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A note on the hygiene of meat mincing machines

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SUMMARY

Two mincing machines were cleaned by different methods, i.e. (*a*) a detergent/sterilizer method and (*b*) scrubbing parts in boiling (98·8° C.) water. Initial results indicated that, on reassembly, post-treatment contamination took place. Efforts to clean each machine as consisting of two distinct parts, (*a*) the casing and (*b*) removable parts, were more satisfactory. Four other mincers which could be completely dis-assembled were satisfactorily cleaned, but only in terms of percentage organisms surviving and not in terms of actual numbers surviving.

INTRODUCTION

No published data are available on the cleaning and maintenance of meat-mincing machines (B. C. Hobbs, personal communication) despite the wide range of bactericidal agents (detergents and detergent/sterilizers) which are marketed commercially for use in the food-processing industry (Thomas, 1969). Results on the cleaning and sterilizing of slicing machines, carving knives and can-openers and the possibility of cross-contamination by slicing machines and cleaning cloths have already been published (Gilbert & Maurer, 1968; Gilbert, 1969). However, much less published information is available on the cleaning of other meat-processing equipment.

This work resulted from a request from a 'carcase service laboratory' for an efficient method of cleaning large commercial meat mincers. The results can be applied to similar equipment in the meat industry, e.g. the sausage department of meat-processing firms, mincers in retail shops and 'home' mincing equipment.

MATERIALS AND METHODS

At first, two mincers, A and B, model No. RKW 82, Wexio Metaniska Verkstad, Vaxjo, Sweden, were available. After a normal day's use they were cleaned by the staff responsible for their maintenance. The parts were dismantled (mincer barrel, worm, blade, 0·95 cm. mincing plate, screw ring and feed tray) and each individually washed in a 2% (w/v) solution of Duet (Diversay, Ireland Ltd) at 71·1° C. (160° F.) and rinsed in clean water. The machine itself, (the feed funnel and worm-housing sleeve) was washed with a cloth in a warm (48·8° C.) silicate detergent solution and also rinsed in clean water. The parts were reassembled. The mincers were rinsed through with 500 ml. of quarter-strength Ringer's solution immediately after use and again after cleaning. The Ringer's solution was

poured over the feed tray and allowed to run down the feed funnel into the worm housing and over the worm with the motor running. The rinse was collected through a sterile glass funnel into a 500 ml. sterile plasma bottle. Serial decimal dilutions were made in Ringer's solution with the addition of 0·1% peptone (Straka & Stokes, 1957) and pour plates made with Plate Count Agar (P.C.A., Oxoid) for colony counts at 22° C. (3 days incubation) and 37° C. (incubation for 1 day).

A further experiment was carried out with the various machine parts and 'stripped' casings treated as separate pieces of equipment. After use the parts were placed in a plastic bag and the rinse (500 ml. Ringer's solution) poured into it. The machine casing was rinsed without the motor running, as the worm was not in position, and the rinse collected as before. After the cleaning procedure, described previously, the parts and machines were rinsed and counts made on the rinses from parts and casings before and after cleaning. The 'stripped' machines (feed funnel and worm housing sleeve) were more closely examined. It was noted that, by scraping these surfaces, a film of hardened soil (comminuted meat and fat) could be removed, therefore the use of cloths for cleaning was discontinued and the surfaces scrubbed with soap-impregnated pads. The diameters of the feed funnel (6·25 cm.) and the casing (21·5 cm.) precluded any other scrubbing method being used. After scrubbing the surfaces were thoroughly washed with clean water. The final method adopted to clean these mincers was:

Parts	Machines
Visible dirt removed, washed in warm (48·8° C.) water and then boiled (98·8° C.) for 10 min.	Visible dirt scraped off, surfaces scrubbed with soap pads and rinsed in clean water.

A further four mincing machines, C, D, E and F, became available to carry out additional tests (in retail shops). Two were 'Crypto Peerless', Model A.D. 12 (North Circular Road, London, N.W. 10) and two were U.S. Berkel, Model E 222 (Berkel Inc., La Porte, Ind. 46350, U.S.A.). These were chosen because all parts could be dismantled. They differed from the Swedish-made models in this respect. The normal cleaning procedure in each shop was as follows:

Mincer	Procedure
C	(*a*) Remove adhering meat from surfaces (*b*) Steep parts in water (98·8° C.) and hand wash when temperature dropped to *ca.* 48° C.
D	(*a*) As C (*b*) Wash in water (82·2° C.) + an anionic detergent
E	(*a*) As C (*b*) Wash in a hot solution (60° C.) of sodium carbonate (2·5%, w/v)
F	(*a*) As C (*b*) Wash in a hot solution (64·4–71·1° C.) of sodium carbonate (1·25%, w/v). Dry with clean cloth

Table 1. *Plate counts at* 22° C. *of rinses taken from mincers A and B (parts* in situ *and routine cleaning)*

Trial no.	Mincer	Count/ml. Before cleaning	Count/ml. After cleaning	Survival (%)
1	A	1,775	9,900	Increase
	B	260	504	Increase
2	A	2,260	13,250	Increase
3	A	575	185,100	Increase
	B	6,450	1,720	26·7
4	A	865	58,800	Increase
	B	123,000	89,400	72·7

Table 2. *Plate counts at* 22° C. *from rinses of parts and casings (separately) of mincers A and B*

Mincer	Equipment	Count/ml. Before cleaning	Count/ml. After cleaning	Survival (%)
A	Parts	9,750	1,240	12·7
	Casing	4,650	6,500	Increase
B	Parts	77,650	1,895	2·44
	Casing	149,000	186,250	Increase

RESULTS

The bacterial counts of two commercial meat mincers, A and B, before and after different methods of cleaning are shown in Tables 1–3.

In Table 1 it is seen that, after cleaning, higher counts were recorded in five out of seven instances. This increase in bacterial count was obviously derived from the casing (feed funnel and worm housing sleeve), which could not be dismantled. It is suggested that the post-treatment rinse washed organisms off these surfaces or there was a 'carry-over' effect as a result of poor cleaning methods.

Table 2 shows the effect of cleaning the parts and the casings separately. In each case there was a considerable reduction in contamination on the parts (87% in mincer A and 98% in mincer B). However, the casings themselves remained a potent focus of contamination. This result tends to support the points already made, namely an increase in post-treatment count was due to either a 'washing off' effect or poor cleaning techniques. These points are confirmed by the data presented in Table 3, which show the results of five trials on both mincers after cleaning the parts and 'stripped' scrubbed machines separately and rinsing them after reassembly. The highest survival count was 14% (mincer A) and the lowest survival count was $<0{\cdot}1\%$ (mincer B).

In Table 4 is presented the data on the cleaning of four meat-mincing machines (C–F) which can be completely 'stripped', i.e. all parts which come in contact with meat can be removed for cleaning. The mean percentage survival at 37° C. ranged from 2·25 to 4·96 and at 22° C. from 0·28 to 0·82.

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Table 3. *Plate counts at* 22° C. *of rinses taken from mincers A and B before and after improved cleaning technique*

Trial no.	Mincer	Count/ml. Before cleaning	Count/ml. After cleaning	Survival (%)
1	A	353,500	163	0·04
2	A	1,940	39	2·03
	B	6,450	182	2·82
3	A	475	68	14·31
	B	183	8	4·63
4	A	13,400	60	0·44
	B	68,500	1,840	2·68
5	A	537,500	21,550	4·00
	B	5,000,000	39,500	< 0·01

Table 4. *Colony counts at* 37° *and* 22° C. *from rinses of mincers C, D, E and F before and after cleaning*

Mincer	Trial no.	37° C. Count/ml. Before cleaning	37° C. Count/ml. After cleaning	37° C. Survival (%)	22° C. Count/ml. Before cleaning	22° C. Count/ml. After cleaning	22° C. Survival (%)
C	1	580,000	2,800	0·48	12,700,000	53,000	0·42
	2	120,000	210	0·18	1,670,000	4,600	0·28
	3	6,000	330	5·50	690,000	3,000	0·44
	4	50,200	2,470	4·92	3,890,000	44,000	2·14
				2·84*			0·82*
D	1	3,200,000	43,000	1·35	5,000,000	410,000	0·82
	2	59,000	9,200	5·60	2,400,000	19,000	0·80
	3	6,700	40	0·59	540,000	2,900	0·54
	4	19,000	280	1·47	1,930,000	19,600	1·12
				2·25*			0·82*
E	1	30,000	110	0·37	700,000	690	0·10
	2	6,000	580	9·67	1,410,000	2,100	0·15
	3	61,000	8,500	3·94	1,960,000	49,000	2·50
	4	790,000	1,000	0·13	13,300,000	8,000	0·06
				3·78*			0·70*
F	1	100,000	7,500	7·50	15,000,000	13,800	0·10
	2	51,000	1,090	2·14	1,380,000	6,300	0·46
	3	85,000	2,570	3·03	9,400,000	11,300	0·12
	4	81,000	31,100	7·17	8,800,000	39,000	0·45
				4·96*			0·28*

* Mean values.

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DISCUSSION

Meat-mincing machines in which only some parts can be dismantled must obviously be treated as two distinct pieces of equipment for cleaning purposes. Removable parts can be satisfactorily cleaned as shown in this experiment. However, those parts which cannot be removed — in this case the feed funnel and the worm housing sleeve (casing) – must be given special attention by what might be described as 'in-place cleaning'. The use of cloths for this task cannot be recommended as this results in recontamination. The Food Hygiene Code of Practice (1969) states that all meat equipment should be designed to eliminate the accumulation of dirt. Some mincers comply with this specification. For example, the 'back creep' of meat juices into the gear box is prevented on some machines by a juice escape valve under the drive hub. Other makes of machine are so designed that the entire worm housing can be removed by loosening wing-nuts, leaving only the motor housing, which makes no contact with meat at any time. Although the percentage survival in four mincers ranged only from 0·13 to 9·67 at 37° C. and 0·06 to 2·50 at 22° C., in terms of actual numbers of surviving micro-organisms the results are unsatisfactory. Thus the mean pretreatment colony count (37° C.) in mincer C was 189×10^3/ml. and the mean post-treatment count was $14{\cdot}5 \times 10^2$/ml. The results at 22° C. are even worse (mincer C); a mean pre-treatment count of $4{\cdot}7 \times 10^6$ and a post-treatment mean of 26×10^3/ml.

Freshly minced meat constitutes one of the most challenging of meat products for quality assurance and public health protection. Reports of retail products with counts $> 10^6$/g. denote microbial contamination that should be reduced or eliminated (Tiwari & Maxcy, 1972). It has been found that off-odours usually develop in minced meat by the time it contains about 10^8/g. (Pearson, 1970). The degree of contamination of a mincer will depend on the number of organisms in the raw meat and the higher the numbers the more difficult it will be to remove them by cleaning methods.

Recommendations

(1) Ensure that all parts which cannot be removed receive special attention by 'in-place' cleaning. Cloths cannot be recommended for this purpose. Mincers do not lend themselves easily to 'in-place' cleaning because of the inaccessability of parts. However, one method which has proved successful in our hands is to scrub such parts with soap pads.

(2) The design of such mincers should be modified so that all parts which come in contact with meat can be dismantled.

(3) Use a proved method of cleaning, either chemical (detergent or detergent/sterilizer) or physical (boiling parts in water). Do not rely on the bactericidal effect of any proprietary chemical which may lead to a false sense of security (see Gilbert & Maurer, 1968).

(4) Apply the chosen method daily or preferably twice daily.

(5) If possible, arrange to have frequent bacteriological rinse tests carried out (such a method is described in this paper) to ensure that only small numbers of micro-organisms survive, e.g. 100/ml. at 22° C.

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