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TRANSLATION FROM THE GERMAN LANGUAGE

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To:	Messrs. J. CHRISTOF GESMBH Plabutscherstraße 115 A-8051 GRAZ Messrs. DIPL.ING. MOSHAMMER GESBR Schörgelgasse 9 A-8010 GRAZ MIDES GESMBH Weinholdstr. 31 A-8010 GRAZ
Subject:	Test report of the waste disinfection device *SINTION*
Ordered by:	Messrs. J. CHRISTOF GESMBH Plabutscherstraße 115 A-8051 GRAZ
Tasks:	Testing of the effectiveness a combined microwave-steam-disinfection process in the waste disinfection device SINTION
Reference:	Directions for the testing of the effectiveness by the waste disinfection process of the German Federal Health Office (*Bundesgesundheitsamt*) and the German Society for Hospital Hygiene (*Deutsche Gesellschaft für Krankenhaushygiene*)

CONTENTS

1 Task

In the order of November 1, 1995 we were asked to test the effectiveness of a combined microwave-steam-disinfection process, as described in the European Patent EP. 0476004. We shall check the effectiveness of the microwave-waste-disinfection device ***SINTION 1.1*** in terms of its future purpose of disinfecting microbiologically contaminated (so-called infectious) waste.

Physical parameters which are relevant for the process of germ killing, are measured in different positions of the disinfection material under practice-oriented conditions. The reduction of the number of germs of the biological indicators in these positions are determined.

Steam- and air-tight systems, such as closed waste bags wrapped in other bags or containers (bag in bag), are not to be considered in our tests.

2 Technical data of the device

2.1 Functioning

The waste is placed in a cylindrical metal container, lined with plastic which is closed by means of an (according to the specifications of the manufacturer) automatically steam- and microwave-tight lid. The cylindrical usable space (diameter 450 mm, height 675 mm) is inclined at an angle of 30° to the perpendicular, and is lined with polypropylene, silicon-caoutchouc as well as with a polytetrafluorethylene coating.

The microwave radiation enters evenly in 6 different places on 2 levels; 2 places being at an angle of 120°, the respective places of the 2 levels are rotated at an angle of 60°.

The operating process can be selected through „operating parameters“ and will be described in 2.2.

During the phase EVACUATE CHAMBER the usable space is evacuated through a bacteria-tight filter, exposed to steam.

During the phase HOLD the waste to be disinfected is heated in bags permeable to steam only by microwave radiation. The power of the microwave radiation is regulated by a pressure sensor through the

programmed hold-time in such a way that the pressure and consequently the hot steam graph keeps the temperature steady.

After termination of the hold-time steam and liquids are exhausted, cooling down the chamber to the programmed temperature and flushing the usable space with air sucked in from the room.

Depending on the amount of waste placed in the device the operating period lasts between 10 and 20 minutes. The operating parameters, the operating period as well as the date and time are recorded on a paper print-out.

2.2 Operating process, operating parameters

START	starts disinfection process by pressing the button
LOCK	automatically locks lid, makes microwave-tight, secures against opening
SEAL	makes chamber pressure-tight
EVACUATE CHAMBER 1	1st evacuation of disinfection chamber to 0.15 bar absolute pressure (p[V1]) through germ filter
CHECK VACUUM	checks disinfection chamber for vacuum tightness
STEAM INLET 1	steam enters up to chamber pressure of 1.2 bar absolute pressure (p[D1])
EVACUATE CHAMBER 2	2nd evacuation of disinfection chamber to 0.3 bar absolute pressure (p[V2]) through germ filter
ENTER STEAM 2	steam enters up to chamber pressure of 2.1 bar absolute pressure (p[D2]), corresponding to steam temperature of 121.7°C
HOLD	holds chamber pressure of 2.1 bar absolute pressure (BD) by applying and controlling microwave energy for 360 sec (HZ)
EXHAUST	removes disinfected condesate cools down disinfected waste to 80°C by dropping pressure in chamber to 0.47 Bar rinsing disinfection chamber with air
AIR ADMISSION	drops pressure to normal
UNSEAL	releases pressure tightness
UNLOCK	releases lid to open
PRINT RECORD	produces operating record

The exhaust of the air and air/steam mixture from the chamber during both the phases EVACUATE CHAMBER 1 and EVACUATE CHAMBER 2 works through the germ filter. This germ filter is automatically disinfected after each waste disinfection process.

During the phase EXHAUST all the liquids are removed from the disinfection chamber. These liquids have been completely disinfected exactly like the waste material and can be disposed of together with the germ filtered air into the drain.

2.3 Technical data (according to the specifications of the manufacturer)

measurements	830 x 1120 x 1180 mm
disinfection chamber	450 ∅, H = 675 mm
weight	ca. 400 kg
operating frequency	2450 ± 50 MHZ
high frequency	3900 W
voltage	230/400 V+ N
electrical current	3 N~
amperage	13 A
power consumption	8700 W
mode of operation	S1 (DB)
average operating period	10 - 20 min (depending on the amount of waste and the operating parameters)

2.4 Specifications

Manufacturer	Messrs. J. CHRISTOF GESMBH, Plabutscherstraße 115, A-8051 GRAZ
Distributor	MIDES GESMBH, Weinholdstr. 31, A-8010 GRAZ
Type	*SINTION 1.1*
Serial Number	95/11/001

3 Test schedule, requirements, basic test criteria

We followed the directions for the testing of the effectiveness of the waste disinfection process by the German Federal Health Office (*Bundesgesundheitsamt*) and the German Society for Hospital Hygiene (*Deutsche Gesellschaft für Krankenhaushygiene*). We used the test schedule for the model test according to 7.1 in the Federal Health Paper (*Bundesgesundheitsblatt*) 4/93 issue 1993/2/1.

3.1 General requirements

It is understood that in disinfection processes the basic requirement for the control of epidemics is that pathogenic agents must not be spread further respectively that the contamination remains limited to the original objects.

The test parameters must be observed on all inner and outer surfaces of the waste material if possible also in all positions of the waste material (e.g. in so-called wet waste or liquids). The test parameters must be defined for the ranges **A** (killing of vegetative bacterial germs, including mycobacteria, fungi, fungus spores), **B** (inactivating viruses) and **C** (killing of splenopathy spores) (list of tested and accepted disinfectants and disinfection processes by the German Federal Health Office).
Further general requirements see Federal Health Paper 4/93 page 158.

3.2 Bio indicators

Bio indicators according to German Standard DIN 58 949 part 4 par. 6 shall be used. This standard refers also to packing, storing and resistance check of bio indicators. Additionally there shall be a quantitative check of the bio indicators for surviving germs at least in the model test. Therefore it is required to perform a quantitative resistance check of the bio indicators in a standard check (saturated steam, 100°C, 15 min). The reduction of the number of germs shall be determined.

3.3 Test load

We shall use containers to fill the waste material into the disinfection device. The measuring points (thermo elements and bio indicators) are placed representatively within the waste in different critical positions. Retracing of the bio indicators is easier when they have been previously marked.

3.3.1 Porous material

The containers are filled as homogenously as possible with cellulose tissue in horizontal layers, avoiding open spaces. Bio indicators according to DIN 58 949 part 4 par. 6 shall be used.

3.3.2 Hollow bodies

As a model for objects with at least one-sidedly open hollow bodies we use test objects acc. to DIN 58 948 part 13 with bio indicators acc. to DIN 58 949 part 4 par. 6. The test objects are to be placed in the disinfection chamber without any additional load.

3.3.3 Liquid material

We are to use plastic bottles filled with 0.5 l of water. The temperature in the liquid is measured by means of thermo elements.

3.4 Test schedule (model test)

Bio indicators are placed in the empty disinfection chamber. The allocation of termperatures is recorded and documented.
This process is repeated with partial as well as with full loads (see DIN 58 949 part 3) with all intended test loads.
The limits of efficiency are to be found using bio indicators.
In the container with the porous material a minimum of ten bio indicators are placed preferably in critical positions. The container is also placed in a critical position in the disinfection chamber.
In the test loads „hollow bodies“ and „liquid material“ at least five test objects are filled with bio indicators; in quantitative tests three test objects are sufficient.

The test is repeated two times.

3.5 Basic test criteria

The basic criterium for a sufficient disinfection of microbiologically contaminated (so-called infectious) waste is the reduction of spores of *bacillus subtilis* acc. to DIN 58 949 for 5 log-steps. The required reduction of the above mentioned spores must be reached in all parts of the waste (inner and outer surfaces). The different types of waste which occur in practice are represented in the test in different test objects (as defined in the test load of the specified standard). These test objects represent the most difficult types of waste that occur in practice.
On the basis of the D_{121}-figures for *bacillus subtilis* of 0.4 to 0.7, which are well-known from literature, you calculate the overall lethality (F-figure) of the process from the formula

$$F_{min}=n*D_{121}$$

wherein

F_{min} = minimum F-figure
n = required number of germ reduction in the power of ten (log-steps)
D_{121} = D-figure at 121°C (spores of *bacillus subtilis*)

with

$$F_{min} = 5 * 0.4\ (0.7) = 2{,}0\ (3.5)\ \text{min}$$

(D-figure = time in minutes to lower the number of germs of a certain micro organism at a certain temperature for one power of ten)

In the present process 3.5 min minimum operating time are supposed for the least favourable case (high D-figure); whereas reference processes (105°C/25 min or 110°C/15 min) as stated in the literature suppose the lower D-figures (0.4). So an additional safety margin is already included in the actual hold time of 6 min.

4 Method

4.1 Bio indicators

Spores of *bacillus subtilis* NCTC 10073 with a number of germs of $1x10^5$ / germ carrier were used as bio indicators for ranges ABC (bio indicator SIMICON DES 105; Ch.Nr.: 895). Restistance corresponded to the specifications of the manufacturer to the requirements of DIN 58 949 part 4 (resistance features).
Additionally a piece of linen (9x3cm) was used as germ carrier with 1ml of a suspension of spores of *bacillus subtilis* (ATCC 1813) with an initial number of germs of $1.5x10^7$. The cultivation of test germs, the production of the spore suspension, the vaccination of the germ carrier, and the resistance check were made acc. to DIN 58 949 part 4.

4.2 Culture conditions

The bio indicators used were shaken in casein-sojbeanflour-pepton solution and bred for 7 days at a temperature of 37°C. When clouding of the fluid culture medium occured, the test germs were tested by over-vaccination blood agar and if necessary microscopy.

4.3 Physical test

(The physical tests and the report were carried out by Mag.Dr. T. Miorini / Institute for Applied Hygiene)

4.3.1 System of measurement

The thermo electric resp. the absolute pressure measurement were made with a 6-colour-process-recorder acc. to prEN 285 (Chessel 4200, Prod.Nr. IO 6216-001) with an absolute pressure absorber (Jumo) and 10 Cu-Co-thermo elements (Type T). The adjustment of the device was carried out on the spot as certified in the enclosed report.
The termoelements were introduced into the chamber through a test tube and each in a metal screen, to protect the sensors from the effects of the microwave. The absolute pressure absorbers werde connected separately to a test tube.
The thermo electric measuring of the temperatures of media in a microwave field bears a problem basically because of high frequency technical laws, that in using thermo elements with screened measuring lines, every test model causes a distortion of the microwave field in the area of the measuring sensor, which influences the measurement results. The influence depends

largely on the kind of medium (steam, cellulose tissue or water) in which temperature measurements are taken because all the media differ widely in their ability to absorb energy through microwaves. The basic job of an appropriate test model is therefore to enable the measurement of temperature in the respective medium, and on the other hand to keep the influence of the test model on the measurement results within tolerable margins of error.

Colour codes of recorder lines:*

T1	yellow
T2	green
T3	violet
T4	blue
T5	black
T6	red
T7	green
T8	violet
T9	black
T10	violet
print	red(bold)

* For the test only sensors T2 to T7 were used.

5 Execution of the test and results

5.1 Empty disinfection chamber (3 cycles)

The bio indicators were placed in the empty disinfection chamber in different positions (see drawing), the allocation of temperatures was measured by 6 thermo elements (TE). The recorder graphs show that the required process parameters concerning the steam temperature are reached (see appendix).
Narrow tubes (test object acc. to DIN 58 948 part 13) with bio indicators acc. to DIN 58 948 part 4 par. 6 were used as models for one-sidedly open hollow bodies. These test objects were put in waste bags without any other extra load into the disinfection chamber.

Position of bio indicators and thermo elements:

Result:
A complete destruction of all germs used in this process took place. The required reduction factor of log 5 was successfully reached.

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
No.	cycle no. 1	BI (TE) position (level/quadrant)	test object/ bio indicator	reduction factor (log)
1	empty 1.1	E3 / II	hollow body + BS	>5
2	empty 1.1	E 1 / III (TE 2)	hollow body + BS	>5
3	empty 1.1	E2 / III	hollow body + BS	>5
4	empty 1.1	E4 / IV (TE 7)	hollow body + BS	>5
5	empty 1.1	E6 / I (TE 6)	hollow body + BS	>5
6	empty 1.1	E1 / III	bac. subtilis 10^5	>5
7	empty 1.1	E2 / I (TE 3)	bac. subtilis 10^5	>5
8	empty 1.1	E3 / II (TE 4)	bac. subtilis 10^5	>5
9	empty 1.1	E4 / IV (TE 5)	bac. subtilis 10^5	>5
10	empty 1.1	E6 / IV	bac. subtilis 10^5	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
1	empty 1.1	E2 / I	bac. subtilis $1.5x10^7$	>7.17
2	empty 1.1	E5 / IV	bac. subtilis $1.5x10^7$	>7.17

BI: bio indicator, TE: thermo element operating time: 19 min

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
No.	cycle no. 1	BI (TE) position (level/quadrant)	test object/ bio indicator	reduction factor (log)
11	empty 1.2	E3 / II	hollow body + BS	>5
12	empty 1.2	E 1 / III (TE 2)	hollow body + BS	>5
13	empty 1.2	E2 / III	hollow body + BS	>5
14	empty 1.2	E4 / IV (TE 7)	hollow body + BS	>5
15	empty 1.2	E6 / I (TE 6)	hollow body + BS	>5
16	empty 1.2	E1 / III	bac. subtilis 10^5	>5
17	empty 1.2	E2 / I (TE 3)	bac. subtilis 10^5	>5
18	empty 1.2	E3 / II (TE 4)	bac. subtilis 10^5	>5
19	empty 1.2	E4 / IV (TE 5)	bac. subtilis 10^5	>5
20	empty 1.2	E6 / IV	bac. subtilis 10^5	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
3	empty 1.2	E2 / I	bac. subtilis $1.5x10^7$	>7.17
4	empty 1.2	E5 / IV	bac. subtilis $1.5x10^7$	>7.17

operating time: 20 min

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
No.	cycle no. 1	BI (TE) position (level/quadrant)	test object/ bio indicator	reduction factor (log)
21	empty 1.3	E3 / II	hollow body + BS	>5
22	empty 1.3	E 1 / III (TE 2)	hollow body + BS	>5
23	empty 1.3	E2 / III	hollow body + BS	>5
24	empty 1.3	E4 / IV (TE 7)	hollow body + BS	>5
25	empty 1.3	E6 / I (TE 6)	hollow body + BS	>5
26	empty 1.3	E1 / III	bac. subtilis 10^5	>5
27	empty 1.3	E2 / I (TE 3)	bac. subtilis 10^5	>5
28	empty 1.3	E3 / II (TE 4)	bac. subtilis 10^5	>5
29	empty 1.3	E4 / IV (TE 5)	bac. subtilis 10^5	>5
30	empty 1.3	E6 / IV	bac. subtilis 10^5	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
5	empty 1.3	E2 / I	bac. subtilis $1.5x10^7$	>7.17
6	empty 1.3	E5 / IV	bac. subtilis $1.5x10^7$	>7.17

operating time: 24 min

5.2 Porous material / partial load (PM/P) (3 cycles)

PE-waste bags permeable to steam (thickness: 60µm / distributor: Schoeller-Bleckmann Ges.m.b.H.) were used as containers.
The waste bags were homogenously filled with cellulose tissue (cut into DIN A4 pieces) in horizontal layers up to a third of their volume (height of the test load: ca 20cm) and the bio indicators were scattered representatively in the load (see drawing).

Position of the bio indicators in the porous material / partial load

Result:
A complete destruction of all germs used in this process took place. The required reduction factor of log 5 was successfully reached.

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
No.	cycle no. 2	BI position: height in the centre of test load (TL)	bio indicators	reduction factor (log)
31	PM/P 2.1	TL: h=5cm	bac. subtilis 10^5	>5
32	PM/P 2.1	TL: h=7.5cm	bac. subtilis 10^5	>5
33	PM/P 2.1	TL: h=10cm	bac. subtilis 10^5	>5
34	PM/P 2.1	TL: h=12.5cm	bac. subtilis 10^5	>5
35	PM/P 2.1	TL: h=15cm	bac. subtilis 10^5	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
7	PM/P 2.1	TL: h=10cm	bac. subtilis $1.5x10^7$	>7.17
8	PM/P 2.1	TL: h=5cm	bac. subtilis $1.5x10^7$	>7.17

operating time: 17 min

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
36	PM/P 2.2	TL: h=5cm	bac. subtilis 10^5	>5
37	PM/P 2.2	TL: h=7.5cm	bac. subtilis 10^5	>5
38	PM/P 2.2	TL: h=10cm	bac. subtilis 10^5	>5
39	PM/P 2.2	TL: h=12.5cm	bac. subtilis 10^5	>5
40	PM/P 2.2	TL: h=15cm	bac. subtilis 10^5	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
9	PM/P 2.2	TL: h=10cm	bac. subtilis $1.5x10^7$	>7.17
10	PM/P 2.2	TL: h=5cm	bac. subtilis $1.5x10^7$	>7.17

operating time: 19 min

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
41	PM/P 2.3	TL: h=5cm	bac. subtilis 10^5	>5
42	PM/P 2.3	TL: h=7.5cm	bac. subtilis 10^5	>5
43	PM/P 2.3	TL: h=10cm	bac. subtilis 10^5	>5
44	PM/P 2.3	TL: h=12.5cm	bac. subtilis 10^5	>5
45	PM/P 2.3	TL: h=15cm	bac. subtilis 10^5	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
11	PM/P 2.3	TL: h=10cm	bac. subtilis $1.5x10^7$	>7.17
12	PM/P 2.3	TL: h=5cm	bac. subtilis $1.5x10^7$	>7.17

operating time: 18 min

5.3 Porous material / full load (PM/F (3 cycles)

The waste bags were homogenously and completely filled with cellulose tissue in horizontal layers (height of the test load: ca 50cm) and the bio indicators were scattered representatively in the load (see drawing).

Position of the bio indicators in the porous material / full load

Result:
A complete destruction of all germs used in this process took place. The required reduction factor of log 5 was successfully reached.

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
No.	cycle no. 3	BI position: height in the centre of test load (TL)	bio indicators	reduction factor (log)
46	PM/F 3.1	TL: h=10cm	bac. subtilis 10^5	>5
47	PM/F 3.1	TL: h=20cm	bac. subtilis 10^5	>5
48	PM/F 3.1	TL: h=30cm	bac. subtilis 10^5	>5
49	PM/F 3.1	TL: h=40cm	bac. subtilis 10^5	>5
50	PM/F 3.1	TL: h=45cm	bac. subtilis 10^5	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
13	PM/F 3.1	TL: h=20cm	bac. subtilis $1.5x10^7$	>7.17
14	PM/F 3.1	TL: h=30cm	bac. subtilis $1.5x10^7$	>7.17

6 thermo elements (TE): 1 TE each near bio indicator and 1 TE free in the chamber operating time: 20 min

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
51	PM/F 3.2	TL: h=10cm	bac. subtilis 105	>5
52	PM/F 3.2	TL: h=20cm	bac. subtilis 105	>5
53	PM/F 3.2	TL: h=30cm	bac. subtilis 105	>5
54	PM/F 3.2	TL: h=40cm	bac. subtilis 105	>5
55	PM/F 3.2	TL: h=45cm	bac. subtilis 105	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
15	PM/F 3.2	TL: h=20cm	bac. subtilis $1.5x10^7$	>7.17
16	PM/F 3.2	TL: h=30cm	bac. subtilis $1.5x10^7$	>7.17

6 thermo elements (TE): 1 TE each near bio indicator and 1 TE free in the chamber operating time: 20 min

Bio indicator *bacillus subtilis* 10^5 SIMICON DES (BS)				
56	PM/F 3.	TL: h=10cm	bac. subtilis 10^5	>5
57	PM/F 3.3	TL: h=20cm	bac. subtilis 10^5	>5
58	PM/F 3.3	TL: h=30cm	bac. subtilis 10^5	>5
59	PM/F 3.3	TL: h=40cm	bac. subtilis 10^5	>5
60	PM/F 3.3	TL: h=45cm	bac. subtilis 10^5	>5
Bio indicator piece of linen *bacillus subtilis* $1.5x10^7$				
17	PM/F 3.3	TL: h=20cm	bac. subtilis $1.5x10^7$	>7.17
18	PM/F 3.3	TL: h=30cm	bac. subtilis $1.5x10^7$	>7.17

6 thermo elements (TE): 1 TE each near bio indicator and 1 TE free in the chamber operating time: 21 min

5.4 Liquids / partial load (3 cycles)

The tests with liquid loads were carried out exclusively by means of thermo electric measurements of the temperatures in the liquid. The test load consisted of 4 polypropylene bottles (500ml) filled with tap water; each bottle being placed in one quadrant (without additional bag). The thermo elements were positioned in all three experiments as follows: (experiments 4.1 - 4.3)

TE	*level*	*position*	*TE*	*level*	*position*
T2	1	quadrant I (bottle)	T6	6	quadrant II (chamber)
T3	1	quadrant II (bottle)	T7	2	quadrant IV (chamber)
T4	1	quadrant III (bottle)			
T5	1	quadrant IV (bottle)			

The recorder graphs in the test model show that in disinfecting liquids, considerable compensation periods must partly be expected (up to 3 min). But because of the sufficiently calculated hold period of 6 min, the process parameters can be reached within the required period of 3.5 min.

5.5 Liquids / full load (3 cycles)

The test load consisted of 3 bottles (see above) in a waste bag with cellulose tissue (height of the test load: ca 25cm). The measuring of the temperatures of the liquids in full load was carried out with a single temperature sensor. *Excursion: In this test model the measuring of temperatures in different places is not permitted because since screened thermo element lines have to be used, the influence of this bunch of screened lines on the original microwave field (without the presence of a bunch of screened lines) is not to be neglected. In using only one single temperature sensor this influence can be minimized and kept within tolerable margins of error.*
Position of thermo elements in experiments 5.1, 5.2 and 5.3:
level 1 / quadrant I (bottle, II (bottle) and III (bottle).
The recorder graphs show that the required process parameters are reached for the steam temperature (see appendix).

5.6 Checking the bio indicators

- All untreated bio indicators (i.e. not treated in the disinfection process) acc. to DIN 58 948 (*bacillus subtilis* 10^5 SIMICON DES) showed germ growth after breeding.
- From the untreated germ carrying pieces of linen with spores of *bacillus subtilis* (initial germ number $1.5x10^{7)}$ the following germ numbers could be re-won:

germ carrier I:	$1.8x10^6$	germ carrier III:	$2.7x10^6$
germ carrier II:	$2.7x10^6$	germ carrier IV:	$3.2x10^6$

5.7 Microbiological check of the drain water

In a special disinfection process a 70 litre PE-bag, half filled with mikrobiological cultures from the regular bacteriologic laboratory of the Institute of Hygiene of the University of Graz was treated. After the disinfection the device was turned off to take out the left-over liquid from the disinfection chamber before the exhaust process. The bacteriological examination (membrane filtration method) showed no germ growth per 250ml of drain water.

6 Valuation of the test results

- The selected operating parameters of 2100 mbar (i.e. a steam temperature of 121.7 °C) with a hold period of 6 min guarantee the disinfection of microbiologically contaminated (so-called infectious) waste. The operating parameters contain a sufficient safety margin compared to the theoretically calculated length of the hold period of 2.0 - 3.5 min (for a required reduction of germ numbers for 5 log-steps). The selection on the device is appropriate for reaching the operating parameters within the full operating time.

- Since there was no proof of any germ growth in any probes we used, we come to the conclusion that all bio indicator, exposed in the 9 experiments, showed the required number of germ reduction of *bacillus subtilis* (preparation acc. to DIN 58 948) for a minimum of 5 log-steps (and furthermore for the preparation with pieces of linen a minimum of 6 log-steps) after disinfection in the device.

- The device in question fullfills the requirements of the German Federal Health Office for thermic disinfection processes, admitted in the „list of disinfection agents and devices, tested and acknowledged by the (German) Federal Health Office", concerning the number of germ reduction in bio indicators, which have a higher resistance than necessary (status of 1990/8/1).

- The device in question fullfills the general requirements for the testing of waste disinfection processes for their efficiency acc. to the directions of the German Federal Health Office and the German Society for Hospital Hygiene (issue 1993/2/1).

- The device in question fullfills the requirements of the ÖNORM (Austrian standard) S 2104 for waste disinfection.

7 Summary

The microwave steam disinfection process, tested in the waste disinfection device SINTION, is capable of the killing of all germs of the resistance ranges A, B, C in microbiologically contaminated (so-called infectious) waste under the most difficult circumstances that may occur in practice (except for air-tight closed systems).

Graz, 1995/12/27

Ass. Prof. Univ.Doz.
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(person in charge)

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8 Appendix

8.1 Measurement reports

8.1.1 Recorder graphs

Empty chamber 1.1
Empty chamber 1.2
Empty chamber 1.3

Porous material / Full load 3.1
Porous material / Full load 3.2
Porous material / Full load 3.3

Liquids / Partial load 4.1
Liquids / Partial load 4.2
Liquids / Partial load 4.3

Liquids / Full load 5.1
Liquids / Full load 5.2
Liquids / Full load 5.3

8.1.2 Adjustment report

Institute for Applied Hygiene
A-8045 Graz, Ursprungweg 160, Tel.: 0316/69 47 11, Fax: 0316/69 47 11-4

Adjustment Report
Temperature

Type: Process Recorder Chessell 4200
Device No.: IO 6216-001 Inv.No.: 006 Date: 1995/11/8

The adjustment of the measuring chain recorder-thermo elements (type T) was carried out acc. to the configuration menu, defining 2 temperatures as starting and finishing point.

The starting point (= 0°C) was set in an ice-cube bath with a magnet mixer by means of a calibrated digital temperature measuring device (ALMENO 2290-3 with Pt 100).

Thermometer No.: 951464, last calibration: 1995/10/20

The finishing point (121°C) was set in an oil bath (Haake DC3) by means of above mentioned thermometer.

The following temperatures were measured:

Environment temperature: 19,3°C

Starting set point: 0.43°C				Finishing set point: 121.3°C			
Measurements							
TE 1	/	TE 6	-0.1°C	TE 1	/	TE 6	121.28°C
TE 2	-1.07°C	TE 7	-0.12°C	TE 2	121.5°C	TE 7	121.42°C
TE 3	-0.78°C	TE 8	/	TE 3	121.41°C	TE 8	/
TE 4	-0.5°C	TE 9	/	TE 4	121.02°C	TE 9	/
TE 5	-0.34°C	TE 10	/	TE 5	120.90°C	TE 10	/

The device was adjusted to the appropriate set points (print-out enclosed).
The correct functioning of the device is certified herewith.

Maintenance carried out by: MIORINI

Signature:

Enclosed: Measurement report