not significantly better than that obtained for standard bedpans. Treating the bedpans, both coated and standard, in a washing machine without a steam cycle was far less effective, about $2{\cdot}5 \times 10^3$ and 3×10^4 organisms being recovered from coated and standard bedpans respectively (Table 1).

Comments from the nursing staff after 1 month's experience with the industrially coated bedpans in use on the wards were favourable, no failures in cleaning being reported. A careful visual inspection of these bedpans on return to the laboratory revealed no apparent damage. Tests with the bacteriological soil produced essentially the same result as before, there being no deterioration in performance.

DISCUSSION

The 'cleanability' of a surface depends on (*a*) its chemical nature (*b*) its smoothness, and (*c*) the amount of soil present. The mass of HSA-Tc soil used in our experiments was approximately 3 mg., which is so small that its removal would be largely governed by surface properties. The tests with uncoated stainless steel bedpans, which conform with our previous experience with cleaning stainless steel surgical instruments (Mostafa & Chackett, 1976*b*), show that even a smooth surface of a material commonly thought to be chemically inert, still has some small chemical affinity for the soil. Coating the bedpans with a continuous film of silicone grease increases the trace soil retention, because the soil becomes attached to the silicone which itself is not very effectively removed from the steel surface. The case with PTFE coating is different because although it is chemically very inert the aerosol spray technique produces an extremely rough surface as shown by the photomicrograph in Plate 2. Trace soil remains adherent to the bedpan during washing, being held in crevices in the matrix of PTFE. Table 1 shows that, although there is no significant difference in behaviour towards gross soil (i.e. the B.S. soil) between the standard and sprayed bedpans, removal of trace soil from the latter is considerably more difficult.

The situation is, however different again when we consider the bedpans coated with PTFE by the industrial process. Photomicrographs (see Plate 3*a*, *b*) show a more uniform and continuous protective layer. There is some degree of roughness but this is not enough to impair cleaning of trace soils, the results being comparable with the uncoated standard bedpans.

All the bedpans, whether coated or not, were cleaned adequately from the gross soil provided the cleaning was not delayed after the application of soil. But a delay of one hour between soiling and cleaning resulted in visible stains on standard as well as on PTFE sprayed bedpans (see Plate 1*b*). The main superiority with the industrially coated bedpans was that a delay of 5 hr. between soiling and cleaning had no effect on the removal of B.S. soil. A few tests with HSA-Tc soil on these bedpans (not included in Table 1) also confirmed this finding.

Our conclusions are therefore that manual coating of bedpans by aerosol sprays is not recommended, as overall cleaning is impaired rather than improved. Another

disadvantage is the necessity to respray the bedpans after they are used. The industrial process, however, produces PTFE coated bedpans which are easily cleaned of trace soil, are effectively disinfected, and are cleaned from gross soil more effectively than are standard uncoated bedpans. We have not had time to test these bedpans over a long period but it seems likely that they will have a rather long life. In certain busy wards such as in medical and geriatric units, a high degree of disinfection may not be required; use of bedpan washers in these wards may be acceptable. But in high risk units the highest standard of disinfection is essential (Ayliffe *et al.* 1974). Although the industrially coated bedpans show no advantage in disinfection over the standard bedpans their use in medical and geriatric units might be recommended because of their superior cleanability especially when cleaning may be delayed.

We must point out that all our work has been concerned with washing using soft water (total hardness 40 p.p.m. $CaCO_3$). Different results might be obtained with hard water.

The authors would like to express their thanks to Dr G. A. J. Ayliffe of Hospital Infection Research Laboratory, Summerfield Hospital, Birmingham, for invaluable discussions, suggestions and comments during this work, to Messrs Pampus Fluorplast Ltd for industrial coating of bedpans with PTFE, and to Messrs Loyne Ltd for the supply of industrial PTFE-coated samples. Co-operation of the nursing staff of Dudley Road Hospital is also gratefully acknowledged. This work was undertaken under the auspices of the D.H.S.S. to which our acknowledgments are due.

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EXPLANATION OF PLATES

Plate 1

(*a*) A typical standard stainless steel bedpan coated with soil of British Standards (1966). (*b*), a PTFE-sprayed bedpan (left) and a standard bedpan after cleaning which was delayed for an hour after the application of soil (right).

Plate 2

A photomicrograph (magnification $\times 1000$) showing the surface texture of PTFE coating resulting from manual aerosol spray.

Plate 3

Photomicrographs (magnification $\times 1000$) showing the surface texture of PTFE coating by an industrial process due to a 'light' spray in (*a*) and that due to a 'heavy' spray, in (*b*).

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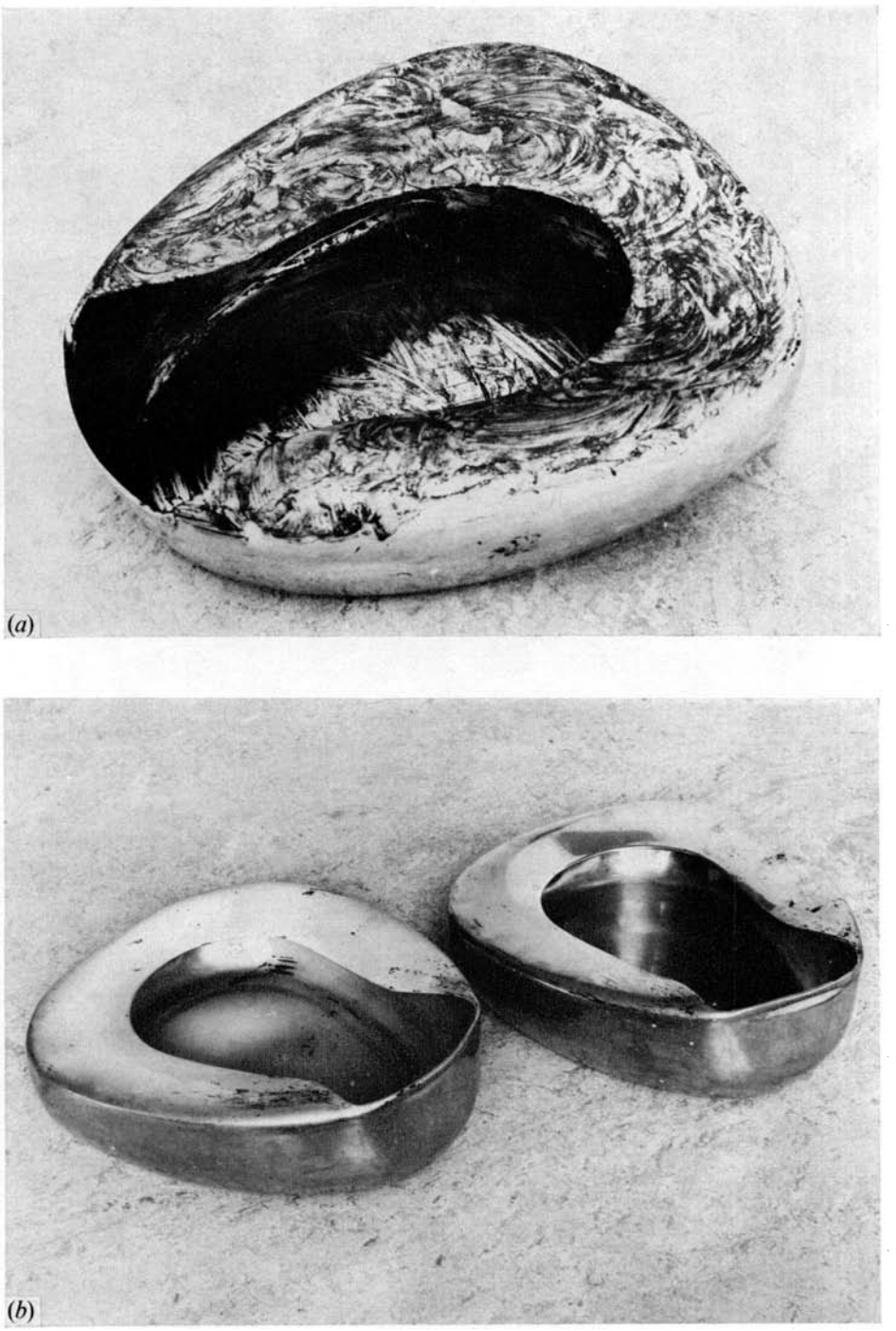

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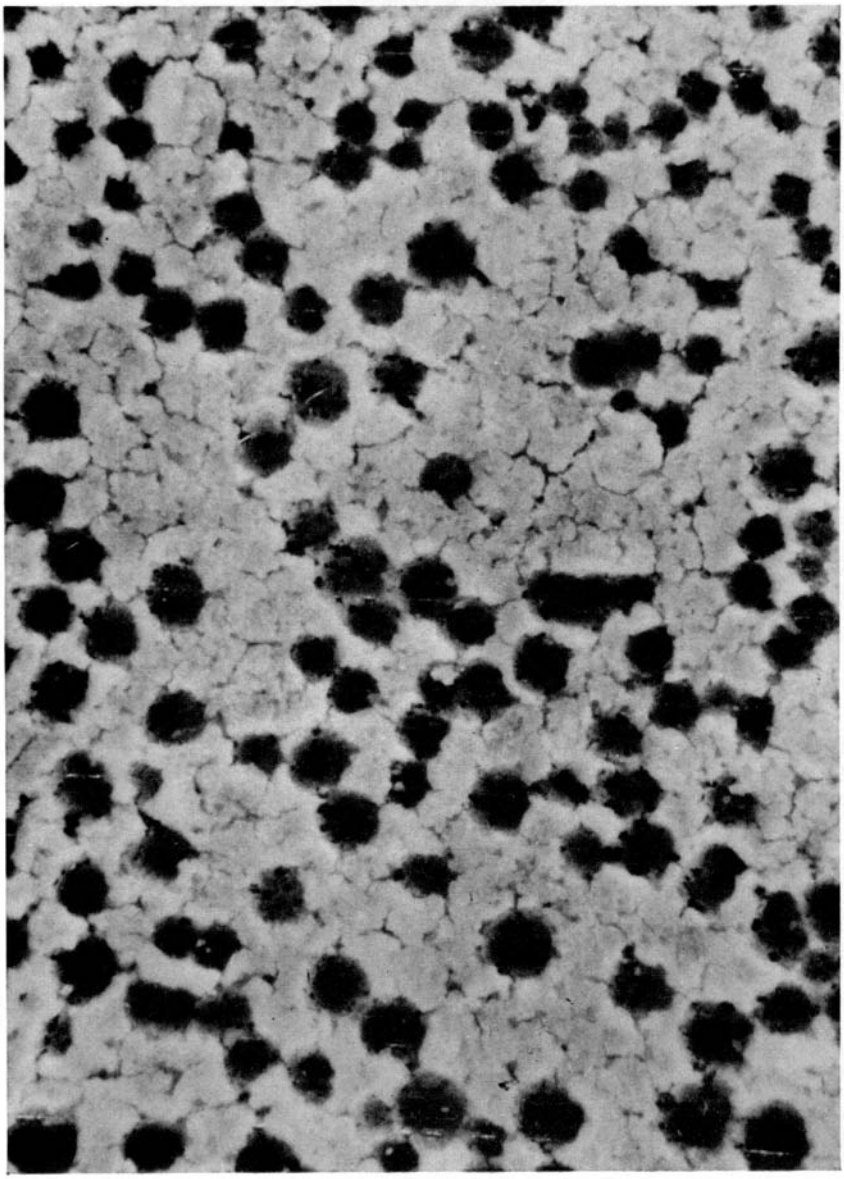

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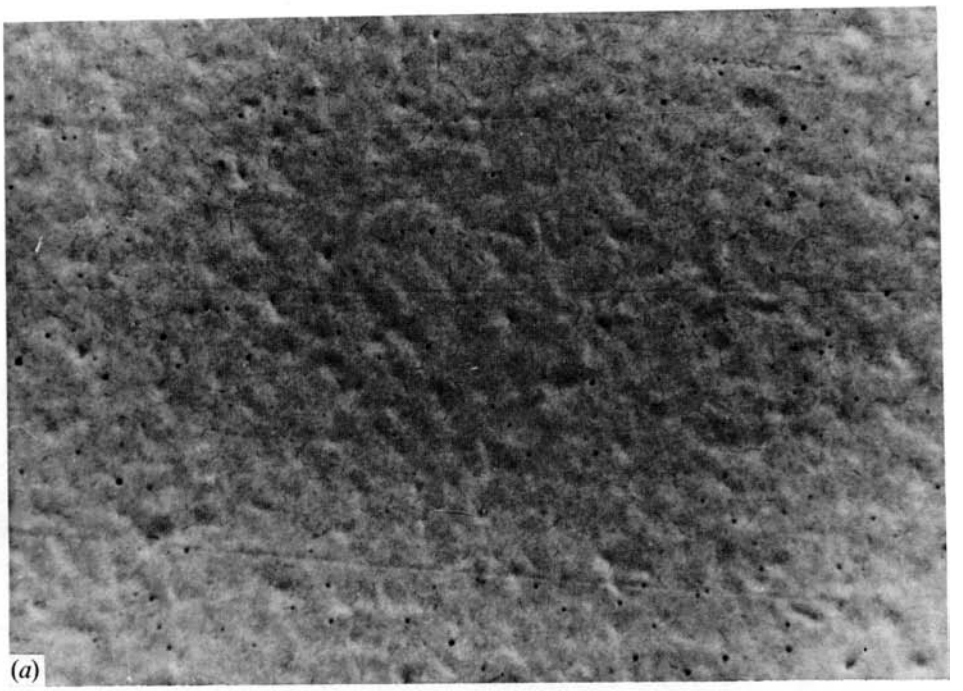

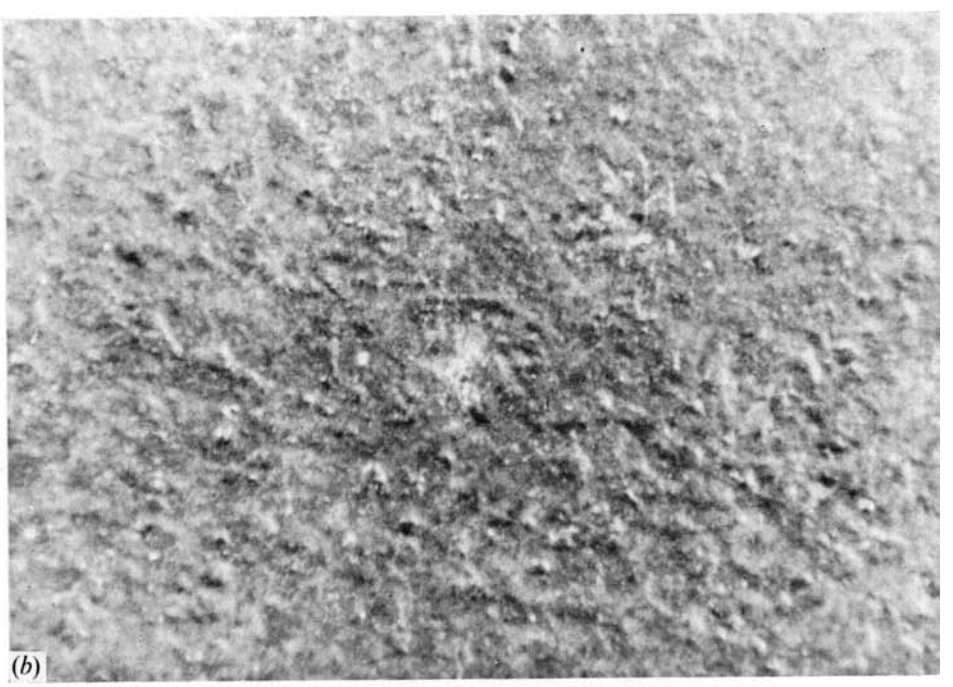

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