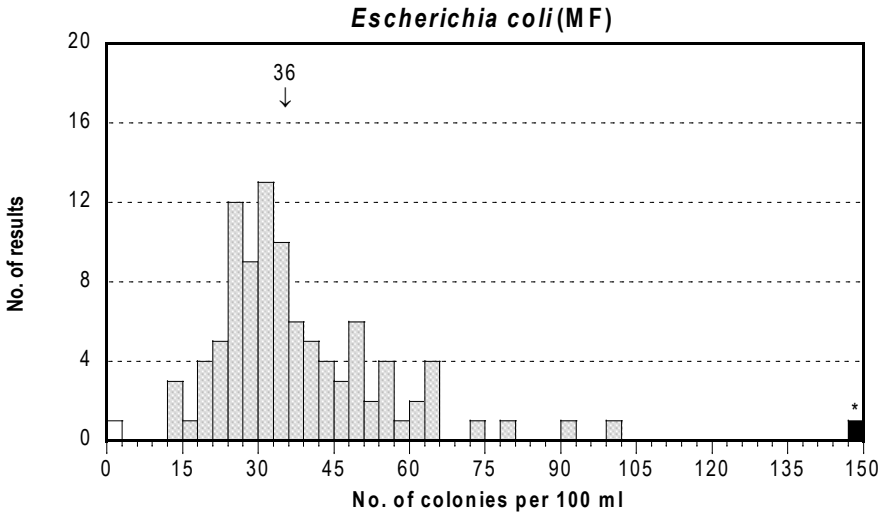
Rapport 20 – 2010

Proficiency Testing

Drinking Water Microbiology
2010:2, September

by Christina Lantz, Tommy Šlapokas and Irina Boriak



LIVSMEDELS VERKET
NATIONAL FOOD ADMINISTRATION, Sweden

Proficiency Testing

Drinking Water Microbiology

2010:2, September

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Introduction

In all analytical activity it is of utmost importance that the work maintains a well documented high standard. Therefore, most laboratories have a system for quality assurance. How well this works has however to be evaluated by an independent part. Such an external quality check of laboratory competence is also commonly required by the accreditation bodies. This may be done by taking part in proficiency tests. The laboratories that participate in the proficiency test are supposed to follow instructions, perform analyses using their routine methods on the received samples and report their results to the organiser. The organiser subsequently evaluates the results and finally compiles them in a report. This report summarises the results from such a proficiency test. There are at all events three purposes with the microbiological proficiency testing activity at the National Food Administration.

1. Laboratories should receive an external evaluation of parts of their analytical competence, including usage of methods, documentation and orderliness.
2. The accreditation bodies in respective countries should have a tool at inspections regarding new accreditation and maintenance of accreditation.
3. Laboratories and the organiser should receive increased knowledge regarding how well methods work, with respect to various types of organisms, at laboratories that on a routinely basis perform analyses.

Design

Analyses and mixtures

This particular proficiency test was performed during week 36 in September 2010, and is registered as no. 3568/2010 at the National Food Administration, Uppsala. Samples were sent to 119 laboratories out of which 34 Swedish, 69 from other Nordic countries and 16 from other countries. One laboratory did not report results.

Assessed parameters:

Coliform bacteria and ***Escherichia coli*** with membrane filtration (MF)

Coliform bacteria and ***Escherichia coli*** with a rapid method with MPN results
Intestinal enterococci with MF
Pseudomonas aeruginosa with MF
Total plate count (Culturable microorganisms) **3 days incubation at 22±2 °C**
Total plate count 2 days incubation at 36±2 °C

Not assessed parameters:

For the MF analyses also the number of suspected colonies on the primary culturing plates could be reported. However, those results have not been included in the calculations of erroneous results with respect to the individual laboratory. No judgement is made, rather, they are used only as base for interpretations and discussions.

The proficiency test comprised three simulated water samples. Each laboratory was assigned to perform the analyses according to its ordinary methods routinely used on drinking water samples. The test material is first and foremost adjusted to those EN ISO methods for analyses of drinking water, stated in the drinking water directive of the European Union (1). Accepted alternative methods in EU are in general also possible to use, as well as other similar methods.

Three freeze-dried test materials were produced from different microorganism mixtures. The material was manufactured and freeze-dried in portions of 0.5 ml in small vials, according to the description by Peterz and Steneryd (2). Each laboratory received one vial of each mixture. The simulated water samples, 800 ml each, were prepared by dissolving the content of the vials in sterile dilution or rinsing agent.

The microbial composition in respective mixture is clear from **table 1**.

Table 1 *Microbial mixtures* [1]

Mixture	Microorganisms	Strain no.	No. of CFU/100 ml [2]
A	*Escherichia coli*	SLV-165	38
	Enterococcus durans	SLV-078	123
	Pseudomonas aeruginosa	SLV-395	10
	Stenotrophomonas maltophilia	SLV-041	34*
B	*Escherichia coli*	SLV-295	45
	Aeromonas hydrophila	SLV-533	12
	Enterococcus hirae	SLV-536	76
	Staphylococcus capitis	SLV-463	60*
C	*Klebsiella oxytoca*	SLV-089	230
	Enterobacter cloacae	SLV-187	297
	Pseudomonas cepacia	SLV-042	732
	Staphylococcus saprophyticus	SLV-013	484

1 For linkage between the randomised sample number and respective mixture, please see annex A

2 Based on results from duplicate analyses, performed at the National Food Administration, of 10 vials per mixture, (for mixture A 5 vials). Somewhat varying results are obtained depending on from which sample volumes and media the calculations are made. The results from m-Endo Agar LES have been used for *E. coli*, *A. hydrophila* and *K. oxytoca*, and *E. cloacae*; those from m-Enterococcus Agar for *E. durans* and *E. hirae*; those from PACN Agar for *P. aeruginosa* and *P. cepacia*; those from YeA for *S. maltophilia* and *S. capitis* (cf. table 2) — no. is stated as cfu ("colony forming units") per 100 ml, if other is not stated

* cfu per ml

Quality check of the samples

Homogenous samples and uniform volumes in all vials are prerequisites in order for comparison of all freeze-dried samples from one mixture to be feasible. The volume has been checked in at least 13 vials from each mixture. The difference between all the vials were at most 3 mg. The highest accepted deviation is 15 mg (3%). **Table 2** presents the results from duplicate analyses of 10 vials from each mixture as coefficients of variation (CV). The results relate to that unit by volume at which the colonies were counted. According to the criteria used, the CV´s were acceptable for all mixtures in order to be regarded as homogenous. The highest accepted CV is normally 25%. At very low colony counts a higher CV is accepted. To read more about the calculations, see the scheme protocol (3)

Table 2 *Coefficients of variation (%; square root transformed results* [1]*) for various microbial groups, in analyses performed in connection to the proficiency test*

Analysis	**Mixture**		
	A	**B**	**C**
Suspected coliform bacteria (MF) [2]	7	6	4 [a]
Suspected thermotolerant coliform bact. (MF) [3]	8	6	25 [a]
Intestinal enterococci (MF) [4]	2	5	4 [a]
Pseudomonas aeruginosa (MF) [5]	12	–	–
Culturable microorg., 3d at 22 °C (pour-plate) [6]	–	–	10
Culturable microorg., 2d at 37 °C (pour-plate) [6]	5	6	9

1 n=10, (mixture A n=5), mean values á 2 analyses of 100 ml for MF and 1 ml for pour-plate, if other is not stated; mixtures A, B and C analysed 20, 15 and 9 weeks ahead of the proficiency test, respectively

2 m-Endo Agar LES according to SS 028167 [analyses were also made on Lactose TTC Agar with Tergitol according to SS-EN ISO 9308-1:2000, but those results are not accounted for here]

3 m-FC Agar, 44 °C according to SS 028167 [analyses were also made on Lactose TTC Agar with Tergitol according to SS-EN ISO 9308-1:2000, but those results are not accounted for here]

4 m-Enterococcus Agar (m-Ent) according to SS-EN ISO 7899-2:2000

5 Pseudomonas Agar base Cetrimide Nalidixic acid Agar (PACN) according to SS-EN ISO 16266:2008

6 Yeast extract Agar (YeA; yeast extract agar with tryptone) according to SS-EN ISO 6222:1999

a Read for the volume 10 ml

– Not analysed

Laboratory results

General information regarding the results

The histograms (**figure 1**) show the actual distribution of the results. False positives are not presented in the histograms. The total number of these, and other results with annotations, are compiled in **table 3**. False results and outliers are generally not included in the calculations. **All reported laboratory results are compiled in annex A and photo examples of colony appearance are given in annex B.**

In most histograms are "tails" in either or both directions, representing values that do not belong to the distribution present. Better normal distributions are obtained by performing square-root transformations of the results, and are, therefore, used for the calculations. The significance of these "tails" is in that way decreased. Very deviating values are identified as outliers also after square root transformation (black bars). They are present in most analyses. False negative results are presented as white bars. The calculations are more elaborately described in the scheme protocol (3).

Outliers are identified with the aid of Grubbs' test according to a modification by Kelly (4). A level of 1% is used as risk to incorrectly assess a result as being an outlier. Although the method itself is objective, it is a prerequisite that the results are normally distributed in order to obtain correct outliers at the 1% level. A result of zero that is identified as a low outlier is regarded as a false negative result. In special situations, e.g. when many zero results are reported and in some borderline cases, a few subjective adjustments are made in order to set just limits, based on the knowledge of the content of the mixtures.

The coefficient of variation (CV) is used to measure the dispersion of the laboratory results. If the dispersion is < 10% it is regarded as very small, 10-20% as small, 20-30% as medium, 30-40% as large and > 40% as very large.

Table 3 *Number of analytical results with annotation in evaluated analyses*

Classification of results	**Number of results**[1]				**Total no. of**
	A	**B**	**C**	**Total**	**laboratories**
No. of evaluated results	692	693	694	***2079***	***118*** [a]
False positives	0	9	29	***38***	***29***
False negatives	8	9	3	***20***	***10***
Low outliers	8	12	6	***26***	***15***
High outliers	13	13	11	***37***	***24***
No. of results with annotation	29	10	49	***121***	***56*** [b]

1 Results obtained in the analyses designated suspected have not been included
a Number of laboratories that reported analytical results
b Number of laboratories that reported at least one result with annotation

Outcome of the mixtures

Mixture A

Discussion in general

The mixture contained four bacterial strains (table 1 and **table 4**): *E. coli* as coliform bacterium, *E. durans* as intestinal enterococcus, *P. aeruginosa* and *S. maltophilia*, which emerges as a culturable microorganism at 22±2 °C as well as at 36±2 °C.

Table 4 *The outcome per analysis of mixture A; F+ and F- are the shares (%) false positive and negative results, respectively. Outl. < and Outl. > are the shares (%) low and high outliers, respectively. Results from analyses on shaded rows have in general not been numerically evaluated – median is there stated instead of mean.*

Analysis	Organisms	CFU/ vol.[1]	CV[2] (%)	F+	F-	Outl <	Outl >
Susp. coliform bacteria (MF)	*E. coli*	*37*	—				
Coliform bacteria (MF)	*E. coli*	34	13	-	1	0	6
Susp. thermotol. colif. bact. (MF)	*E. coli*	*33*	—				
E. coli (MF)	*E. coli*	35	16	-	2	0	0
Coliform bact. (rapid method)	*E. coli*	38	11	-	1	3	0
E. coli (rapid method)	*E. coli*	38	11	-	1	1	0
Susp. intest. enterococci (MF)	*E. durans*	*120*	—				
Intestinal enterococci (MF)	*E. durans*	120	10	-	0	1	0
Susp. *P. aeruginosa* (MF)	*P. aeruginosa*	*8*	—				
Pseudomonas aeruginosa (MF)	*P. aeruginosa*	8	26	-	3	0	3
Culturable microorganisms (total count) 22±2 °C, 3 days	*S. maltophilia* *(E. durans)* *(P. aeruginosa)* *(E. coli)*	24	14	-	0	4	0
Culturable microorganisms (total count) 36±2 °C, 2 days	*S. maltophilia* *(E. durans)* *(P. aeruginosa)* *(E. coli)*	23	16	-	1	0	1

1 "Colony Forming Units" per unit by volume – 1 ml for total count microorg., otherwise 100 ml
2 "Coefficient of Variation" – calculated from square root transformed results (see Annex)
- Numerical value impossible to obtain
– Organism not included or numerical value not calculated
( ) The organism contributes with only a few colonies
[ ] The organism often appears as a false positive in a suspected analysis
{ } The organism may give varying results depending on different definitions

Coliform bacteria (MF)

- The results were well distributed (figure 1A). The dispersion was small.
- 1 false negative result and 6 high outliers were reported.
- Merely one *E. coli* strain made up the coliform bacteria.
- The deviating high results may be due to that small, yellow oxidase negative *E. durans* colonies have been included as coliform bacteria when Lactose TTC Agar was used as medium according to the standard XX-EN ISO 9308-1:2000.

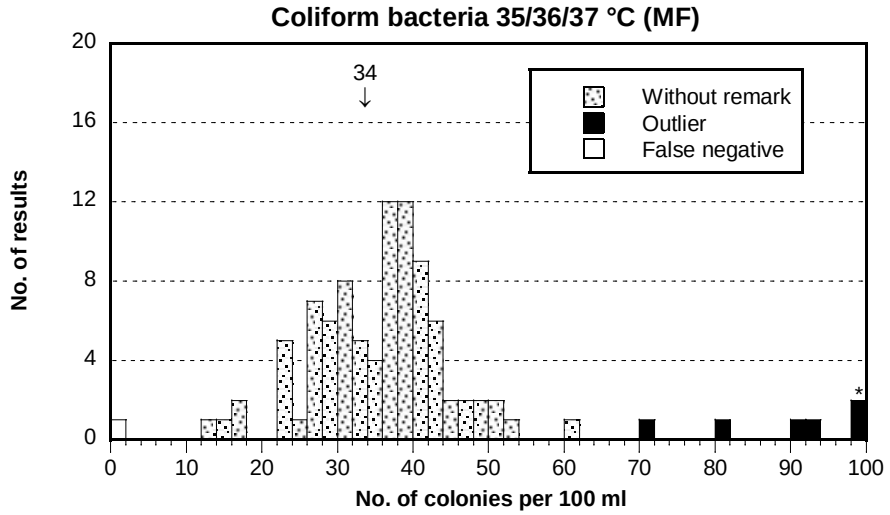


***Figure 1A Mixture A**, histogram of all analytical results. False negatives are represented by white bars, and outliers (false negatives excluded) are represented by black bars. The range of the x-axis has not been adjusted to very deviating values. Results outside the range of x are indicated by a bar with an asterisk (*) on top, at the right end of the x-axis. The mean value of the analysis is presented together with an arrow above the bars. Calculation of the mean value was made from square root transformed results, outliers and false negatives excluded.*

Suspected thermotolerant coliform bacteria

In 56 cases, colonies regarded as suspected thermotolerant coliform bacteria were obtained. They are made up by *E. coli*, which emerged on m-FC Agar or Lactose TTC Agar at 44/44.5 °C.

E. coli (MF)

- The results were well distributed (figure 1B). The dispersion was small.
- 2 false negative results were reported.

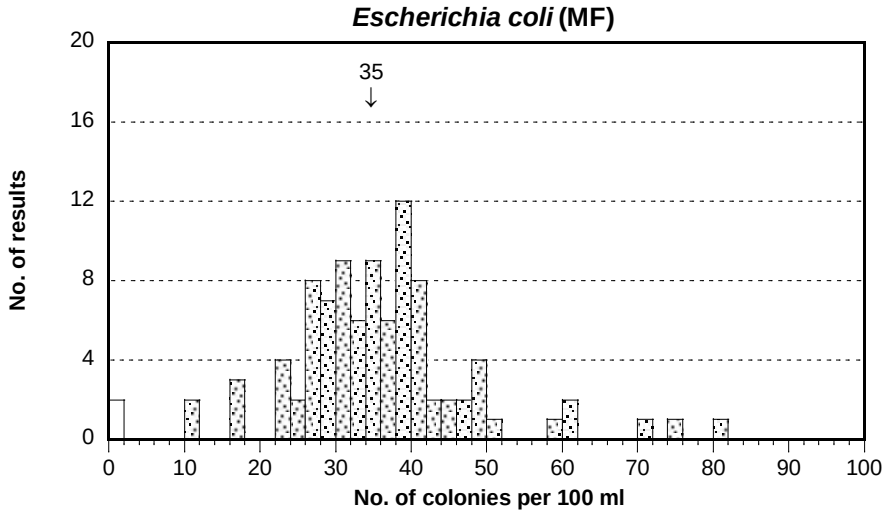


Figure 1B ***Mixture A****, see figure 1A for explanations*

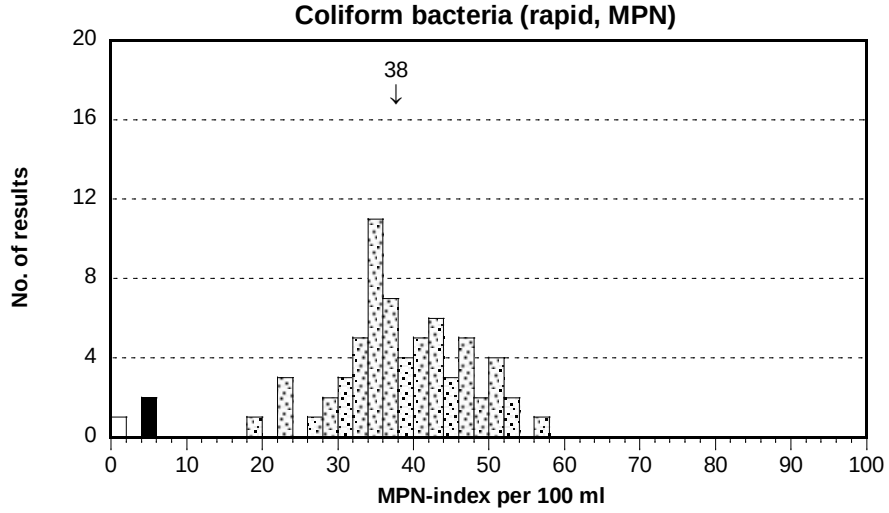


Figure 1C ***Mixture A****, see figure 1A for explanations*

Coliform bacteria (rapid method, MPN)

- The results were well distributed (figure 1C) and the dispersion was small.
- 1 false positive result and 2 low outilers were reported.

E. coli (rapid method, MPN)

- The results were less dispersed than when the MF method was used (figure 1D).
- 1 false negative result and 1 low outlier were reported.

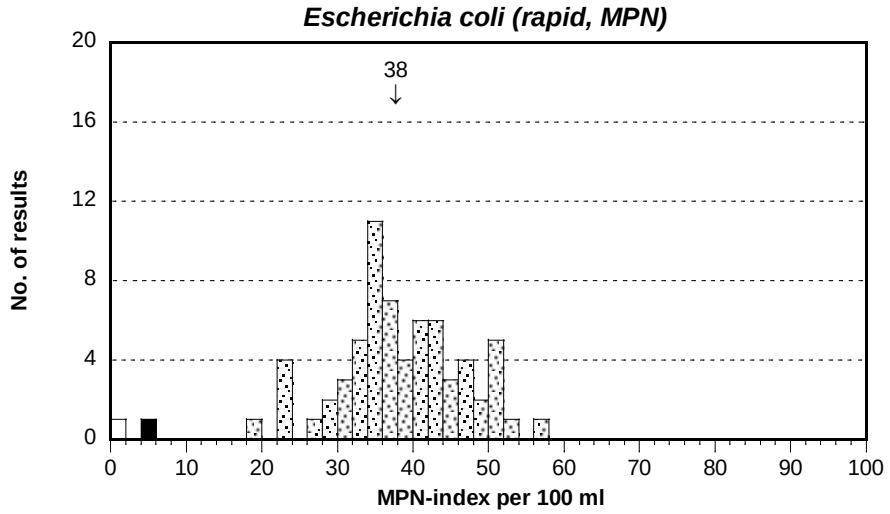


Figure 1D ***Mixture A****, see figure 1A for explanations*

Intestinal enterococci

- The results were well distributed (figure 1E). The dispersion was small.
- 1 low outlier was reported.
- The *E. durans* strain made up the intestinal enterococci. The strain has shown tendencies to give a markedly lower exchange on certain batches of membrane filters and is therefore a good "indicator" for filter problems with respect to enterococci. Such interference may be a possible explanation to the lowest results.

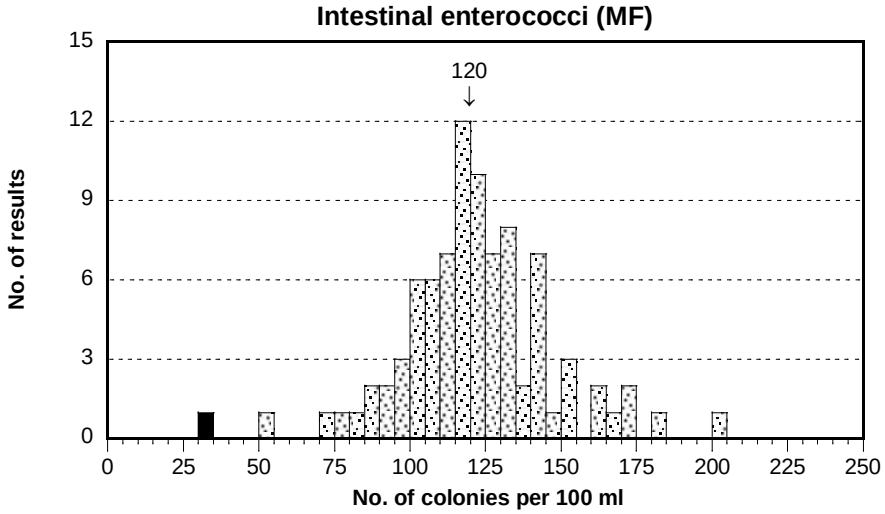


Figure 1E ***Mixture A****, see figure 1A for explanations*

Pseudomonas aeruginosa

- The results were well distributed (figure 1F), the dispersion was of medium order, mainly because the content was low.
- 2 high outliers were reported.
- Confirmation is in general not necessary when the standard method is used, since the colonies ought to have become greenish.

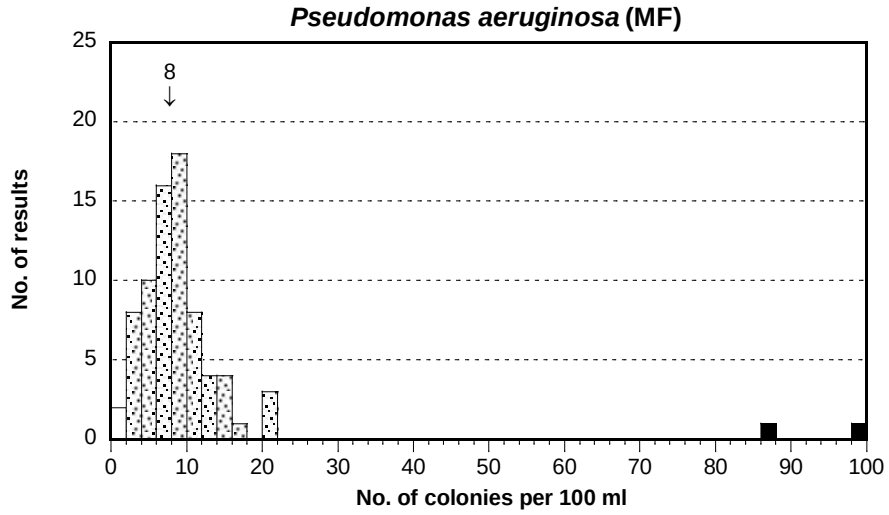


Figure 1F ***Mixture A****, see figure 1A for explanations*

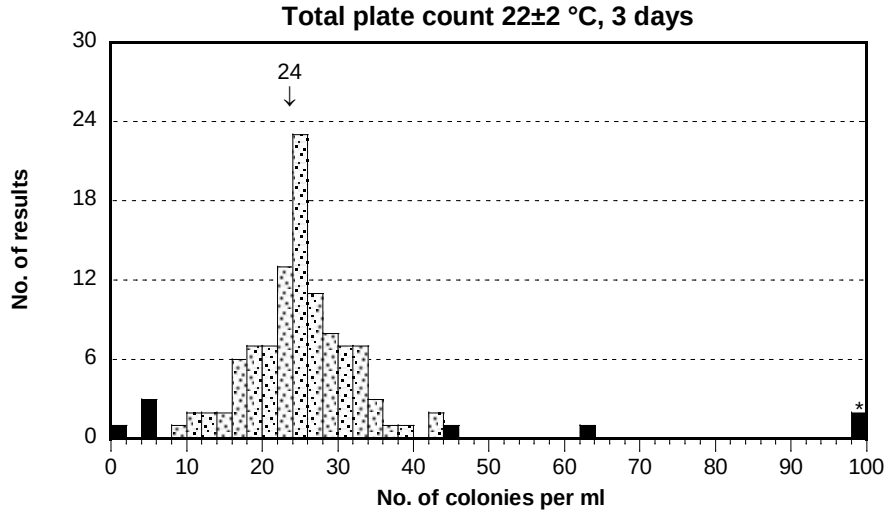


Figure 1G ***Mixture A****, see figure 1A for explanations*

Culturable microorganisms 22 °C, 3 days

- The results were well distributed at 22±2 °C (figure 1G). The dispersion was small.

- No false results, but 4 low and 4 high outliers were reported. The high outliers may have been caused by contamination in the laboratory.

Culturable microorganisms 36 °C, 2 days

- The results were somewhat more scattered at 36±2 °C, compared to at 22±2 °C (figure 1H), but the dispersion was still small at this temperature as well.
- 1 false negative result and 1 high outlier were reported.

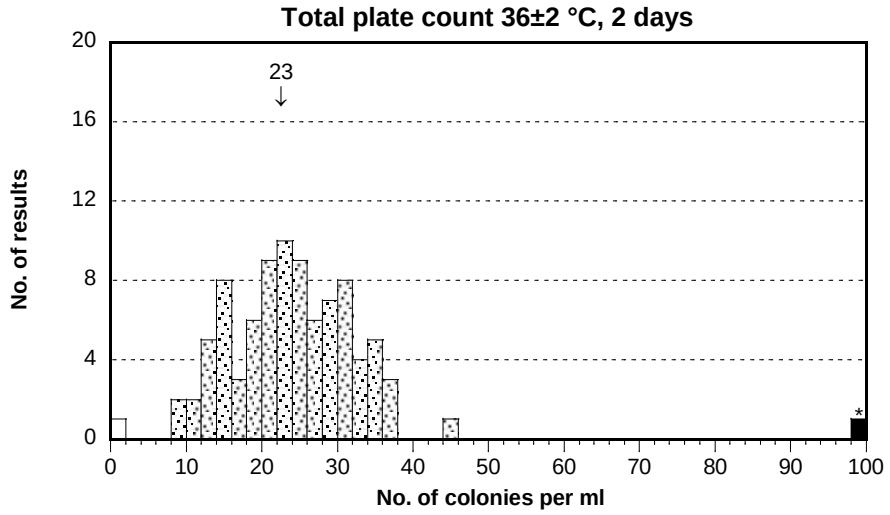


Figure 1H ***Mixture A****, see figure 1A for explanations*

Mixture B

Discussion in general

The mixture contained four bacterial strains (table 1 and **table 5**): *E. coli* as coliform bacterium, *A. hydrophila* which is able to emerge as a suspected coliform bacterium, *E. hirae* as intestinal enterococcus and *S. capitis* which emerges as a culturable microorganism at 36 °C but not at 22±2 °C. The *E. coli* strain did not emerge on all media in the *E. coli* analysis.

Table 5 *The outcome of mixture B; see table 4 for explanations and notes*

Analysis	**Organisms**	**CFU/ vol.**[1]	**CV**[2] **(%)**	**F+**	**F-**	**Outl <**	**Outl >**
Susp. coliform bacteria (MF)	*E. coli* *[A. hydrophila]*	*47*	—				
Coliform bacteria (MF)	*E. coli*	39	12	-	1	2	3
Susp. thermotol. colif. bact. (MF)	*E. coli*	*32*	—				
E. coli (MF)	*E. coli*	38	14	-	6	2	1
Coliform bact. (rapid method)	*E. coli*	38	14	-	1	3	0
E. coli (rapid method)	—	0	—	6	-	-	-
Susp. intest. enterococci (MF)	*E. hirae*	*75*	—				
Intestinal enterococci (MF)	*E. hirae*	74	8	-	1	1	0
Susp. *P. aeruginosa* (MF)	—	*0*	—				
Pseudomonas aeruginosa (MF)	—	0	—	0	-	-	-
Culturable microorganisms (total count) 22±2 °C, 3 days	*(E. coli)* *(A. hydrophila)* *(E. hirae)*	1	64	-	0	0	8
Culturable microorganisms (total count) 36±2 °C, 2 days	*S. capitis* *(E. coli)* *(A. hydrophila)* *(E. hirae)*	57	11	-	0	5	0

Coliform bacteria (MF)

- The results were well distributed (figure 1I). The dispersion was small.
- 1 false positive result, 3 low and 3 high outliers were reported.
- An *E. coli* strain with typical appearance made up the coliform bacteria.
- Present in the mixture was also a strain of *A. hydrophila*, whose colonies in many cases appeared as suspected coliform bacteria along with *E. coli*. The median for these was 47 cfu per 100 ml. After confirmation the mean value is 39 cfu and the *A. hydrophila* colonies have in most cases been disregarded of.

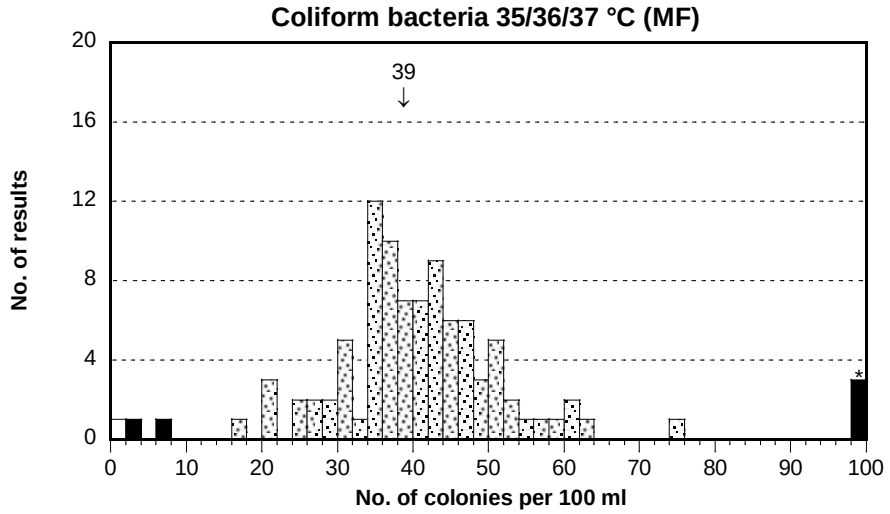


Figure 1I ***Mixture B****, see figure 1A for explanations*

Suspected thermotolerant coliform bacteria

In 57 cases colonies regarded as suspected thermotolerant coliform bacteria were obtained (figure 1J). They are made up by *E.* coli, which emerged on m-FC Agar and Lactose TTC Agar at 44/44.5 °C. What may have caused the results of zero is not known.

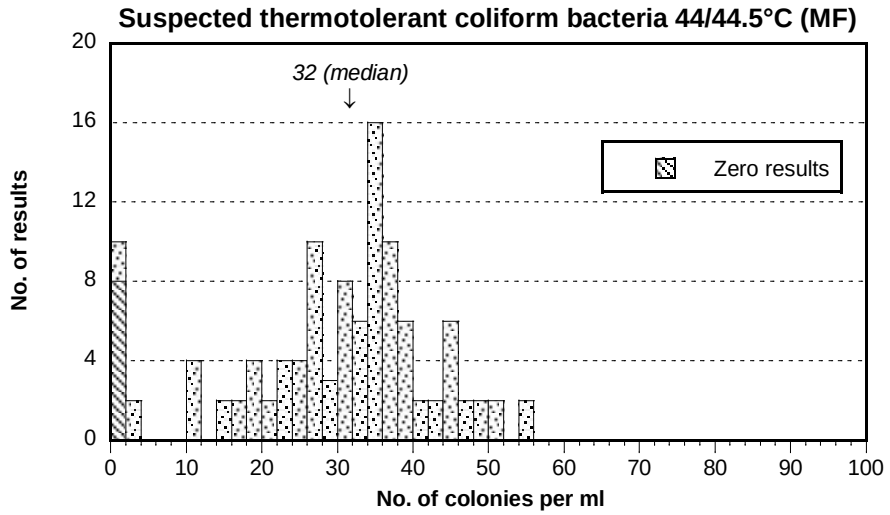


Figure 1J ***Mixture B****, see figure 1A for explanations*

E. coli, MF

- The results were well distributed. The dispersion was small (figure 1K).
- 6 false negative results, 2 low and 1 high outlier were reported.

- The *E. coli* strain emerges with typical colonies on m-Endo Agar LES and LTTC Agar at 35-37 °C, as well as on m-FC Agar at 44/44.5 °C. It does however not emerge with typical colonies on media based on detection of *β*-glucuronidase activity, e.g. Chromocult Agar® (Merck).
- Concerning laboratories that have analysed *E. coli* based on *β*-glucuronidase activity, the correct result is zero.

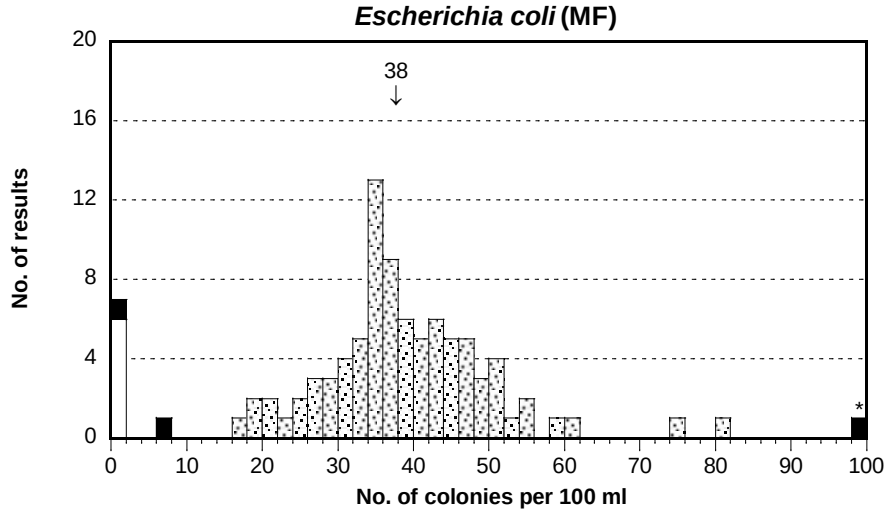


Figure 1K ***Mixture B****, see figure 1A for explanations*

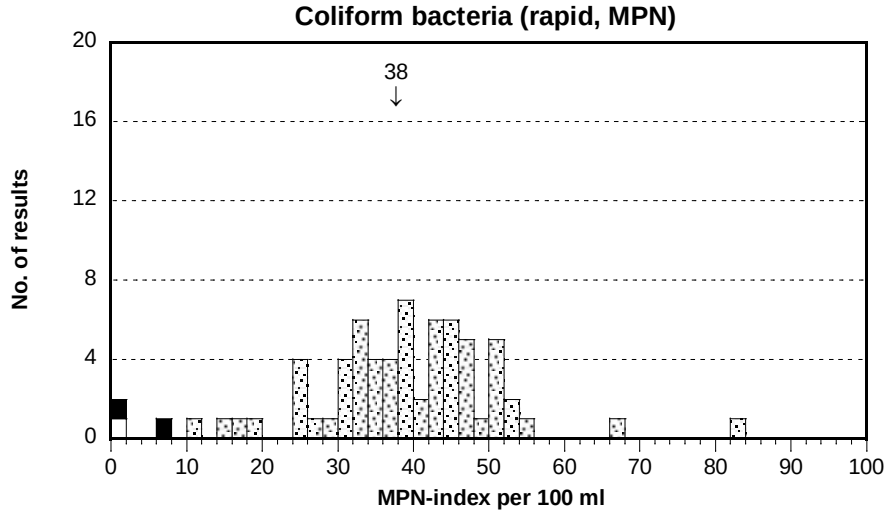


Figure 1L ***Mixture B****, see figure 1A for explanations*

Coliform bacteria (rapid method, MPN)

- The results were well distributed (figure 1L). The dispersion was small. The mean value was roughly the same as with the MF method.

- 1 false negative result and 2 low outliers were reported.

E. coli (rapid method, MPN)

- The *E. coli* strain in the mixture is *β*-glucuronidase negative, which means that it normally will not give any fluorescence with Colilert®-18/24 Quanti-Tray®. The bacteria should therefore not be detected as *E. coli* with this method. Still 4 false positive results have been reported.
- Earlier tests made at the National Food Administration were done to observe if incubation time of Colilert®-18 affect the reading of fluorescence. After 24 hours of incubation there were still no fluorescence (7).

Intestinal enterococci

- The results were well distributed (figure 1M). The dispersion was very small.
- 1 false negative result and 1 low outlier were reported.
- A strain of *E. hirae* made up the intestinal enterococci.

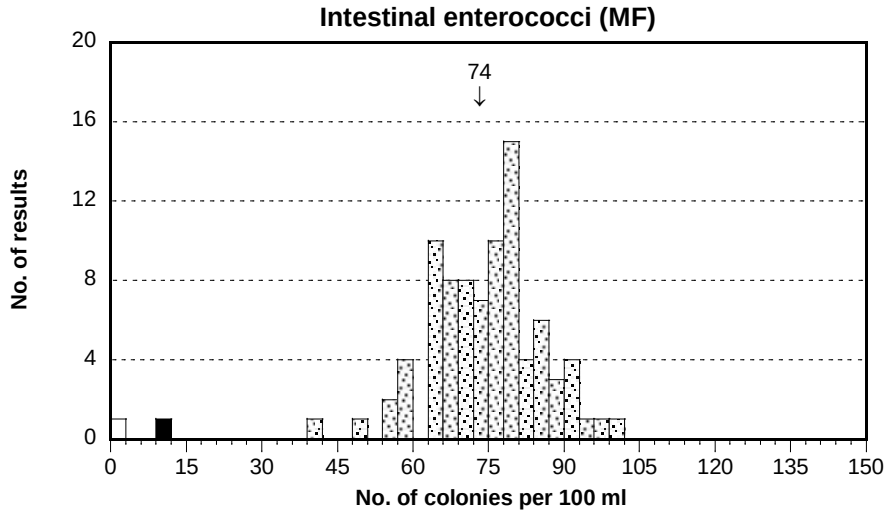


Figure 1M ***Mixture B****, see figure 1A for explanations*

Culturable microorganisms 22 °C, 3 days

- The results were rather well distributed, considering the low mean -1 cfu per ml (figure 1N). The relative dispersion was therefore, as expected, large.
- *S. capitis* does not emerge at 22 °C. The three remaining bacterial strains however do, but at very low numbers.
- 8 high outliers were reported.

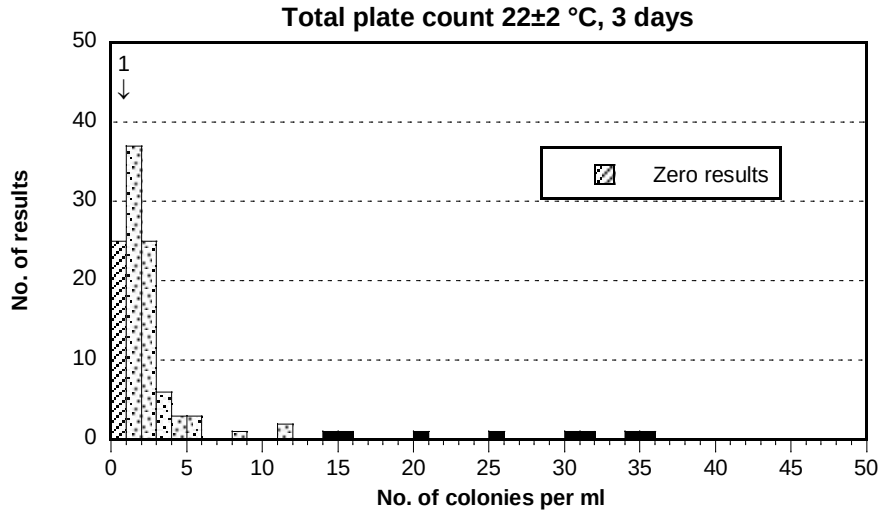


Figure 1N ***Mixture B****, see figure 1A for explanations*

Culturable microorganisms 36 °C, 2 days

- The results were well distributed (figure 1O). The relative dispersion was small.
- 5 low outliers were reported, the cause of which is unknown.
- *S. capitis* emerges at 36 °C, and made up the majority of culturable microorganisms. The remaining bacterial strains emerged at very low numbers.

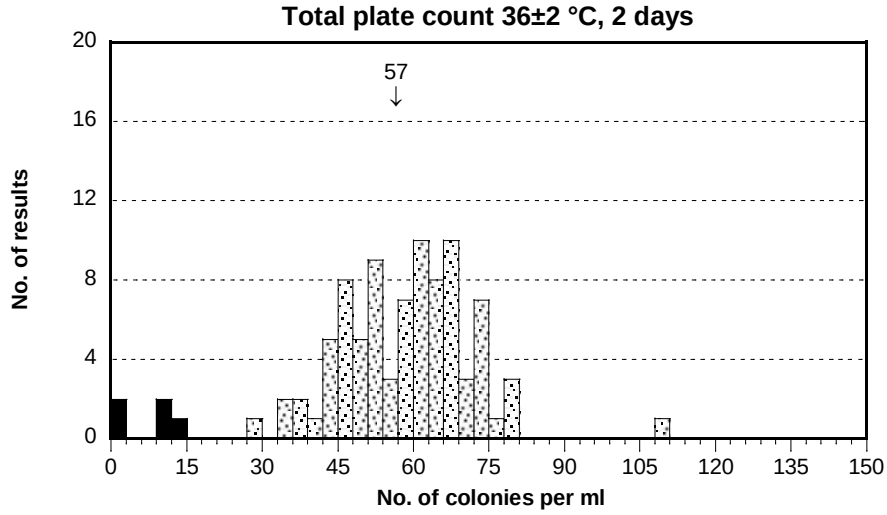


Figure 1O ***Mixture B****, see figure 1A for explanations*

Mixture C

Discussion in general

The mixture contained four bacterial strains (table 1 and **table 6**): *E. cloacae* and *K. oxytoca* as coliform bacteria, *P. cepacia* which emerges with pale colonies but without fluorescence on Pseudomonas Agar base with cetrimide and naldixic acid (PACN Agar), and a strain of *S. saprophyticus*, whose colonies are more or less red on m-Enterococcus Agar and may therefore be suspected to be enterococci.

Table 6 *The outcome of mixture C; see table 4 for explanations and notes*

Analysis	**Organisms**	**CFU/ vol.**[1]	**CV**[2] **(%)**	**F+**	**F-**	**Outl <**	**Outl >**
Susp. coliform bacteria (MF)	*K. oxytoca* *E. cloacae*	*418*	—				
Coliform bacteria (MF)	*K. oxytoca* *E. cloacae*	399	18	-	1	2	1
Susp. thermotol. colif. bact. (MF)	—	*75*	—				
E. coli (MF)	—	0	—	20	-	-	-
Coliform bact. (rapid method)	*K. oxytoca* *E. cloacae*	446	14	-	0	4	0
E. coli (rapid method)	—	0	—	3	-	-	-
Susp. intest. enterococci (MF)	*S. saprophyticus*	*0*	—				
Intestinal enterococci (MF)	—	0	-	2	-	-	-
Susp. *P. aeruginosa* (MF)	*P. cepacia*	*0*	—				
Pseudomonas aeruginosa (MF)	—	0	—	8	-	-	-
Culturable microorganisms (total count) 22±2 °C, 3 days	*S. saprophyticus* *E. cloacae* *K. oxytoca* *P. cepacia*	14	16	-	1	1	5
Culturable microorganisms (total count) 36±2 °C, 2 days	*S. saprophyticus* *E. cloacae* *K. oxytoca* *P. cepacia*	14	17	-	1	0	4

Coliform bacteria (MF)

- The results were well distributed (figure 1P). The dispersion was small.
- 1 false negative result, 2 low and 1 high outlier were reported.
- One strain each of *K. oxytoca* and *E. cloacae* with typical appearance on both m-Endo Agar LES and LTTC Agar made up the coliform bacteria.

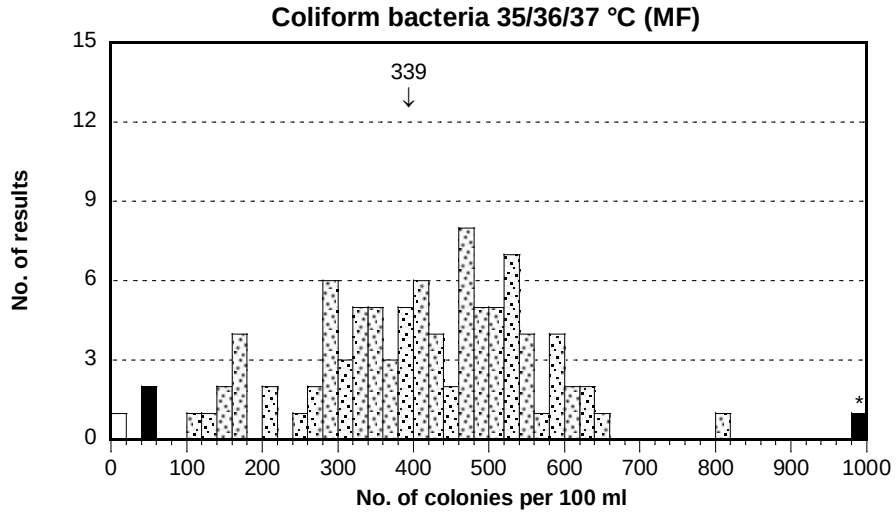


Figure 1P ***Mixture C****, see figure 1A for explanations*

Suspected thermotolerant coliform bacteria

In 56 cases colonies were obtained that were regarded as suspected thermotolerant coliform bacteria. They are made up by *E. cloacae*, which emerged to some extent on m-FC Agar and Lactose TTC Agar at 44/44.5 °C.

E. coli (MF)

- No *E. coli* was present in the mixture. However, a *K. oxytoca* strain and an *E. cloacae* strain, which emerge with typical colonies on both m-Endo Agar LES and TTC Agar at 35-37 °C, were included.
- When confirming for *E. coli*, and not performing tests for gas production or *β*-glucuronidase activity, *K. oxytoca* colonies may grow and produce indole in broth at 44 °C (5, 6), and therefore be taken for *E. coli*.
- If confirmation was performed from plates incubated at 44/44.5 °C, no *K. oxytoca* colonies will be available for confirmation.
- 19 false positive results were reported. These results can not be said to be erroneous, unless tests for gas production or *β*-glucuronidase activity have been made.

Coliform bacteria (rapid method, MPN)

- The results were well distributed, but with a few low and high values (figure 1Q). The dispersion was still small.
- 3 low outliers were reported.
- Both strains *K. oxytoca* and *E. cloacae* are ONPG positive and contribute to the result.

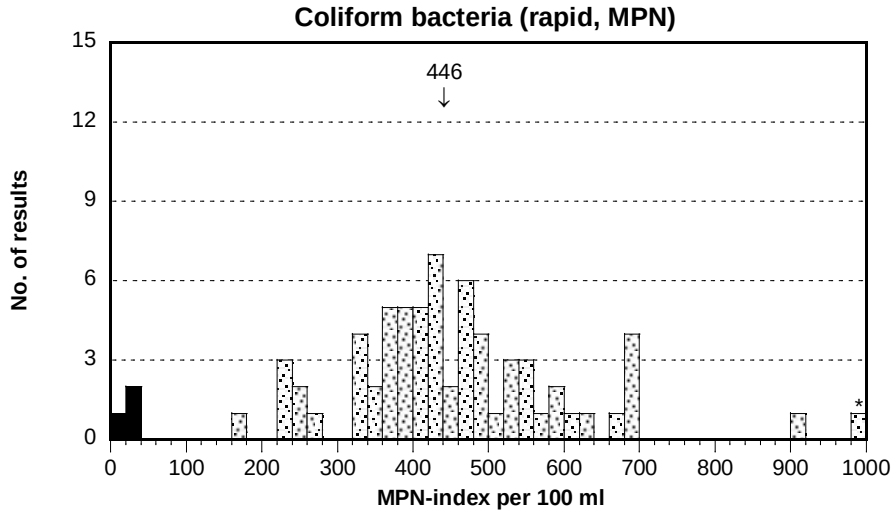


Figure 1Q ***Mixture C****, see figure 1A for explanations*

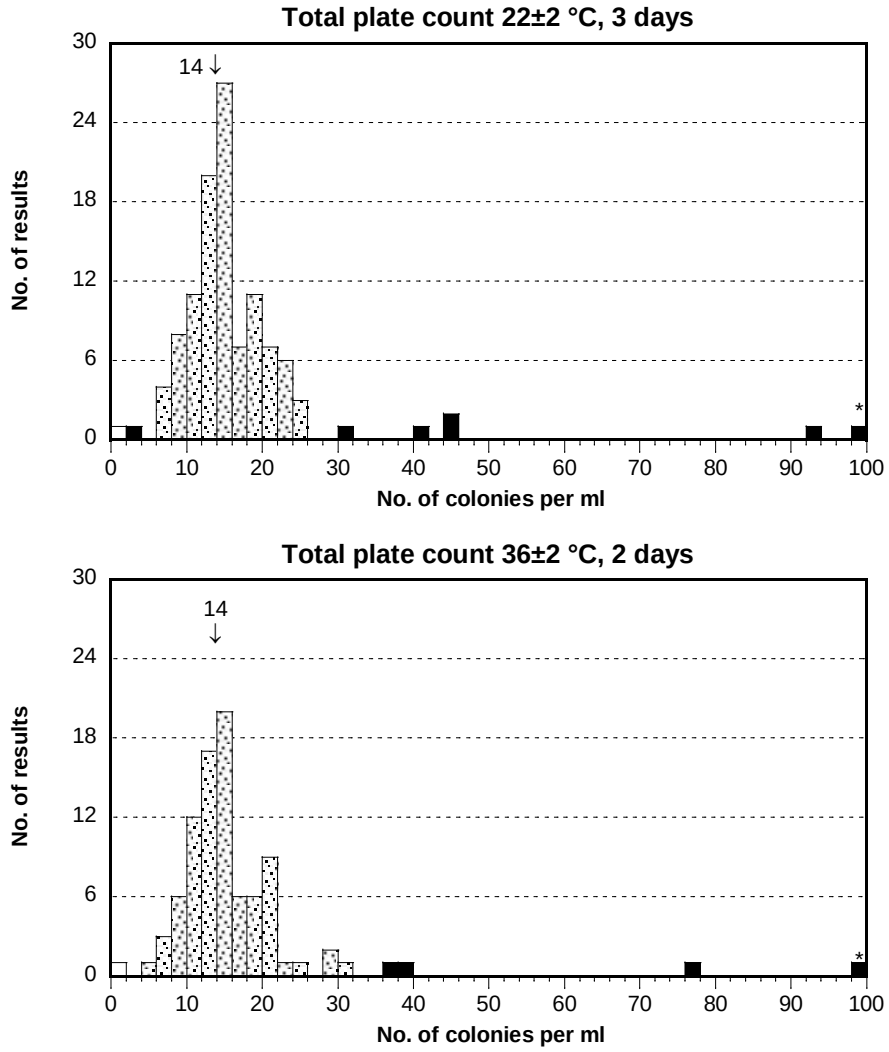
E. coli (rapid method, MPN)
- No *E. coli* was present in the mixture and the outcome should be zero.

Intestinal enterococci
- No intestinal enterococci were present in the mixture.
- 2 false positive results were, however, reported.
- A strain of *Staphylococcus saprophyticus* was included in the mixture, and it´s colonies may be reddish on m-Enterococcus Agar. The strain is negative in the confirmation step (no esculin hydrolysis).

Pseudomonas aeruginosa
- No *P. aeruginosa* was present in the mixture.
- 6 false positive results were reported.
- A strain of *P. cepacia*, which emerges as pale yellow-white colonies on PACN Agar was included. They are however not fluorescent in UV-light and should not be regarded as suspected *P. aeruginosa*. When confirmed further, the strain is positive in Acetamide broth but negative on King B (no fluorescence).

Culturable microorganisms 22 °C, 3 days and 36±2 °C, 2 days
- The results were well distributed in both analyses (figures 1R and 1S). The dispersion was small.
- 1 false negative result, 1 low and 6 high outliers were reported at 22 °C.
  1 false negative and 4 high outliers were reported at 36 °C.

- The majority of the culturable microorganisms at both temperatures was made up by *S. saprophyticus*.



Figures 1R and 1S *Mixture C, see figure 1A for explanations*

Outcome of the methods

General information regarding methods

After the optional new web recording of method information, started in September 2006, there is still too few laboratory replies as regards most parameters for any reasonable comparisons between methods used for one and the same analysis to be made. The share of method information in relation to the numerical results that were stated by the participating laboratories is presented in **table 7**. The share ranges from 71% for culturable microorganisms 36 °C, to 84% for *E. coli* (MF).

If method alternatives should be missing in the method forms, we repeat the appeal to you to inform us about such alternatives, in order to be able to add them to the available alternatives. New alternatives may possibly be in slight need of modification by us, as regards linguistics, to fit among the others. The final adjustment of the method information can thus not be made by the laboratories until the new alternatives have been added.

Table 7 *The number of participating laboratories that stated analytical results and method information, and the share of method information expressed as percentage for respective parameters.*

Analytical parameter	**Analytical results** *(no.)*	**Method information** *(no.)*	**Method information** *(%)*
Coliform bacteria (MF)	96	80	83
Thermotol. colif. bact. (MF)	57	43	75
E. coli (MF)	95	80	84
Coliform bact. (rapid method)	69	53	77
E. coli (rapid method)	69	53	77
Intestinal enterococci	88	63	72
Pseudomonas aeruginosa	76	73	76
Culturable microorg., 22±2 °C	112	90	80
Culturable microorg., 36±2 °C	91	65	71

Results for coliform bacteria and *E. coli* (MF) with different methods

In Norway, Finland and Sweden, the previously used membrane filtration methods (MF) for coliform bacteria may be used at statutory sampling, as alternatives to the reference method EN ISO 9308-1:2000, based on Lactose TTC Agar with Tergitol 7 (”LTTC Agar”). The previously used methods, which are based on m-Endo Agar LES (”LES endo agar”) and m-FC Agar, are often used more or less modified. In Sweden and Finland, m-FC Agar should not be used for *statutory sampling* in drinking water, rather, *E. coli* should be determined by the confirmation of ”LES Endo Agar” plates incubated at 36±2 °C. The *E. coli* confirmation in Sweden is made up by a negative oxidase test for coliform bacteria, and in addition, a positive indole test at 44 °C and since the autumn of 2010 β-glucuronidase activity test is also included, in order to eliminate among others, indole positive, thermotolerant *K. oxytoca* strains (8). In Finland, an additional gas test at 44 °C or β-glucuronidase activity test is recommended as well. In such cases, *E. coli* should be indole positive as well as gas or β-glucuronidase positive.

Apart from the reference method *XX*-EN ISO 9308-1:2000 (*XX* stands for the national versions), the older national standards used in Finland, Norway and

Sweden are presented individually in table 8 an 9. There are also the terms SS 028167 Modif. and SFS 3016/4088 Modif., as regards *E. coli*. They involve modifications such as those that were stated above, with respect to Sweden and Finland, respectively. Individual results obtained with another method or where the method is not known is not discussed here.

Regarding coliform bacteria, there was some difference for the results obtained with different methods (**table 8A**). The mean value for coliform bacteria in mixture

Table 8 *Number of answers and results, outliers excluded, with different method standards in MF analysis of coliform bacteria (A) and E. coli (B) incubated at 36±2 °C*

Method standard	Total no. of answ.	Mixture A n	Mixture A Mv [1]	Mixture B n	Mixture B Mv [1]	Mixture C n	Mixture C Mv [1]
A. Coliform bacteria	***74***	***70***	**36**	***71***	**41**	***74***	**413**
XX-EN ISO 9308-1:2000 [a]	*15*	*15*	36	*18*	39	*20*	353
SS 028167 [b]	*22*	*22*	36	*20*	39	*21*	452
SFS 3016 [c]	*31*	*32*	36	*31*	44	*31*	422
NS 4788 [d]	*2*	*2*	29	*2*	42	*2*	504
Other	*0*	*0*	–	*0*	–	*0*	–
B. Escherichia coli	***47***	***47***	**35**	***44***	**38**	***39***	**0**
XX-EN ISO 9308-1:2000 [a]	*11*	*11*	38	*11*	39	*8*	0
SS 028167 Modif. [b, e]	*14*	*14*	34	*13*	37	*11*	0
SFS 3016/4088 Modi [f, g]	*22*	*22*	33	*20*	39	*20*	0
NS 4792 [h]	*0*	*0*	–	*0*	–	*0*	–
Other	*0*	*0*	–	*0*	–	*0*	–

1 Mean values based o square root transformation cfu per 100 ml

a ISO/CEN Standard: Water quality — Detection and enumeration of *Escherichia coli* and coliform bacteria — Part 1: Membrane filtration method, September 2000 (XX stands for the national translations, if any)

b Swedish Standard: Coliform Bacteria, Thermotolerant Coliform Bacteria and *Escherichia coli* in Water — Determination with Membrane Filtration Method (MF), 2nd ed. 1996-03-13

c Finnish Standard: Membrane filter technique for the enumeration of total coliform bacteria in water, 2001-05-21

d Norwegian Standard: Coliform Bacteria — Membrane filter method, 1st ed. May 1990

e *E. coli* are coliform bacteria from m-Endo Agar LES that are indole positive at 44 °C or *β*- glucuronidase and indole positive at 44 °C

f Finnish Standard: Membrane filter technique for the enumeration of thermotolerant (faecal) coliform bacteria in water, 2001-05-21

g *E. coli* are coliform bacteria from m-Endo Agar LES that are indole positive, alternatively gas and indole positive or *β*-glucuronidase & indole positive at 44 °C

h Norwegian Standard: Thermotolerant coliform bacteria and presumptive *E. coli* — Membrane filter method, 1st ed. May 1990

C seem to be lower when method XX-EN ISO 9308-1:2000 is used compared with the other methods. Difficulties to count colonies on LTTC Agar could be a possible explanation.

Table 8B accounts for the outcome of *E. coli* that is confirmed after primary incubation at 36±2 °C. Mixture C did not contain any *E. coli*. Mixture A contained a "normal" *E. coli* but no obvious differences could be found there. Mixture B contained a *E. coli* that is *β*-glucuronidase negative but no obvious differences could be found there either.

Table 9 accounts for the outcome of suspected thermotolerant coliform bacteria and confirmed *E. coli* from media incubated at 44/44.5 °C. For the analysis of suspected thermotolerant coliform bacteria the national methods are used in a greater extend then EN ISO 9308-1:2000. Some differences in the results between

Table 9 *Number of answers and results, with different method standards in analysis of suspected thermotolerant coliform bacteria (A; all results) and E. coli (B; outliers excluded) with membrane filtration and incubation at 44/44.5 °C*

Method standard	Total no. of answ.	Mixture A		Mixture B		Mixture C	
		n	Mv [1]	n	Mv [1]	n	Mv [1]
A. Susp. thermotol. colif. bact.	***43***	***42***	**33**	***43***	**26**	***43***	**67**
XX-EN ISO 9308-1:2000 [a]	*8*	*8*	38	*8*	22	*8*	70
SS 028167 [b]	*8*	*8*	37	*8*	30	*8*	148
SFS 4088 [c]	*21*	*20*	29	*21*	24	*21*	58
NS 4792 [d]	*5*	*5*	34	*5*	29	*5*	32
Other	*1*	*1*	29	*1*	28	*1*	0
B. Escherichia coli	***16***	***16***	**34**	***16***	**38**	***14***	**0**
XX-EN ISO 9308-1:2000 [a]	*7*	*7*	36	*7*	41	*6*	0
SS 028167 [b]	*2*	*2*	39	*2*	35	*2*	0
SFS 4088 [c]	*4*	*4*	32	*4*	41	*4*	0
NS 4792 [d]	*2*	*2*	29	*2*	26	*2*	0
Other	*1*	*1*	32	*1*	32	*1*	0

1 Mean values based o square root transformation

a ISO/CEN Standard: Water quality — Detection and enumeration of *Escherichia coli* and coliform bacteria — Part 1: Membrane filtration method, September 2000 (XX stands for the national translations, if any)

b Swedish Standard: Coliform Bacteria, Thermotolerant Coliform Bacteria and *Escherichia coli* in Water — Determination with Membrane Filtration Method (MF), 2nd ed. 1996-03-13

c Finnish Standard: Membrane filter technique for the enumeration of total coliform bacteria in water, 2001-05-21

d Norwegian Standard: Coliform Bacteria — Membrane filter method, 1st ed. May 1990

Table 10 *Number of results, outliers excluded, with different method variants in the analysis of coliform bacteria (A) and E. coli (B) with membrane filtration*

A. Coliform bacteria MF	**Total no. of answ.**	**Mixture**					
		A		**B**		**C**	
		n	Mv [1]	n	Mv [1]	n	Mv [1]
Medium							
m-Endo Agar/Broth LES	*54*	*54*	35	*53*	42	*54*	444
”LTTC Agar” [2]	*18*	*14*	36	*16*	38	*18*	345
Chromocult Agar	*1*	*1*	53	*1*	42	*1*	200
Other	*1*	*1*	29	*1*	38	*1*	327
Incubation temperature							
35 °C	*20*	*20*	35	*18*	1020	*19*	453
36 °C	*19*	*19*	35	*19*	1467	*19*	433
37 °C	*34*	*30*	36	*32*	1163	*34*	380
Other	*2*	*1*	42	*0*	–	*2*	431

B. *Escherichia coli* MF	**Total no. of answ.**	**Mixture**					
		A		**B**		**C**	
		n	Mv [1]	n	Mv [1]	n	Mv [1]
Medium 35/36/37 °C [3]	***47***	***47***	**35**	***44***	**38**	***39***	**0**
m-Endo Agar/Broth LES	*35*	*35*	33	*33*	38	*31*	0
”LTTC Agar” [2]	*11*	*11*	38	*11*	39	*8*	0
Chromocult Agar	*1*	*1*	29	*0*	–	*0*	–
Other	*0*	*0*	–	*0*	–	*0*	–
Medium 44/44.5 °C [4]	***8***	***8***	**32**	***8***	**33**	***8***	**0**
m-FC Agar/Broth	*5*	*5*	33	*5*	27	*5*	0
”LTTC Agar [2]	*3*	*3*	32	*3*	44	*3*	0
Other	*0*	*0*	–	*0*	–	*0*	–
Incubation temperature	***78***	***78***	**36**	***73***	**38**	***65***	**0**
From 35/36/37 °C	*48*	*48*	35	*45*	38	*40*	0
From 44/44.5 °C	*15*	*15*	34	*15*	38	*14*	0
From both 36 or 44 °C	*11*	*11*	39	*9*	41	*8*	0
Other	*4*	*4*	47	*4*	39	*3*	0

1 Mean values calculated based on square root transformation
2 m-Lactose TTC (2,3,5-triphenyltetrazolium chloride) Agar + Tergitol 7 (heptadecylsulphate) according to EN ISO 9308-1:2000
3 Results regarding confirmed *E. coli*; from method information for coliform bacteria
4 Results regarding confirmed *E. coli*; from method information for thermotolerant coliform bacteria

the methods for suspected thermotolerant coliform bacteria may exist but is in such case probably correlated to the used strains and do not need to be general. There is a tendency that SS 028167 gives slightly higher results then the two other methods with LES endoagar, SFS 4088 and NS 4792, at least in some mixtures. A possible explanation could be that some laboratories in Finland and Norway incubate at 44.5 °C instead of 44 °C which is the dominant temperature in Sweden. A higher temperature is a selective component and therefore more inhibiting but is of course strain dependent.

Table 10 accounts for the outcome based on different primary media and incubation temperatures, independent of which method standard served as base. In mixture A and B one strain each of *E. coli* was included as the only coliform bacteria. Only small differences could be noticed regarding analysis of both coliform bacteria and *E. coli*. In mixture B could small differences be noticed regarding incubation temperature, 44/44.5 °C, for *E. coli*. m-FC agar is incubated at 44.5 °C by some laboratories in Finland and Norway while LTTC agar should normally be incubated at 44 °C.

Regarding coliform bacteria, there was some differences in the results between different media in mixture C, where no *E. coli* was included but, however, two other coliform bacteria. LTTC agar appear to have lower recovery than LES endoagar. This may be due to that it could be more difficult to count colonies on plates with LTTC agar. The colonies are not always distinct on that medium. It is probably not negative to incubate at 37 °C instead of at 35 or 36 °C. The lower results at 37 °C is most likely dependent on that relatively more results from LTTC agar is included there.

The outcome of deviating results – judgement

The reported results from all laboratories are accounted for in **annex A**. A summary of the results from each laboratory in annex A – apart from false results – is given by a box plot in **figure 2**. The lesser range from smallest to largest value, and the more centred around the standard value zero, the greater is the similarity among the laboratory results *and those averages obtained by pooling all accepted laboratory results.*

The laboratories are not grouped or ranked based on their results. The **judgement** that is made **aims to** clearly give information regarding the **number of false results and outliers**. These are presented in the tables below the box plots. Besides, false results and outliers are shaded and put in boldface in annex A. There are also limits for lowest and highest value accepted in each analysis stated in the summarizing rows at the bottom of annex A.

For description of how the analytical results have been treated and for recommendations on how follow-up of the results may be done, please see the scheme protocol (3). It is found as a PDF document on the website of our microbiological schemes www.slv.se/absint.

Figure 2 *Box plots and number of deviating values for each participating laboratory. The square root transformed results of a laboratory is converted into standardised values (z-value) to be able to compare the different analyses.*

- *Standardised values are calculated from the formula z = (x – mv) / s*
- *Standardised values > +4 and < –4 have in the plots received the values +4 and –4, respectively.*
- *False results do not generate z values and are not included in 'No. of results'. False positive results cannot be illustrated in the box plots. The no. of false positives and false negatives are clear from the table beneath the plots.*
- *The outliers are included in the plots after recalculation to standardised values with the same s values as the rest of the results. The nos. is clear from the table.*
- *The horizontal line in each box indicates the median of the laboratory.*
- *The two box area parts embrace 25% of the results above and below the median, respectively. The lines reaching out from the box and/or the circles embrace the remaining 50% of the results, false results excluded.*
- *A circle is created when a result is highly deviating* from the rest.*
- *The background is decorated with lines and shaded fields to indicate ranges in order to simplify localisation of the laboratory results.*

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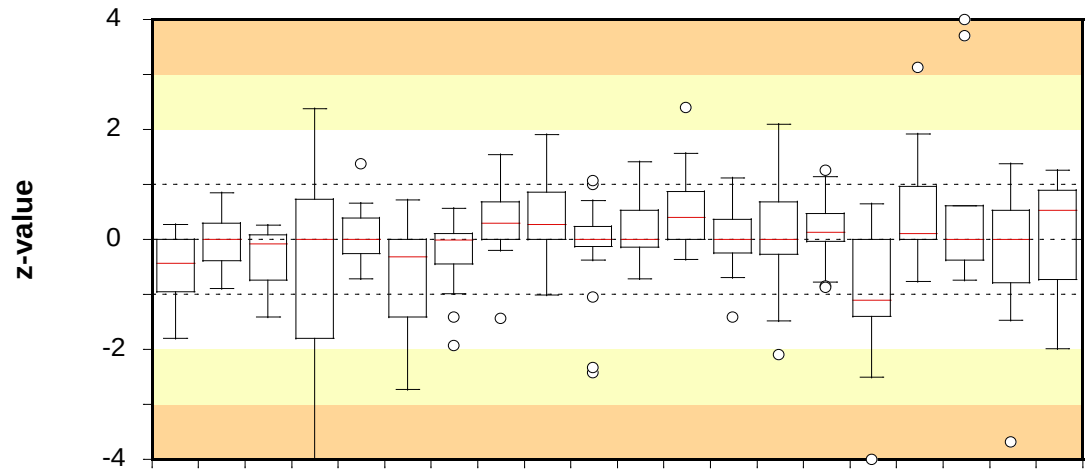
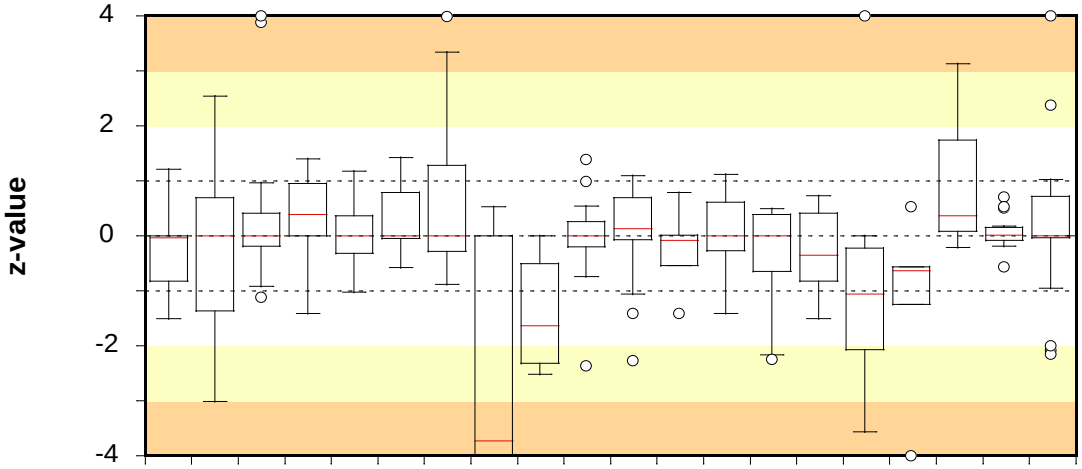
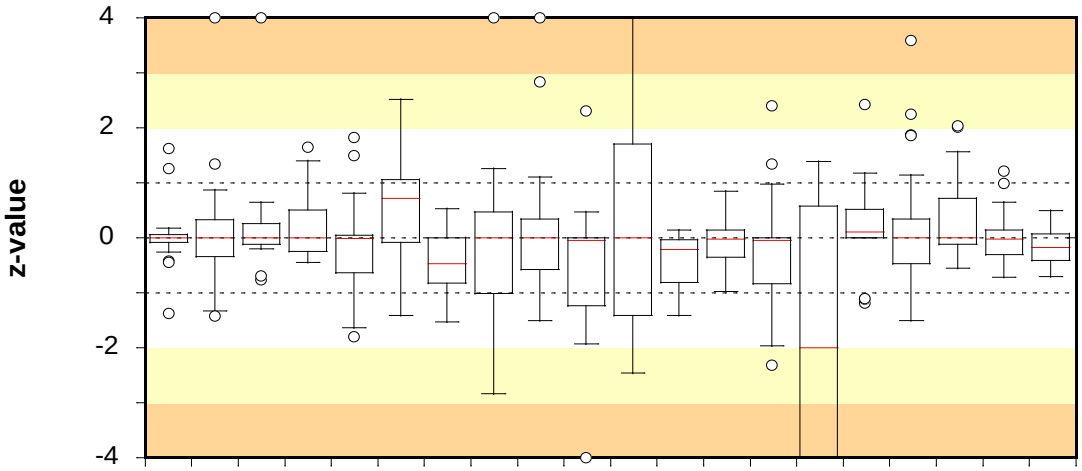
* < [smallest value of the box - 1.5 × (largest value of the box - smallest value of the box)] or > [largest value of the box + 1.5 × (largest value of the box - smallest value of the box)]



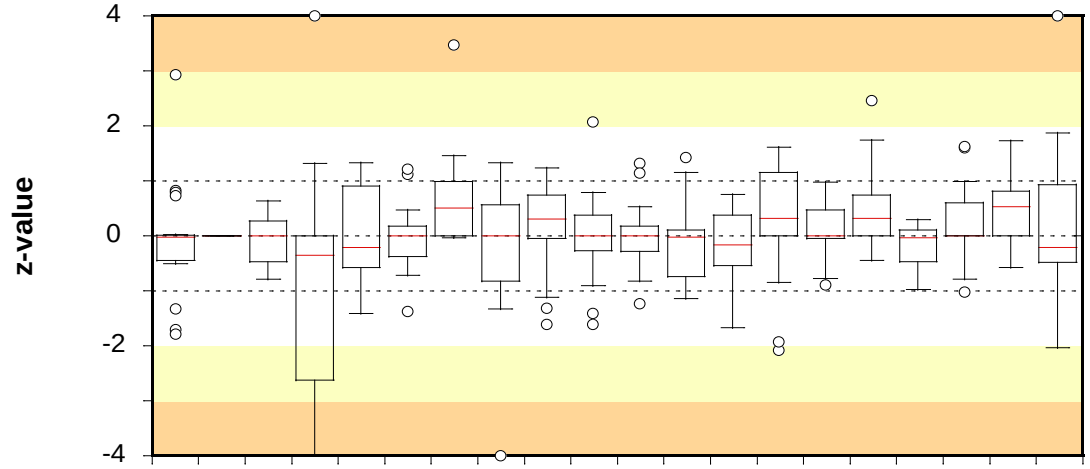
	1081	1131	1149	1237	1254	1290	1545	1594	1611	1684	1753	1868	1970	2050	2386	2670	2704	2745	3042	3055
No. of results	16	15	3	17	24	17	18	24	24	23	24	15	17	24	18	15	13	9	22	3
False positive	-	-	-	1	-	1	-	-	-	1	-	-	1	-	-	-	1	-	1	-
False negative	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-
Low outliers	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-



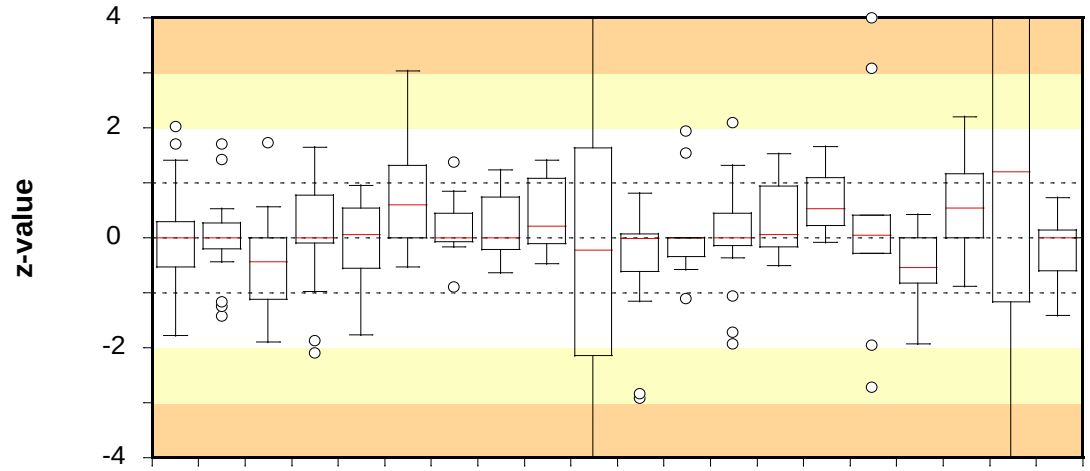
Lab no.	3076	3135	3159	3162	3305	3339	3475	3511	3533	3588	3593	3730	3868	4015	4064	4180	4278	4288	4319	4339
No. of results	9	11	21	24	24	18	18	9	11	18	24	5	24	18	14	12	5	3	15	24
False positive	-	1	-	-	-	-	-	-	1	-	-	1	-	-	1	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	1	-	-	-
Low outliers	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	1	1	-	-	-
High outliers	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	1	-	-	-	2



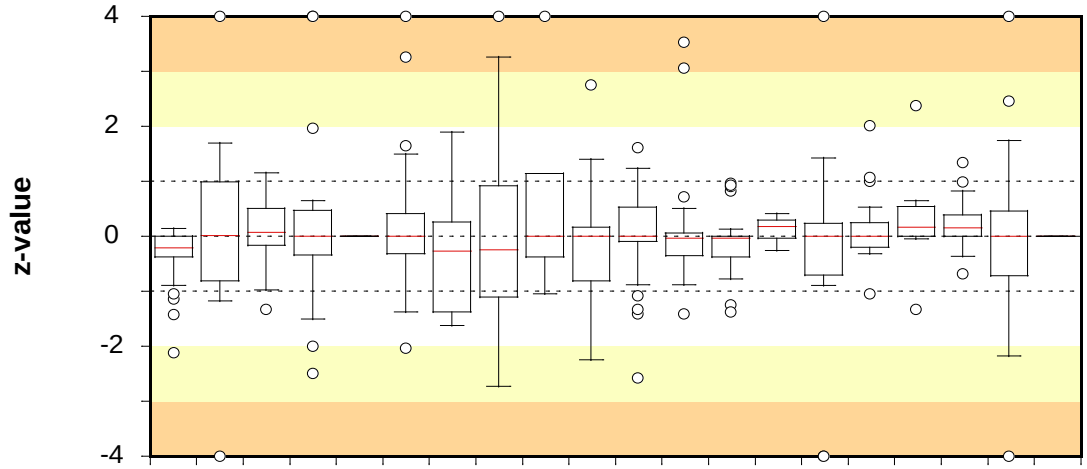
Lab no.	4343	4356	4539	4633	4713	4723	4889	4980	5018	5094	5188	5201	5447	5701	5893	5950	6042	6180	6233	6253
No. of results	24	24	17	21	24	11	21	21	23	18	14	3	18	23	7	24	24	24	24	8
False positive	-	-	-	-	-	1	-	-	-	-	-	-	-	1	2	-	-	-	-	1
False negative	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	-	-	-	-	-	-	1	-	-	-	-	3	-	-	-	-	-
High outliers	-	1	1	-	-	-	-	2	1	-	2	-	-	-	-	-	1	-	-	-



Lab no.	6456	6731	7096	7191	7235	7248	7302	7330	7395	7420	7428	7442	7564	7596	7626	7688	7728	7876	7896	7906
No. of results	19	-	18	17	14	22	24	15	23	23	18	14	6	24	18	24	17	18	17	9
False positive	-	-	-	1	1	1	-	-	1	-	-	1	-	-	-	-	1	-	1	-
False negative	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1



Lab no.	7930	7962	7968	8068	8177	8255	8260	8329	8347	8365	8380	8428	8435	8569	8598	8626	8628	8663	8742	8751
No. of results	21	24	24	24	14	24	9	16	12	14	24	9	18	8	3	9	17	24	6	12
False positive	-	-	-	-	1	-	-	2	-	3	-	-	-	1	-	-	1	-	-	-
False negative	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	1	-
High outliers	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	-	-	2	-



Lab no.	8766	8809	8862	8898	8926	8955	9002	9051	9306	9359	9436	9465	9569	9589	9736	9897	9899	9903	9956
No. of results	24	14	24	23	-	24	10	18	12	24	24	24	24	3	24	21	18	18	24
False positive	-	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Low outliers	-	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	2
High outliers	-	1	-	3	-	1	-	2	2	1	-	-	-	-	1	-	-	-	1

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Annex A *Results of the participants. Susp. = suspected on membrane filter before confirmation. Results given as <1, <2, <10 and <100 are treated as zero. The fields with other results given as < 'value' and results given as > 'value' are* ***yellow****, and those results are not included in calculations or evaluations. This is also valid for results in* ***shaded columns****.* ***Empty hatched fields*** *indicate that the result has been deleted due to misunderstanding of instructions or use of improper method. A* ***hyphen*** *indicate that no result has been reported.* ***Figures written in bold in yellow fields*** *indicate outliers, false positive and false negative results.* ***Underlined zero values*** *indicate results characterized as 'False negative ?'.* ***Crossed out sample numbers*** *on a line indicate that the samples probably*

Lab no.	Sample	Suspected coliform bacteria (MF)			Coliform bacteria (MF)			Susp. thermotolerant coliform bact. (MF)			*E. coli* (MF)			Coliform bacteria ("rapid" MPN)			*E. coli* ("rapid" MPN)		
	A B C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1081	3 2 1	-	-	-	23	39	280	25	28	-	25	<1	<1	33	33	220	33	<1.1	<1.1
1131	1 2 3	29	54	530	27	46	530	-	-	-	27	46	0	34	44	460	34	0	0
1149	3 1 2	26	6	330	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1237	2 1 3	-	-	-	17	48	510	-	-	-	17	48	100	-	-	-	-	-	-
1254	2 3 1	-	-	-	31	40	450	-	-	-	31	40	0	35	46	410	35	<1	<1
1290	3 1 2	-	-	-	41	41	150	-	-	-	27	41	100	-	-	-	-	-	-
1545	1 3 2	39	44	270	39	39	270	39	39	1	39	39	<1	-	-	-	-	-	-
1594	1 3 2	41	49	370	41	46	370	40	34	42	41	46	0	38	45	260	38	0	0
1611	2 1 3	44	40	490	44	32	490	42	30	280	44	32	0	40	37	365	40	0	0
1684	3 1 2	34	50	380	34	50	380	-	11	0	34	50	0	35	15	472	35	15	0
1753	1 3 2	39	54	586	39	45	586	-	-	-	39	45	0	50	33	378	50	0	0
1868	3 1 2	38	36	520	38	36	520	-	-	-	38	36	0	46	46	687	44	0	0
1970	1 2 3	36	54	530	32	43	530	43	35	320	39	35	0	-	-	-	-	-	-
2050	1 2 3	30	53	536	30	35	536	-	-	-	30	35	0	42	44	669	42	0	0
2386	3 2 1	42	42	600	42	42	600	48	43	0	48	43	0	-	-	-	-	-	-
2670	2 1 3	22	27	120	22	27	120	22	27	0	22	27	0	-	-	-	-	-	-
2704	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	38	50	430	38	<1	<1
2745	2 3 1	40	34	300	40	34	300	40	34	0	40	34	0	-	-	-	-	-	-
3042	3 1 2	41	31	45	41	31	45	41	31	45	41	31	45	42	42	380	40	0	0
3055	1 3 2	42	35	218	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3076	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3135	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	50	11	900	50	4	0
3159	3 2 1	-	-	-	31	31	550	-	-	-	31	27	0	41	41	478	41	<1	<1
3162	1 2 3	48	54	555	47	36	555	-	-	-	47	36	0	44	45	613	42	0	0
3305	2 3 1	38	40	500	38	30	500	-	-	-	38	30	0	31	53	496	31	0	0
3339	1 3 2	42	34	320	42	34	320	-	-	-	42	34	0	-	-	-	-	-	-
3475	3 2 1	70	45	327	70	38	327	-	-	-	70	38	0	49	35	397	49	0	0
3511	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	5.21	6.91	25.67	5.21	<1	<1
3533	1 3 2	0	20	119	26	20	119	10	0	100	0	0	80	-	-	-	-	-	-
3588	1 3 2	31	56	480	31	43	480	27	17	0	27	17	0	-	-	-	-	-	-
3593	1 2 3	-	-	-	38	42	464	38	24	0	38	42	0	47	51	175	47	0	0
3730	3 1 2	44	42	560	-	-	-	-	-	-	35	37	300	-	-	-	-	-	-
3868	3 2 1	32	56	420	32	50	420	26	26	5	32	50	0	34	50	430	34	0	0
4015	2 1 3	28	44	468	28	40	468	26	25	245	28	40	0	22	44	520	22	0	0
4064	1 2 3	-	-	-	30	46	285	-	-	-	30	46	214	-	-	-	-	-	-
4180	3 1 2	-	-	-	27	16	51	-	-	-	-	-	-	-	-	-	-	-	-
4278	3 2 1	-	-	-	29	3	0	-	-	-	-	-	-	-	-	-	-	-	-
4288	2 1 3	30	39	470	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4319	1 3 2	35	54	475	35	38	475	21	0	0	35	38	0	-	-	-	-	-	-
4339	1 3 2	-	-	-	36	42	560	33	36	230	36	42	0	23	17	390	23	0	0
4343	1 3 2	36	45	382	36	37	382	-	-	-	36	37	0	38	54	387	38	0	0
4356	2 3 1	25	45	470	23	38	470	34	27	112	23	38	0	35	24	435	35	0	0
4539	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	43	43	429	43	0	0
4633	3 1 2	-	-	-	39	40	500	30	34	0	30	34	0	36	34	408	36	0	0
4713	1 3 2	36	41	300	36	37	300	28	36	95	36	37	0	27	48	220	27	0	0
4723	3 2 1	60	50	509	60	38	509	29	14	209	60	38	169	-	-	-	-	-	-
4889	2 1 3	-	-	-	29	35	210	-	-	-	29	32	<1	31	31	250	31	<1	<1
4980	2 3 1	14	34	400	14	34	400	33	19	0	33	19	0	42.9	25.4	406	42.9	<1	<1
5018	2 1 3	92	48	290	92	34	290	-	-	-	74	0	0	29	52	328	28	0	0
5094	2 3 1	36	61	800	36	31	800	29	26	0	29	26	0	-	-	-	-	-	-
5188	1 3 2	142	113	590	142	106	590	142	106	590	58	58	<1	-	-	344	-	-	<1
5201	1 3 2	31	45	327	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5447	3 1 2	31	56	530	31	37	530	-	-	-	31	37	0	-	-	-	-	-	-
5701	1 2 3	34	51	418	34	20	418	34	20	418	34	20	334	36	38	488	36	<1	<1
5893	2 3 1	-	-	-	-	-	-	23	23	1.1	49	54	0	5.1	1.1	23	23	1.1	1.1
5950	1 3 2	35	61	418	35	45	418	54	34	84	35	45	0	29	41	453	29	0	0
6042	3 2 1	31	60	580	28	60	580	-	-	-	28	60	<1	33	39	490	33	<1	<1
6180	3 2 1	49	60	450	49	36	450	37	54	350	49	36	0	56	34	419	56	0	0
6233	3 1 2	38	37	350	38	37	350	39	39	0	38	37	0	43	32	435	43	0	0
6253	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	35	33	523	35	29	0
6456	1 3 2	-	-	-	42	37	520	-	-	-	30	22	<1	34	24	450	34	<1	<1
6731	3 2 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7096	2 3 1	37	50	300	37	35	300	38	27	112	38	35	0	-	-	-	-	-	-
7191	2 3 1	13	27	350	13	27	350	11	1	0	11	1	0	-	-	-	-	-	-
7235	3 1 2	47	42	340	47	34	340	-	-	-	47	29	102	-	-	-	-	-	-
7248	2 1 3	38	44	365	38	34	365	32	33	<1	38	34	<1	39	36	368	39	<1	<1
7302	2 3 1	40	60	473	40	43	473	-	-	-	40	43	0	46	46	687	46	0	0
7330	1 2 3	-	-	-	-	-	-	-	-	-	32	32	0	-	-	-	-	-	-
7395	1 2 3	45	67	490	45	52	490	38	36	200	45	52	0	44	26	520	44	0	0
Mean					**34**	**39**	**399**				**35**	**38**	**0**	**38**	**38**	**446**	**38**	**0**	**0**
CV (%)					13	12	18				16	14	-	11	15	17	11	-	-

are mixed up. False positive and false negative values are excluded, as well as other outliers, in the summarizing calculated results at the end of the table. The mean value (Mean) is the square of the mean value for the square root transformed results (mv). The coefficient of variation (CV) is the standard deviation (s) in percentage of the mean value for the square root transformed results. As means to calculate the z-scores of your own, the appropriate values of mv and s are given at the end of the table. The x-values of a laboratory are obtained as the square roots of each reported result, respectively. z = (x - mv) / s.

Susp. intestinal enterococci (MF)			Intestinal enterococci (MF)			Susp. *Pseudomonas aeruginosa* (MF)			*Pseudomonas aeruginosa* (MF)			Total plate count 22 °C, 3 days			Total plate count 36±2 °C, 2 days			Lab no.
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C				
-	-	-	-	-	-	-	-	-	-	-	-	17	-	13	15	61	14	**1081**
-	-	-	-	-	-	-	-	-	-	-	-	23	1	13	-	-	-	**1131**
-	-	-	-	-	-	-	-	-	-	-	-	26	0	14	-	-	-	**1149**
-	-	-	140	39	<1	-	-	-	20	<1	<1	27	<1	12	16	**13**	7	**1237**
-	-	-	130	66	0	-	-	-	10	0	0	25	2	21	26	66	13	**1254**
-	-	-	109	64	0	-	-	-	7	0	0	10	0	13	9	35	16	**1290**
120	80	480	120	80	<1	2	<1	<1	2	<1	<1	25	<1	14	21	52	11	**1545**
160	81	3	160	81	0	7	0	330	7	0	0	28	1	19	32	72	17	**1594**
133	63	0	133	63	0	12	0	0	12	0	0	38	2	22	37	67	21	**1611**
119	75	0	119	75	0	9	0	0	9	0	0	29	2	6	22	45	17	**1684**
129	66	0	129	66	0	7	0	0	7	0	0	31	2	14	21	55	14	**1753**
-	-	-	-	-	-	-	-	-	-	-	-	42	1	22	-	-	-	**1868**
130	71	0	130	71	0	9	23	590	9	0	**590**	32	0	14	29	49	14	**1970**
132	75	0	132	75	0	3	62	991	3	0	0	30	4	25	21	34	21	**2050**
127	79	3	127	79	0	2000	0	0	5	0	0	27	1	13	17	47	20	**2386**
98	63	0	98	63	0	4	0	0	4	0	0	**1**	0	**0**	**0**	66	**0**	**2670**
-	-	-	103	**0**	**77**	-	-	-	-	-	-	25	11	24	36	67	17	**2704**
-	-	-	-	-	-	-	-	-	-	-	-	**940**	**14**	14	-	-	-	**2745**
88	63	0	88	63	0	11	0	**>100**	11	0	**>100**	31	2	21	31	48	10	**3042**
-	-	-	-	-	-	-	-	-	-	-	-	33	2	7	-	-	-	**3055**
-	-	-	-	-	-	6	0	0	6	0	0	17	1	11	13	74	14	**3076**
-	-	-	-	-	-	-	-	-	2	0	0	-	-	-	13	43	9	**3135**
-	-	-	116	71	0	-	-	-	-	-	-	28	**15**	**44**	23	62	18	**3159**
143	90	0	143	90	0	6	0	0	6	0	0	27	0	16	33	65	12	**3162**
105	69	440	105	69	0	9	0	0	9	0	0	23	2	14	24	67	18	**3305**
140	85	0	140	85	0	12	0	0	12	0	0	24	1	12	35	60	15	**3339**
-	-	-	-	-	-	-	-	-	-	-	-	19	1	13	26	54	**39**	**3475**
-	-	-	-	-	-	-	-	-	-	-	-	**5**	2	**3.61**	-	-	-	**3511**
70	100	0	70	54	0	0	0	0	**0**	0	0	15	0	6	-	-	-	**3533**
115	85	0	115	85	0	7	0	0	7	0	0	34	1	15	25	60	15	**3588**
-	-	-	115	67	0	-	-	-	10	0	0	18	0	19	22	69	19	**3593**
-	-	-	-	-	-	-	-	-	-	-	-	21	0	18	-	-	-	**3730**
96	86	340	96	86	0	9	0	0	9	0	0	32	0	11	30	62	15	**3868**
105	78	513	105	78	0	-	-	-	-	-	-	27	1	14	-	-	-	**4015**
-	-	-	127	58	0	-	-	-	-	-	-	27	2	11	21	42	11	**4064**
-	-	-	-	-	-	-	-	-	5	0	0	12	**52**	9	11	52	9	**4180**
-	-	-	-	-	-	-	-	-	-	-	-	17	2	12	-	-	-	**4278**
-	-	-	-	-	-	-	-	-	-	-	-	23	11	16	-	-	-	**4288**
116	72	427	116	72	0	-	-	-	-	-	-	29	2	12	24	58	15	**4319**
-	-	-	120	79	0	-	-	-	20	0	0	**1500**	1	19	**1400**	46	19	**4339**
110	74	309	110	74	0	8	0	0	8	0	0	23	1	9	24	80	15	**4343**
126	65	0	126	65	0	14	9	430	14	0	0	24	**31**	12	30	63	18	**4356**
103	72	0	103	72	0	-	2	63	7	0	0	26	1	**45**	23	49	**>1000**	**4539**
-	-	-	118	90	0	-	-	-	-	-	-	34	5	15	34	59	13	**4633**
120	68	37	120	68	0	3	0	190	3	0	0	15	1	16	20	78	24	**4713**
145	66	500	145	66	0	-	-	-	-	-	-	32	0	18	-	-	-	**4723**
-	-	-	120	77	<1	-	-	-	10	<1	<1	17	1	11	-	-	-	**4889**
132	63	0	132	63	0	-	-	-	-	-	-	33	1	**93**	13	39	**77**	**4980**
108	58	0	108	58	0	6	0	84	6	0	0	24	3	12	31	64	15	**5018**
-	-	-	119	79	0	2	0	276	2	0	0	**4**	1	10	14	58	8	**5094**
-	-	-	-	-	-	-	-	-	-	-	-	13	<1	6	14	60	5	**5188**
-	-	-	-	-	-	-	-	-	-	-	-	23	<1	15	-	-	-	**5201**
132	68	0	132	68	0	7	0	0	7	0	0	24	2	15	25	53	10	**5447**
103	64	400	103	64	<1	14	<1	301	14	<1	<1	42	<1	13	31	42	8	**5701**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5893**
150	79	0	150	79	0	4	0	0	4	0	0	32	3	15	45	64	15	**5950**
180	58	340	180	58	<1	8	<1	440	8	<1	<1	22	1	14	26	47	**36**	**6042**
145	69	455	143	69	0	9	0	0	9	0	0	24	2	22	19	61	16	**6180**
110	73	0	110	73	0	7	0	0	7	0	0	21	1	19	19	74	11	**6233**
129	75	1	-	-	-	-	-	-	-	-	-	20	1	15	-	-	-	**6253**
-	-	-	200	82	<1	-	-	-	-	-	-	-	1	14	-	37	13	**6456**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**6731**
-	-	-	125	73	0	-	-	-	9	0	0	27	1	12	28	48	12	**7096**
135	89	0	135	89	0	1100	0	270	**1100**	0	**270**	9	0	14	11	29	15	**7191**
108	84	0	108	84	0	-	-	-	-	-	-	25	0	10	32	69	12	**7235**
110	79	<1	110	79	<1	<1	<1	228	**<1**	<1	**192**	32	1	9	33	58	11	**7248**
150	90	0	150	90	0	10	0	0	10	0	0	25	1	19	31	110	20	**7302**
-	-	-	141	83	0	-	-	-	9	0	0	18	4	10	14	**10**	21	**7330**
130	57	0	130	57	0	9	0	600	9	0	**600**	23	3	14	27	42	11	**7395**
			120	**74**	**0**				**8**	**0**	**0**	**24**	**1**	**14**	**23**	**57**	**14**	**Mean**
			10	7	-				26	-	-	13	71	15	16	11	17	**CV (%)**

Lab no.	Sample	Suspected coliform bacteria (MF)			Coliform bacteria (MF)			Susp. thermotolerant coliform bact. (MF)			*E. coli* (MF)			Coliform bacteria ("rapid" MPN)			*E. coli* ("rapid" MPN)		
	A B C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
7420	2 1 3	32	47	280	32	47	280	18	39	79	32	**0**	0	41	66	240	41	<1	<1
7428	3 2 1	36	48	340	36	41	340	34	35	84	34	35	<1	-	-	-	-	-	-
7442	1 2 3	27	29	582	27	29	582	-	-	-	27	29	**582**	37	39	682	37	0	0
7564	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7596	3 2 1	50	51	620	50	51	620	26	33	0	26	33	0	48	50	680	48	0	0
7626	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	46	46	324	46	0	0
7688	3 2 1	-	-	-	41	54	390	-	-	-	41	55	0	44	35	435	44	0	0
7728	2 1 3	-	-	-	36	35	333	-	-	-	36	35	**183**	-	-	-	-	-	-
7876	2 3 1	40	30	405	40	30	405	-	-	-	40	30	<1	52	30	540	52	<1	<1
7896	3 1 2	38	47	320	38	47	320	38	47	320	38	47	<1	-	-	-	-	-	-
7906	2 1 3	-	-	-	43	60	160	-	-	-	-	-	-	-	-	-	-	-	-
7930	3 2 1	37	62	400	37	62	400	-	-	-	-	-	-	53	32	226	50	<1	<1
7962	2 1 3	23	46	240	23	38	240	26	30	78	23	38	0	40	42	435	40	0	0
7968	1 2 3	23	30	260	23	25	260	23	22	0	23	25	0	33	37	327	33	0	0
8068	3 1 2	42	53	610	42	53	610	17	19	15	17	19	0	42	38	620	42	0	0
8177	3 2 1	38	47	480	38	24	480	-	-	-	38	24	**340**	-	-	-	-	-	-
8255	3 1 2	49	75	640	49	75	640	-	-	-	49	75	0	41	32	580	41	0	0
8260	1 3 2	27	44	376	27	44	376	34	41	141	34	41	<1	-	-	-	-	-	-
8329	2 3 1	29	47	530	29	34	530	-	-	-	29	34	**230**	-	-	-	-	-	-
8347	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	50	43	380	50	0	0
8365	2 3 1	104	0	172	**0**	**0**	151	0	0	22	**0**	**0**	**15**	**<2**	**<2**	**17**	**<2**	<2	**7**
8380	3 2 1	25	48	420	25	47	420	25	48	<1	25	47	<1	18	28	350	18	<1	<1
8428	2 3 1	430	101	830	-	-	-	-	-	-	60	32	<10	-	-	-	-	-	-
8435	3 1 2	40	42	478	40	42	478	18	32	0	40	42	0	-	-	-	-	-	-
8569	2 1 3	39	70	330	39	56	330	35	35	188	35	35	**188**	-	-	-	-	-	-
8598	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8626	1 2 3	37	50	280	37	40	168	37	50	280	11	35	0	-	-	-	-	-	-
8628	1 3 2	-	-	-	29	34	170	-	-	-	29	34	**120**	-	-	-	-	-	-
8663	1 2 3	42	55	550	42	44	550	49	44	90	42	44	0	50	45	590	50	0	0
8742	3 2 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8751	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	33	47	472	33	<1	<1
8766	1 3 2	32	37	418	32	29	418	29	28	<1	32	29	<1	35	30	411	35	<1	<1
8809	2 1 3	155	82	408	**81**	58	292	-	-	-	35	49	**40**	-	-	-	-	-	-
8862	1 3 2	27	69	473	27	51	473	-	-	-	27	51	<1	47	24	476	47	<1	<1
8898	2 1 3	16	155	5649	16	**108**	**5649**	-	-	-	16	**108**	**741**	35	36	548	35	0	0
8926	1 3 2	16	4	110	-	-	-	4	3	72	-	-	-	-	-	-	-	-	-
8955	1 2 3	-	-	-	**90**	43	160	-	-	-	81	43	0	34	42	460	34	<1	<1
9002	1 2 3	55	44	220	53	42	200	30	0	10	29	**0**	**10**	-	-	-	-	-	-
9051	1 3 2	164	100	541	**164**	**100**	541	164	10	90	27	80	0	-	-	-	-	-	-
9306	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	30	31	559	30	0	0
9359	1 2 3	36	47	380	36	41	380	-	-	-	36	41	<10	22	38	365	22	0	0
9436	2 1 3	50	45	518	50	45	518	50	45	518	50	45	<1	37	42	579	37	<1	<1
9465	3 1 2	30	42	282	30	37	282	30	37	282	30	37	0	37	82	1120	37	0	0
9569	2 1 3	31	48	395	31	48	395	26	44	<1	31	48	<1	36	50	365	36	<1	<1
9589	3 2 1	-	-	-	36	37	460	-	-	-	-	-	-	-	-	-	-	-	-
9736	2 3 1	27	6	342	27	**6**	342	-	-	-	27	**6**	0	32.7	39.3	517.2	32.7	0	0
9897	1 3 2	32	66	436	32	50	436	39	36	236	32	50	0	36	39	488	36	0	0
9899	3 1 2	40	45	482	40	45	482	-	-	-	40	45	0	-	-	-	-	-	-
9903	2 3 1	39	48	438	39	48	438	39	31	261	39	31	0	-	-	-	-	-	-
9956	2 3 1	-	-	-	36	21	630	43	35	230	36	21	0	34	19	320	34	0	0

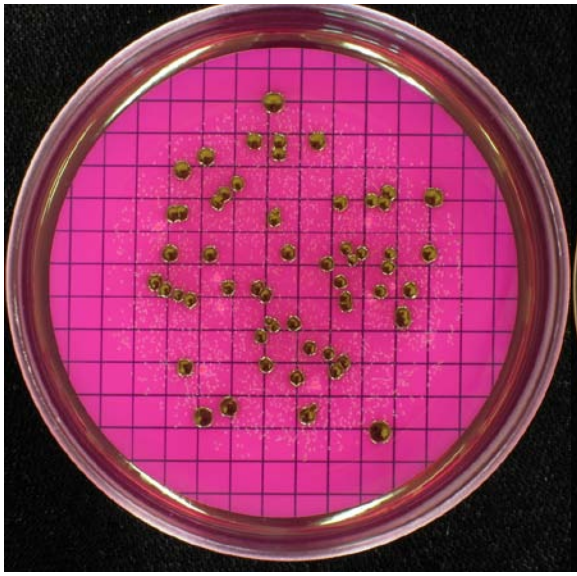
n		83	83	83	96	96	96	56	57	56	95	95	95	68	68	69	68	68	69
Min		0	0	45	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0
Max		430	155	5649	164	108	5649	164	106	590	81	108	741	56	82	1120	56	29	7
Median		37	47	418	36	39.5	419	33	32	75	35	37	0	37	39	435	37	0	0
Mean					**34**	**39**	**399**				**35**	**38**	**0**	**38**	**38**	**446**	**38**	**0**	**0**
CV (%)					13	12	18				16	14	-	11	15	17	11	-	-
False positive		-	-	-	0	0	0	-	-	-	0	0	19	0	0	0	0	4	2
False negative		-	-	-	1	1	1	-	-	-	2	6	0	1	1	0	1	0	0
Outliers, low		-	-	-	0	2	2	-	-	-	0	2	0	2	2	3	1	0	0
Outliers, high		-	-	-	6	3	1	-	-	-	0	1	0	0	0	0	0	0	0
Low limit OK		0	0	45	13	16	119	0	0	0	11	17	0	18	11	175	18	0	0
High limit OK		430	155	5649	60	75	800	164	106	590	81	80	0	56	82	1120	56	0	0

mv *(√Mean)*			5.863	6.283	19.968			5.900	6.154	0.000	6.161	6.161	21.130	6.128	0.000	0.000
s *(CV*mv/100)*			0.749	0.784	3.597			0.951	0.857	0.000	0.657	0.946	3.490	0.665	0.000	0.000
x *(√Result)*																
z *([x-mv]/s)*																

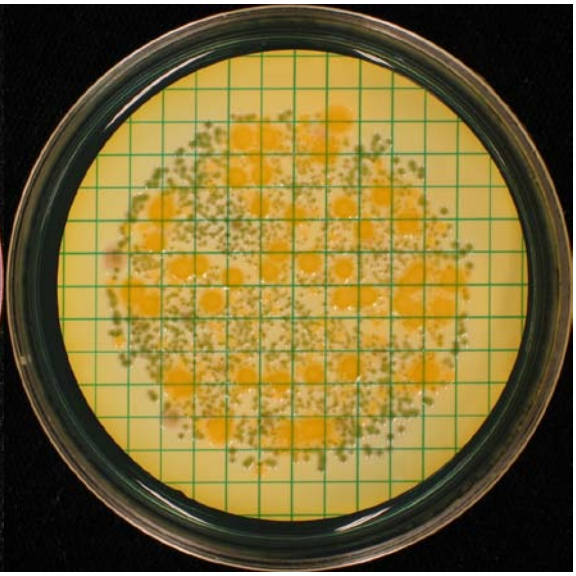
Susp. intestinal enterococci (MF)			Intestinal enterococci (MF)			Susp. *Pseudomonas aeruginosa* (MF)			*Pseudomonas aeruginosa* (MF)			Total plate count 22 °C, 3 days			Total plate count 36±2 °C, 2 days			Lab no.
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C				
120	78	0	120	78	0	6	0	0	6	0	0	29	0	14	21	68	12	**7420**
124	77	<1	124	77	<1	7	9	12	7	<1	<1	21	2	11	34	73	9	**7428**
-	-	-	-	-	-	-	-	-	-	-	-	25	1	15	-	-	-	**7442**
-	-	-	-	-	-	-	-	-	-	-	-	21	1	8	29	54	16	**7564**
76	75	0	76	75	0	2	0	0	2	0	0	24	2	21	30	72	20	**7596**
128	79	0	128	79	0	5	0	0	5	0	0	24	1	13	21	66	14	**7626**
-	-	-	110	75	0	-	-	-	9	0	0	31	2	23	28	62	28	**7688**
-	-	-	123	77	0	-	-	-	6	0	0	21	1	15	22	53	10	**7728**
110	85	<1	110	85	<1	9	<1	<1	9	<1	<1	-	-	-	-	-	-	**7876**
130	94	<1	130	94	<1	13	<1	310	13	<1	**310**	29	2	18	30	52	22	**7896**
-	-	-	-	-	-	-	-	-	-	-	-	23	**35**	13	27	46	12	**7906**
82	73	<1	82	73	<1	5	<1	<1	5	<1	<1	30	<1	14	17	62	13	**7930**
117	69	0	117	69	0	16	0	0	16	0	0	22	2	15	35	64	13	**7962**
165	80	0	165	80	0	3	0	175	3	0	0	28	2	13	19	36	11	**7968**
116	82	0	116	82	0	5	0	0	5	0	0	20	5	22	28	59	10	**8068**
100	84	550	100	84	0	-	-	-	-	-	-	25	3	13	19	57	19	**8177**
140	89	0	140	89	0	-	-	-	8	0	0	28	1	21	28	73	21	**8255**
-	-	-	-	-	-	-	-	-	-	-	-	30	1	21	-	-	-	**8260**
144	88	430	144	88	0	10	0	665	10	0	**665**	25	1	19	23	66	14	**8329**
150	70	0	150	70	0	-	-	-	-	-	-	23	3	19	-	-	-	**8347**
76	76	454	52	66	**436**	92	0	0	**87**	0	0	**5**	**25**	12	37	52	30	**8365**
120	80	<1	120	80	<1	7	<1	<1	7	<1	<1	23	2	15	20	51	13	**8380**
-	-	-	160	70	0	-	-	-	4	0	0	-	-	-	-	-	-	**8428**
117	56	0	117	56	0	2	0	290	2	0	0	18	1	25	22	53	21	**8435**
-	-	-	-	-	-	-	-	-	-	-	-	25	1	21	-	-	-	**8569**
-	-	-	-	-	-	-	-	-	-	-	-	36	2	14	-	-	-	**8598**
-	-	-	-	-	-	-	-	-	-	-	-	27	**20**	**31**	-	-	-	**8626**
-	-	-	100	78	<1	-	-	-	9	<1	<1	23	<1	11	19	63	9	**8628**
170	100	0	170	100	0	15	0	0	15	0	0	19	2	21	19	61	15	**8663**
-	-	-	-	-	-	-	-	-	-	-	-	24	8	**450**	15	**9**	**270**	**8742**
-	-	-	-	-	-	-	-	-	-	-	-	25	<1	14	23	50	15	**8751**
89	72	336	89	72	<1	8	<1	<1	8	<1	<1	23	1	15	21	45	6	**8766**
94	65	0	94	65	0	-	-	-	-	-	-	35	2	17	15	**1**	13	**8809**
124	79	454	124	79	<1	9	<1	<1	9	<1	<1	19	2	13	25	67	10	**8862**
117	97	516	117	97	0	9	0	0	9	0	0	17	0	16	13	65	13	**8898**
0	21	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**8926**
-	-	-	110	76	0	-	-	-	7	0	0	26	5	9	29	78	12	**8955**
90	80	0	90	80	0	-	-	-	-	-	-	26	0	9	-	-	-	**9002**
109	65	382	109	65	0	4	0	0	4	0	0	10	3	8	9	44	10	**9051**
-	-	-	-	-	-	-	-	-	-	-	-	**62**	1	**41**	22	73	20	**9306**
136	90	1	136	90	0	7	0	0	7	0	0	**45**	4	10	13	45	7	**9359**
96	48	600	96	48	<1	240	<1	273	10	<1	<1	19	<1	15	14	63	15	**9436**
115	68	0	115	68	0	9	0	0	9	0	0	25	0	11	27	67	13	**9465**
103	71	440	103	71	<1	5	<1	<1	5	<1	<1	17	1	9	24	70	13	**9569**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9589**
110	65	0	110	65	0	12	0	0	12	0	0	31	**34**	16	35	**2**	12	**9736**
173	76	0	173	76	0	-	-	-	-	-	-	25	2	13	23	45	14	**9897**
124	77	400	124	77	0	2700	0	490	20	0	0	24	1	16	14	57	15	**9899**
128	78	556	128	78	0	14	0	867	14	0	0	25	1	19	24	53	15	**9903**
31	10	0	**31**	**10**	0	-	-	-	11	0	0	24	**30**	23	24	77	28	**9956**
71	71	71	88	88	88	58	59	58	76	76	75	111	111	112	90	91	90	**n**
0	10	0	31	0	0	0	0	0	0	0	0	1	0	0	0	1	0	**Min**
180	100	600	200	100	436	2700	62	991	1100	0	665	1500	52	450	1400	110	270	**Max**
120	75	0	120	75	0	8	0	0	8	0	0	25	1	14	23	59.5	14	**Median**
			120	**74**	**0**				**8**	**0**	**0**	**24**	**1**	**14**	**23**	**57**	**14**	**Mean**
			10	7	-				26	-	-	13	71	15	16	11	17	**CV (%)**
-	-	-	0	0	2	-	-	-	0	0	6	0	0	0	0	0	0	**False pos.**
-	-	-	0	1	0	-	-	-	2	0	0	0	0	1	1	0	1	**False neg.**
-	-	-	1	1	0	-	-	-	0	0	0	4	0	1	0	5	0	**Outliers <**
-	-	-	0	0	0	-	-	-	2	0	0	4	9	6	1	0	4	**Outliers >**
0	10	0	52	39	0	0	0	0	2	0	0	9	0	6	9	29	5	**Low limit**
180	100	600	200	100	0	2700	62	991	20	0	0	42	11	25	45	110	30	**High limit**
			10.973	8.583	0.000				2.784	0.000	0.000	4.929	1.029	3.790	4.792	7.582	3.764	**mv**
			1.084	0.643	0.000				0.711	0.000	0.000	0.647	0.732	0.576	0.789	0.838	0.622	**s**
																		x
																		z

Mixture A

m-Endo Agar LES, 37 °C



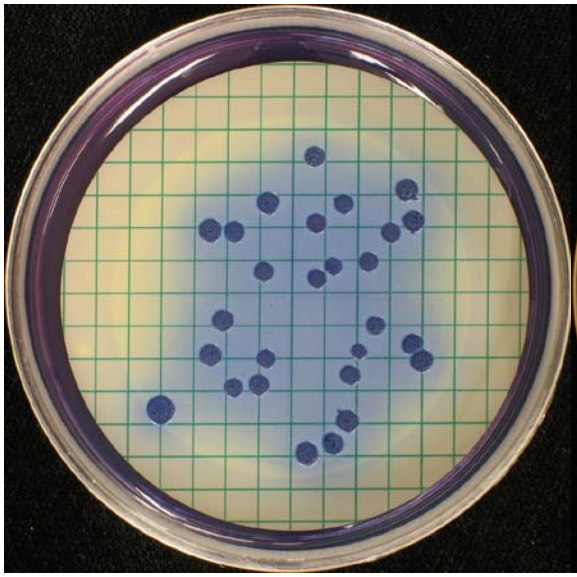
100 ml



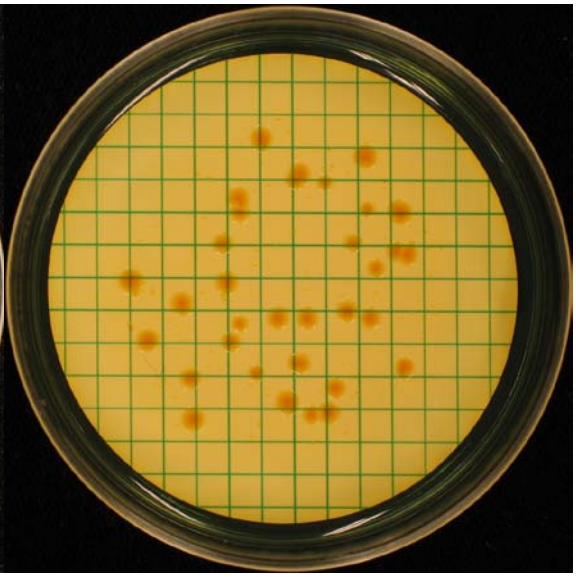
100 ml

m-Lactose TTC Agar, 37 °C

m-FC Agar, 44 °C



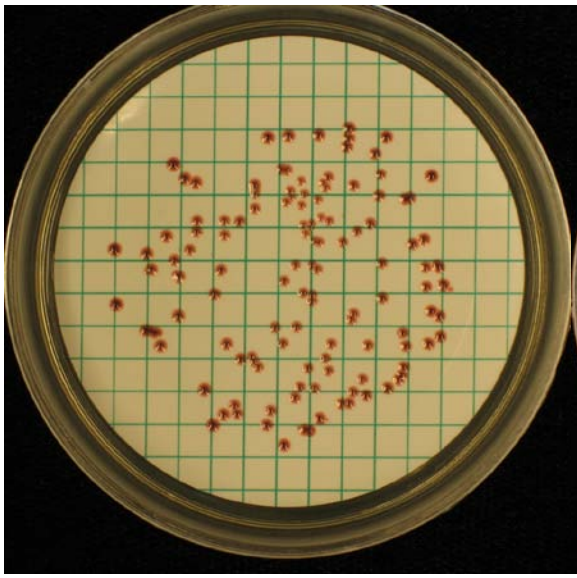
100 ml



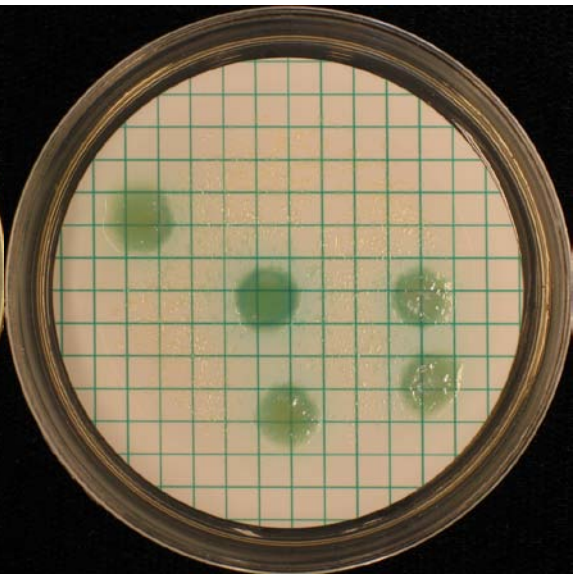
100 ml

m-Lactose TTC Agar, 44 °C

m-Enterococcus Agar, 37 °C



100 ml, 2 days

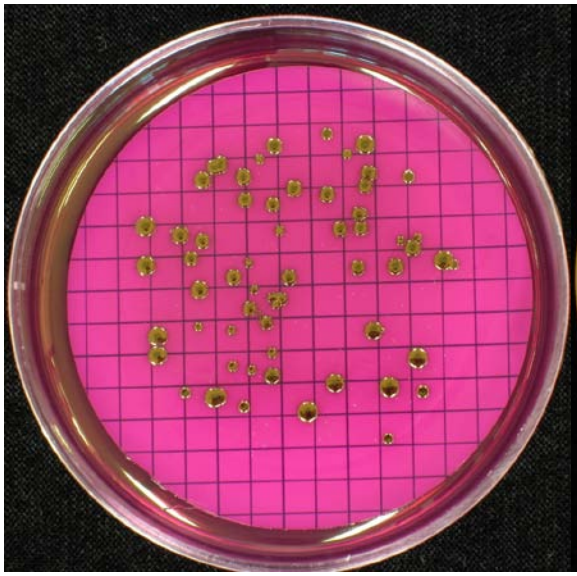


100 ml, 2 days

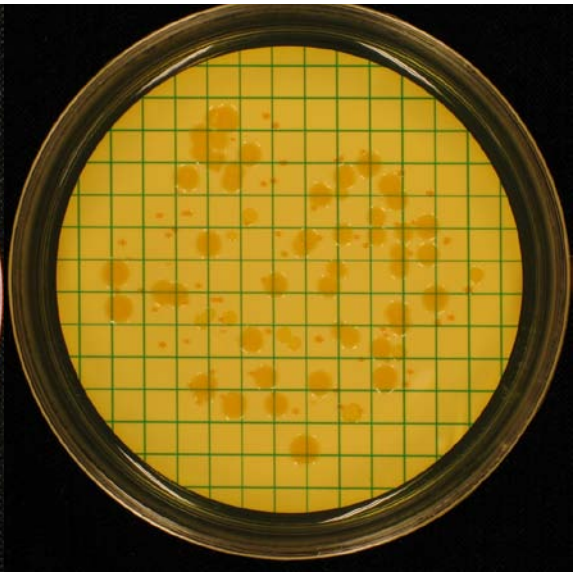
m-Pseudomonas CN Agar, 37 °C

Mixture B

m-Endo Agar LES, 37 °C



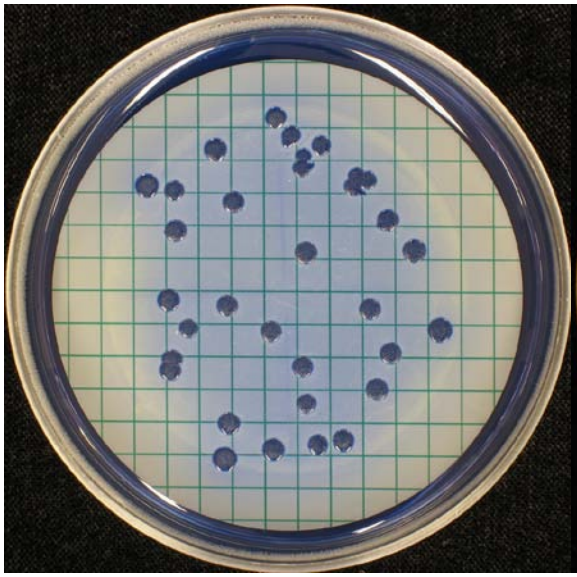
100 ml



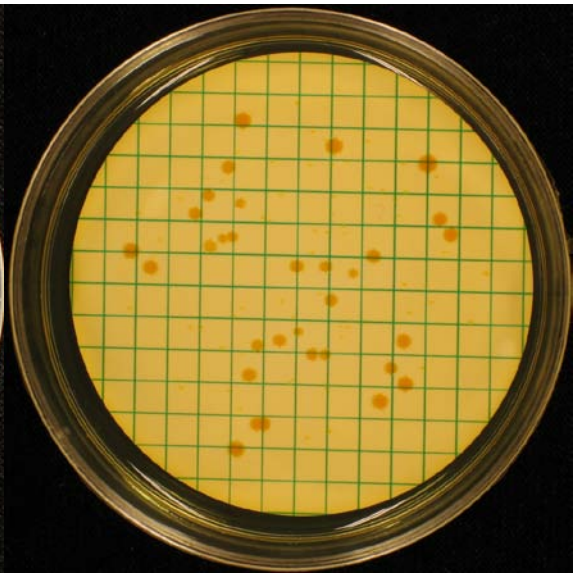
100 ml

m-Lactose TTC Agar, 37 °C

m-FC Agar, 44 °C



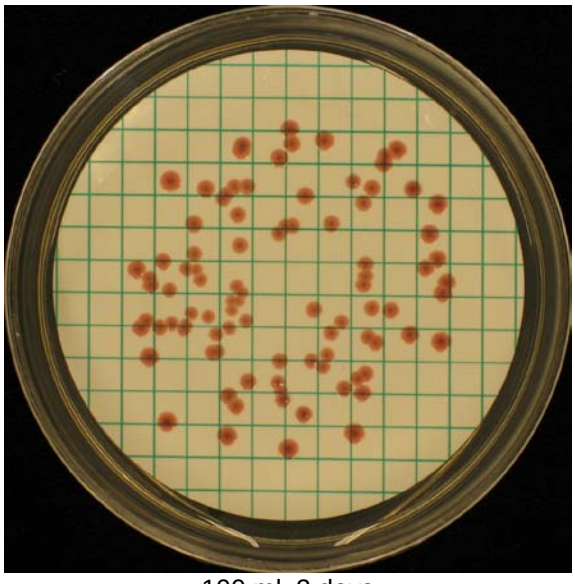
100 ml



100 ml

m-Lactose TTC Agar, 44 °C

m-Enterococcus Agar, 37 °C

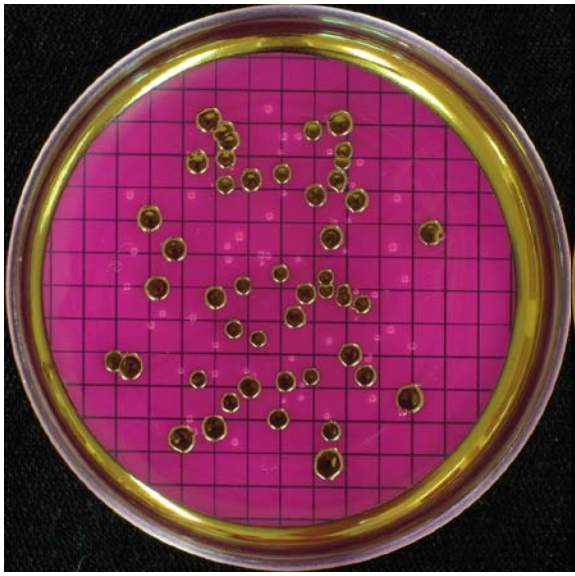


100 ml, 2 days

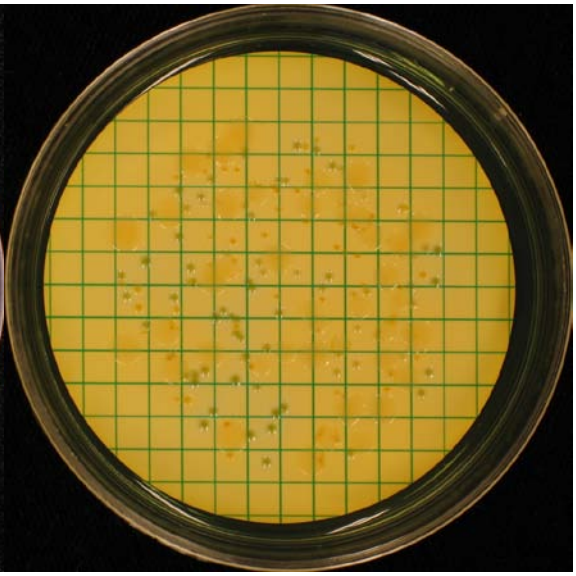
m-Pseudomonas CN Agar, 37 °C

Mixture C

m-Endo Agar LES, 37 °C



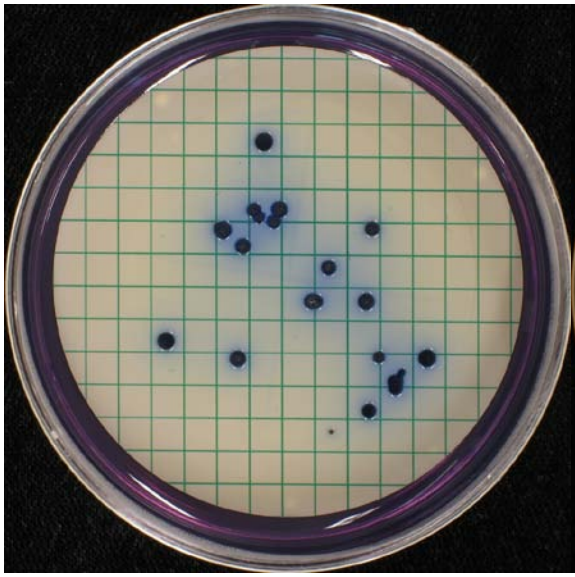
10 ml



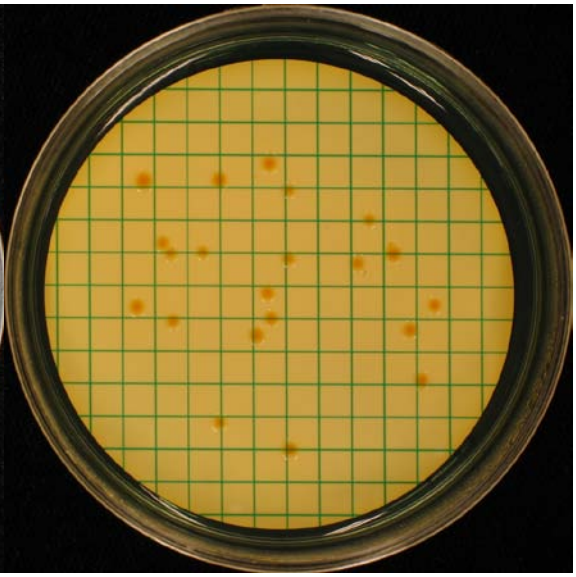
10 ml

m-Lactose TTC Agar, 37 °C

m-FC Agar, 44 °C



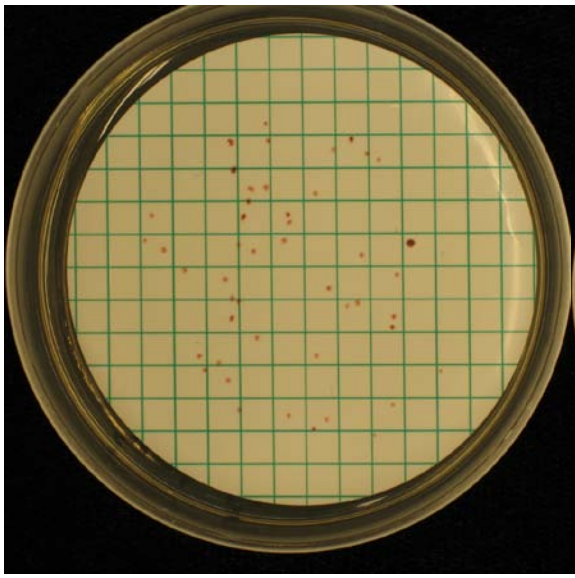
10 ml



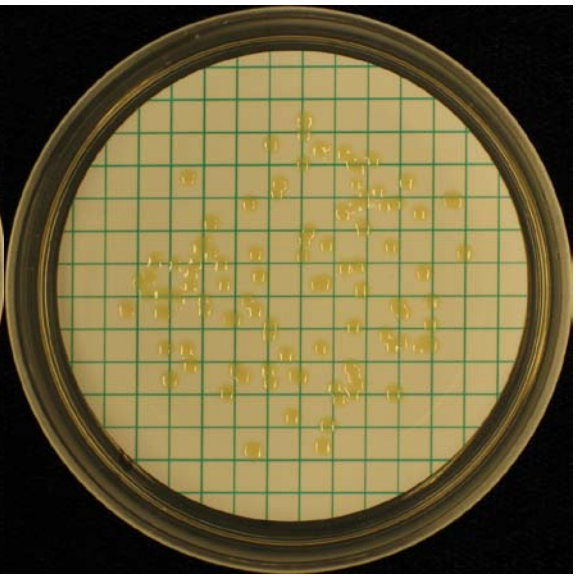
10 ml

m-Lactose TTC Agar, 44 °C

m-Enterococcus Agar, 37 °C



10 ml, 2 days



10 ml, 2 days

m-Pseudomonas CN Agar, 37 °C

Rapporter som utgivits 2009

1. Nedkylning av slaktkroppar (nöt) på gårdsnära slakterier – Kartläggning och utvärdering av ny metodik av R Lindqvist och J-E Eriksson.
2. Proficiency Testing. – Food Microbiology, January 2009 by C Normark and M Olsson.
3. Proficiency Testing – Food Chemistry, Nutritional Components of Food, Round N 43 by L Merino.
4. Riskprofil – Mögel och mykotoxiner i livsmedel av E Fredlund, L Abramsson Zetterberg, A-M Thim och M Olsen.
5. Proficiency Testing – Food Chemistry, Trace Elements in Food, Round T-18 by C Åstrand and L Jorhem.
6. Kontrollprogrammet för tvåskaliga blötdjur – Årsrapport 2008 – av M Persson och B Karlson.
7. Rapportering av livsmedelskontrollen 2008 av D Rosling.
8. Rapportering av dricksvattenkontrollen 2008 av D Rosling.
9. Proficiency Testing. – Food Microbiology, April 2009 by C Normark, M Olsson and I Tillander.
10. Proficiency Testing. – Drinking Water Microbiology, 2009:1, March by T Slapokas, A Jenzten and M Olsson.
11. Kontroll av restsubstanser i levande djur och animaliska livsmedel. Resultat 2008 av I Nordlander, B Aspenström-Fagerlund, A Glynn, A Johansson, K Granelli, E Fredberg, I Nilsson, Livsmedelsverket och K Girma, Jordbruksverket.
12. Fett och fettsyror i den svenska kosten i – Analyser av Matkorgar inköpta 2005 av W Becker, A Eriksson, M Haglund och S Wretling.
13. Färdiga såser, glutenfria produkter och Aloe Vera – analys av näringsämnen av I Mattisson, C Gard, A Staffas och C Åstrand.
14. Kemisk riskprofil för dricksvatten av K Svensson, U Beckman-Sundh, P O Darnerud, C Forslund, H Johnsson, T Lindberg och S Sand.
15. Proficiency Testing – Food Chemistry, Nutritional Components of Food, Round N 44 by L Merino.
16. Matförgiftningar i Sverige – analys av rapporterade matförgiftningar 2003-2007 av M Lindblad, A Westöö, R Lindqvist, Livsmedelsverket, M Hjertqvist och Y Andersson, Smittskyddsinstitutet.
17. Proficiency Testing – Food Chemistry, Vitamins in Food, Round V-7 by H S Strandler and A Staffas.
18. Riksprojekt 2008. Transfettsyror i kakor/kex och chips – märkning och hlster av L Wallin, S Wretling och I Mattisson.
19. Utbudet av nyckelhålsmärkta färdigförpackade produkter i september 2009 av E Lövestam och A Laser Reuterswärd.
20. Hur annonseras nyckelhåsmärkningen i direktreklam till hushåll av E Lövestam och A Laser Reuterswärd.
21. Rapport från GMO-projektet 2009. Undersökning av GMO-livsmedel – förekomst, spårbarhet och märkning av Z Kurowska.
22. Indikatorer för bra matvanor – resultat från intervjuundersökningar 2008 av W Becker.
23. Proficiency Testing – Food Chemistry, Trace Elements in Food, Round T-19 by C Åstrand and Lars Jorhem.
24. Proficiency Testing – Food Microbiology, October 2009 by C Normark and K Mykkänen.
25. Proficiency Testing – Drinking Water Microbiology, 2009:2, September by T Slapokas, C Lantz and M Olsson.

Rapporter som utgivits 2010

1. Proficiency Testing – Food Chemistry, Lead and cadmium extracted from ceramics by C Åstrand and Lars Jorhem.
2. Fullkorn, bönor och ägg – analys av näringsämnen av C Gard, I Mattisson, A Staffas och C Åstrand.
3. Proficiency Testing – Food Chemistry, Nutritional Components of Food, Round N 45 by L Merino.
4. Proficiency Testing – Food Microbiology, January 2010 by C Normark and K Mykkänen.
5. Riksprojekt 2009. Salmonella, Campylobacter och E.coli i färska kryddor och bladgrönsaker från Sydostasien av N Karnehed och M Lindblad.
6. Vad gör de som drabbas av magsjuka och matförgiftningar – resultat från en nationell intervju-undersökning av J Toljander och N Karnehed.
7. The Swedish Monitoring of Pesticide Residues in Food of Plant Origin: 2008, Part 1 – National Report by A Andersson, F Broman, A Hellström and B-G Österdahl.
   The Swedish Monitoring of Pesticide Residues in Food of Plant Origin: 2008, Part 2 – Report to Commission and EFSA by A Andersson and A Hellström.
8. Proficiency Testing – Food Chemistry, Trace Elements in Food, Round T-20 by C Åstrand and Lars Jorhem.
9. Proficiency Testing – Drinking Water Microbiology, 2010:1, March by C Lantz, T Šlapokas and M Olsson.
10. Rapportering av livsmedelskontrollen 2009 av D Rosling och K Bäcklund Stålenheim.
11. Rapportering av dricksvattenkontrollen 2009 av D Rosling.
12. Proficiency Testing – Food Microbiology, April 2010 by C Normark, K Mykkänen and I Boriak.
13. Kontroll av restsubstanser i levande djur och animaliska livsmedel. Resultat 2009 av I Nordlander, B Aspenström-Fagerlund, A Glynn, A Johansson, K Granelli, E Fredberg, I Nilsson, Livsmedelsverket och K Girma, Jordbruksverket.
14. Metaller i fisk i Sverige – sammanställning av analysdata 2001-2005 av B Sundström och L Jorhem.
15. Import av fisk från tredje land – redlighetsprojekt inom gränskontrollen av E Fredberg, P Elvingsson och Y Sjögren.
16. Djurskydd vid slakt – ett kontrollprojekt av C Berg och T Axelsson.
17. Proficiency Testing – Food Chemistry, Nutritional Components of Food, Round N 46 by L Merino.
18. Proficiency Testing – Food Chemistry, Vitamins in Food, Round V-8 by H S Strandler and A Staffas.
19. Potatis – analys av näringsämnen av V Öhrvik, I Mattisson, S Wretling och C Åstrand.
20. Proficiency Testing – Drinking Water Microbiology, 2010:2, September by C Lantz, T Šlapokas and I Boriak.

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