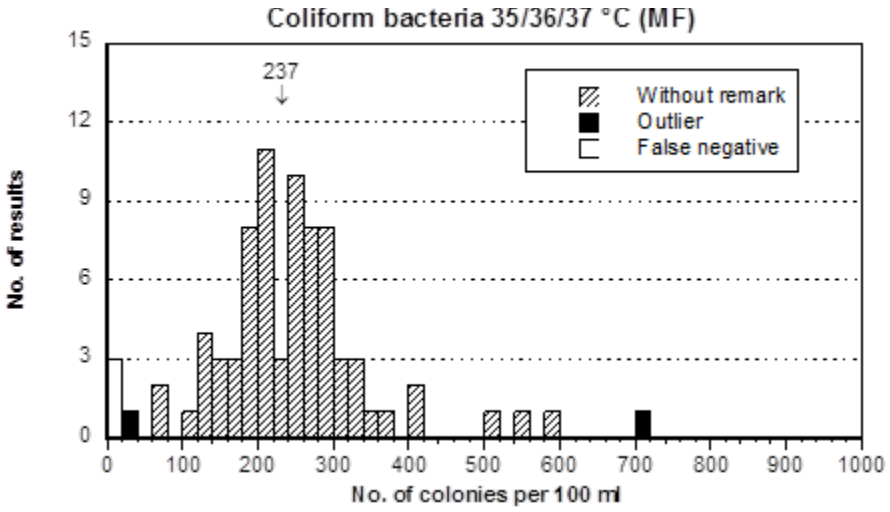
Rapport 24 – 2012

Proficiency Testing

Drinking Water Microbiology

2012:2, September

by Tommy Šlapokas and Kirsi Mykkänen



LIVSMEDELS VERKET
NATIONAL FOOD AGENCY, Sweden

Proficiency Testing

Drinking Water Microbiology

2012:2, September

Tommy Šlapokas [1]
Kirsi Mykkänen[1,2]

[1] Compilation and writing [2] Laboratory work

1st edition

National Food Agency
Box 622
SE-751 26 UPPSALA
SWEDEN

Uppsala 2012

SWEDAC ACKREDITERING
1457
ISO/IEC 17043

Introduction

All analytical activities require the execution of work of a high standard that is accurately documented. For this purpose most laboratories carry out some form of internal quality assurance, but their analytical work also has to be evaluated by an independent party. Such external quality control of laboratory competence is commonly required by accreditation bodies and can be done by taking part in proficiency testing (PT).

In a proficiency test, identical test material is examined by a number of laboratories. The laboratories must follow instructions, perform analyses on the samples provided and report their results to the organiser. They are also expected to use their routine methods for their analyses. The organiser subsequently evaluates the results using statistical tools and finally compiles them in a report.

Benefits of the National Food Agency's proficiency tests

1. Laboratories are externally evaluated with respect to their analytical competence, including usage of methods, documentation and orderliness.
2. Accreditation bodies are provided with a tool for inspections regarding new accreditation or maintenance of accreditation.
3. Laboratories and the organiser improve their knowledge of the efficiency of analytical methods used routinely by participating laboratories with respect to various types of organisms.

Edition
Version 1 (17 December 2012)

Editor in chief
Annika Rimland, Head of the Science Department, National Food Agency

Responsible for the scheme
Tommy Šlapokas, Microbiologist, Microbiology Division, National Food Agency

Contents

Design

Analyses and mixtures

This proficiency test was performed in September 2012, and is registered as no. 2639/2012 at the National Food Agency, Uppsala. Samples were sent to 114 laboratories, 36 of which were in Sweden, 58 in other Nordic countries and 20 in other countries. Eight laboratories did not report results.

Assessed parameters

Coliform bacteria and ***Escherichia coli*** with membrane filtration method (MF)
Coliform bacteria and ***Escherichia coli*** with rapid kit methods using most probable numbers (MPN)
Intestinal enterococci with MF
Pseudomonas aeruginosa with MF
Culturable microorganisms (total count) after incubation for 3 days at **22±2 °C**
Culturable microorganisms (total count) after incubation for 2 days at **36±2 °C**

Not assessed parameters

For the analyses using membrane filtration, the number of **suspected colonies** obtained on the primary culture plates could be reported by the participants, i.e. before the confirmation steps. However, these results are used as information for interpretation and discussion of analyses outcomes only.

The proficiency test comprised three simulated water samples. Each laboratory was assigned to perform the analyses according to the methods routinely used on drinking water samples. The test material is first and foremost adjusted to the 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 also possible to use, as well as other similar methods.

Three freeze-dried test materials were produced with 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 were prepared by dissolving the content of the vials in 800 ml of sterile diluent. The composition of each mixture is listed in **Table 1**.

Abbreviations of the most commonly used media names

LES:	m-Endo Agar LES
LTTC:	m-Lactose TTC Agar with Tergitol (EN-ISO 9308-:2000)
m-FC	m-FC Agar
m-Ent	m-Enterococcus Agar (Slanetz & Barley)
PACN	Pseudomonas Agar base + Cetrimide and Nalidixic acid
YeA	Yeast extract Agar (EN ISO 6222:1999)

Table 1 *Microbial mixtures* [1]

Mixture	Microorganisms	Strain no.	No. of cfu/100 ml [2]
A	*Enterobacter cloacae*	SLV-451	300
	Enterococcus durans	SLV-078	620
	Pseudomonas aeruginosa	SLV-453	130
	Stenotrophomonas maltophilia	SLV-041	39 *
B	*Cronobacter sakazakii*	SLV-419	27
	Escherichia coli	SLV-082	32
	Enterococcus hirae	SLV-536	61
	Staphylococcus saprophyticus	SLV-013	<1 *
	Staphylococcus capitis	SLV-463	84 *
C	*Klebsiella oxytoca*	SLV-553	610
	Escherichia coli	SLV-295	250
	Enterococcus faecium	SLV-459	100
	Pseudomonas aeruginosa	SLV-455	47
	Pseudomonas fluorescens	SLV-535	29 *

1 The links between the mixtures and the randomised sample numbers are shown in Annex A

2 Results based on duplicate analyses of 10 vials per mixture, performed at the National Food Agency (Table 2); LES was used for *E. coli*, *E. cloacae* and *K. oxytoca*; m-FC for *C. sakazakii*; m-Ent for *E. durans*, *E. hirae* and *E. faecium*; PACN for *P. aeruginosa*; YeA for *S. maltophilia*, *S. saprophyticus*, *S. capitis* and *P. fluorescens* – cfu = colony forming units

* cfu per ml

Quality control of the mixtures

It is essential to have a homogeneous mixture and a uniform volume in all vials in order to allow comparison of all freeze-dried samples derived from one mixture. The volume was checked in at least 9 vials of each mixture and the biggest differences between vials were 2, 5 and 3 mg for mixture A, B and C, respectively. The highest accepted volume variation is 15 mg (3%). **Table 2** presents the coefficients of variation (CV) of the results from duplicate analyses of 10 vials from each mixture. The results relate to the unit by volume at which the colonies were counted. The highest accepted CV normally is 25%. For very low colony counts, like for the analysis of culturable microorganisms at 22˚C in mixture B, a higher CV is accepted. For 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]	5 [a]	4 [b]	5 [a]
Suspected thermotolerant colif. bact. (MF) [3]	7 [a]	7	8 [a]
Intestinal enterococci (MF) [4]	6 [a]	4	3
Pseudomonas aeruginosa (MF) [5]	10 [a]	–	8
Culturable microorg., 3d 22 °C (pour-plate) [6]	4	61	8
Culturable microorg., 2d 37 °C (pour-plate) [6]	4	6	8

1 n=10 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 15, 14 and 12 weeks ahead of the proficiency test, respectively

2 m-Endo Agar LES according to SS 028167 [a preliminary analysis of concentrations was also done on Lactose TTC Agar with Tergitol according to SS-EN ISO 9308-1:2000]

3 m-FC Agar, 44 °C according to SS 028167 [a preliminary analysis of concentrations was also done on Lactose TTC Agar with Tergitol according to SS-EN ISO 9308-1:2000]

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

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

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

a Results for 10 ml

b Only for *E. coli*. *C. sakazakii* was difficult to enumerate on LES during our control.

– 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 histograms but are compiled in **Table 3** together with the other results with annotations. All reported laboratory results are listed in **Annex A**. Z-values for the all evaluated results are given in **Annex B** and pictures of colony appearance on various media are presented in **Annex C**.

Most histograms have "tails" in either or both directions, due to values that do not belong to a normal distribution. Calculations are performed after square root transformations of the results which give better normal distributions and therefore decrease the significance of the "tails". Very deviating values are present in most analyses and are identified as outliers (black bars) 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 is objective, it is a prerequisite that the results are normally distributed in order to obtain correct outliers. 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 the right limits based on the knowledge of the mixture's contents.

False negative results are presented with white bars in the histograms. False results and outliers are not included in the calculations. Calculations are more elaborately described in the scheme protocol (3).

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]				**No. of**
	A	**B**	**C**	**Total**	**laboratories**
No. of evaluated results	617	616	617	***1850***	***106***[a]
False positives	2	4	3	***9***	***4***
False negatives	6	5	7	***18***	***14***
Low outliers	9	4	5	***18***	***13***
High outliers	9	12	7	***28***	***17***
No. of results with annotation	26	25	22	***73***	***36***[b]

1 Results from the analyses not assessed are not included

a Number of laboratories that reported analytical results

b Number of laboratories that reported at least one result with annotation

Mixture A

The composition of mixture A is presented in **Table 1.** The microorganisms detected for each analysis are listed in **Table 4**, as well as the results average, their dispersion (CV) and the percentages of false results and outliers. The dispersion was very small or small for all parameters.

Coliform bacteria MF and rapid methods

For the analysis of coliform bacteria, *E. cloacae* formed colonies with the typical metal sheen on LES. The plate reading was also relatively easy on LTTC, where the strain formed large yellow colonies surrounded by a mixed

Table 4 *Outcome of analyses for mixture A; F+ and F- are % of false positive and false negative results, respectively. Outl < and Outl > are % of low and high outliers, respectively. Shaded analyses are not numerically assessed and the median is stated instead of mean.*

Analysis	Organisms	cfu/ vol[1]	CV[2] (%)	F+	F-	Outl <	Outl >
Susp. coliform bacteria (MF)	*E. cloacae*	245					
Coliform bacteria (MF)	*E. cloacae*	237	19	-	4	1	1
Susp. thermotol. colif. bact. (MF)	*E. cloacae*	0					
E. coli (MF)	*[E. cloacae]*	0	-	1	-	-	-
Coliform bact. (rapid method)	*E. cloacae*	257	11	-	0	2	2
E. coli (rapid method)	—	0	-	2	-	-	-
Susp. intest. enterococci (MF)	*E. durans*	530					
Intest. enterococci (MF)	*E. durans*	566	9	-	3	9	0
Susp. *P. aeruginosa* (MF)	*P. aeruginosa*	75					
P. aeruginosa (MF)	*P. aeruginosa*	67	20	-	2	0	8
Culturable microorganisms (total count) 22±2 °C, 3 days	*S. maltophilia* *E. durans* *E. cloacae* *(P. aeruginosa)*	38	11	-	0	0	1
Culturable microorganisms (total count) 36±2 °C, 2 days	*S. maltophilia* *E. durans* *E. cloacae* *(P. aeruginosa)*	38	9	-	0	0	1

1 "colony forming units" per unit of volume – 1 ml for total count microorg., otherwise 100 ml
2 "Coefficient of Variation" – calculated from square root transformed results (see Annex A)
- numerical value impossible to obtain
— organism absent or numerical value has not been calculated
( ) the organism contributes with very few colonies
[ ] the organism is false positive on the primary growth medeium
{ } the result depends on the particular method variant used or a specific definition

flora, even if the yellow colour under the colonies was impossible to distinguish as all the medium became yellow.

- *E. cloacae* is a coliform bacterium producing *β*-galactosidase that is detected with rapid methods based on this enzymatic activity.

Suspected thermotolerant coliform bacteria (MF)

- Suspected thermotolerant coliform bacteria were reported by 15 out of 43 laboratories performing the analysis. *E. cloacae* formed small blue colonies on m-FC but the strain did not grow at all on LTTC at 44°C.

E. coli MF and rapid methods

- There was no *E. coli* in mixture A. One false positive result was reported for each method.

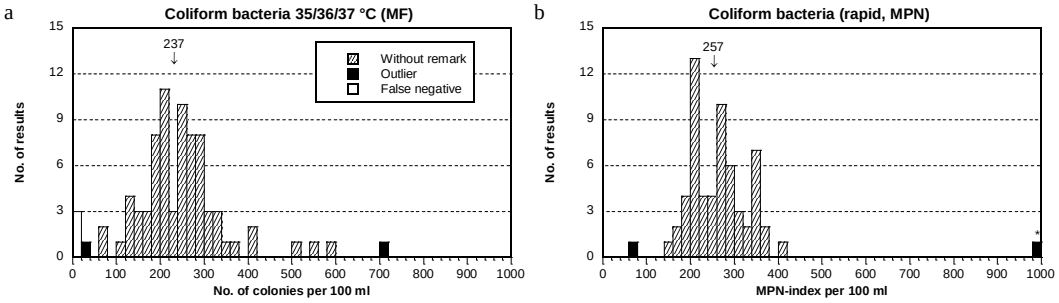


Figure 1a-b Mixture A, *Histogram of all analytical results. False negatives are presented as white bars. Outliers, false negatives excluded, are represented by black bars. The x-axis scale is not adjusted to very high deviating results. They are marked with an asterisk. The mean value of the analysis is stated and indicated by an arrow above the bars. Calculations have been made from square root transformed results, outliers and false negatives excluded.*

Intestinal enterococci

- The target organism for this analysis was *E. durans*. Results had revealed that the strain could grow poorly on some batches of membrane filters and is therefore a good "indicator" of filter-related problem with enterococci. Such observations could give an explanation for the 9 low outliers reported. We have noticed that filter batches from Pall Life Science (Gelman) can lead to very low results.

Pseudomonas aeruginosa

- The strain of *P. aeruginosa* included in the mixture formed clearly blue-green colonies on PACN. Hence, no confirmation step was necessary if the analysis was done according to the standard method describing the use of this medium. However, on this medium, also some white colonies of *E. cloacae* grew that could cause misinterpretation, especially as they turn up green during the second

day of incubation. These colonies might be the reason of the 5 high outliers reported. However, the "white" colonies do not fluoresce under UV exposure.

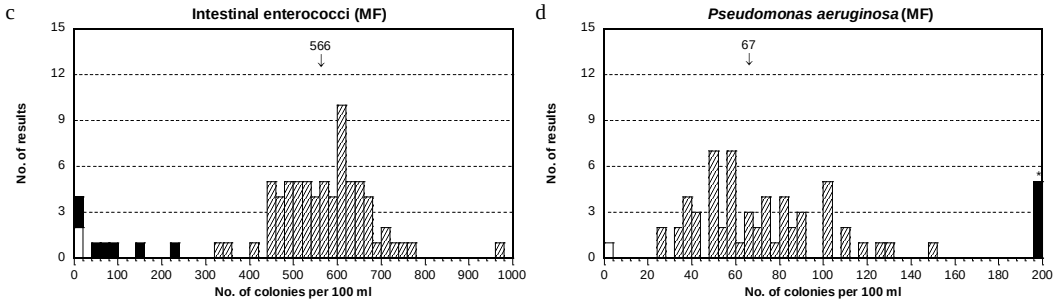


Figure 1c-d ***Mixture A****, see figure 1a-b for explanation*

Culturable microorganisms 22 °C, 3 days and 36 °C, 2 days

- All four strains present in mixture A formed colonies for these analyses in relation to their concentrations. *S. maltophilia* was the most abundant in the mixture.

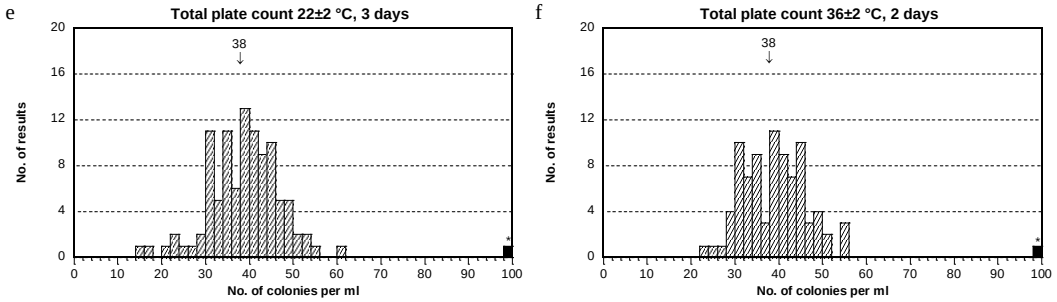


Figure 1e-f ***Mixture A****, see figure 1a-b for explanations*

Mixture B

The composition of mixture B is presented in **Table 1.** The microorganisms detected for each analysis are listed in **Table 5**, as well as the results average, their dispersion (CV) and the percentages of false results and outliers. The distribution of the results was very small or small for most analyses except for culturable microorganisms at 22 °C. For *E. coli* (MF) the distribution was medium.

Table 5 *Outcome of each analysis for mixture B; see Table 4 for explanations.*

Analysis	**Organisms**	**cfu/ vol**[1]	**CV** [2] **(%)**	**F+**	**F-**	**Outl <**	**Outl >**
Susp. coliform bacteria (MF)	*E. coli* *C. sakazakii*	52					
Coliform bacteria (MF)	*E. coli* *C. sakazakii*	55	16	-	1	1	3
Susp. thermotol. colif. bact. (MF)	*E. coli* *C. sakazakii*	35					
E. coli (MF)	*E. coli* *[C. sakazakii]*	30	21	-	1	0	2
Coliform bact. (rapid method)	*E. coli* *C. sakazakii*	65	10	-	0	2	2
E. coli (rapid method)	*E. coli*	36	11	-	2	0	0
Susp. intest. enterococci (MF)	*E. hirae* *{S. saprophyticus}*	59					
Intest. enterococci (MF)	*E. hirae*	58	8	-	3	0	1
Susp. *P. aeruginosa* (MF)	—	0					
P. aeruginosa (MF)	—	0	-	3	-	-	-
Culturable microorganisms (total count) 22±2 °C, 3 days	*(E. hirae)* *(S. saprophyticus)* *(C. sakazakii)* *(E. coli)*	2	44	-	0	0	5
Culturable microorganisms (total count) 36±2 °C, 2 days	*S. capitis* *(E. hirae)* *(S. saprophyticus)* *(C. sakazakii)* *(E. coli)*	76	8	-	0	2	1

Coliform bacteria (MF)

- *C. sakazakii* and *E. coli* grew as coliform bacteria on LES and LTTC. On LES both *E. coli* and *C. sakazakii* formed colonies with clear metallic sheen, although somewhat different. On LTTC the colonies from both strains were

yellow. On this medium grew also a background of small yellow colonies from the intestinal enterococcus strain *E. hirae.*

Suspected thermotolerant coliform bacteria

- Suspected thermotolerant coliform bacteria were reported by 43 laboratories. Colonies that grow on m-FC and LTTC at 44/44.5 °C were from *C. sakazakii* and *E. coli*.

E. coli, MF

- Regardless the primary analysis (at 36±2 °C or 44/44.5°C), for which both the strains of *E. coli* and *C. sakazakii* grew, confirmation steps must be performed. This allows eliminating *C. sakazakii* as suspected *E. coli*, as this strain is negative for indol production and *β*-glucuronidase activity.

Coliform bacteria and E. coli (rapid methods, MPN)

- Both *E. coli* and *C. sakazakii* were detected as coliform bacteria with methods based on *β*-galactosidase activity, e.g. Colilert®-18/24 Quanti-Tray® which is clearly the most widely used.
- In mixture B, only the *E. coli* strain is *β*-glucuronidase positive and is therefore the only microorganism detected as *E. coli* with Colilert®-18/24 Quanti-Tray®.

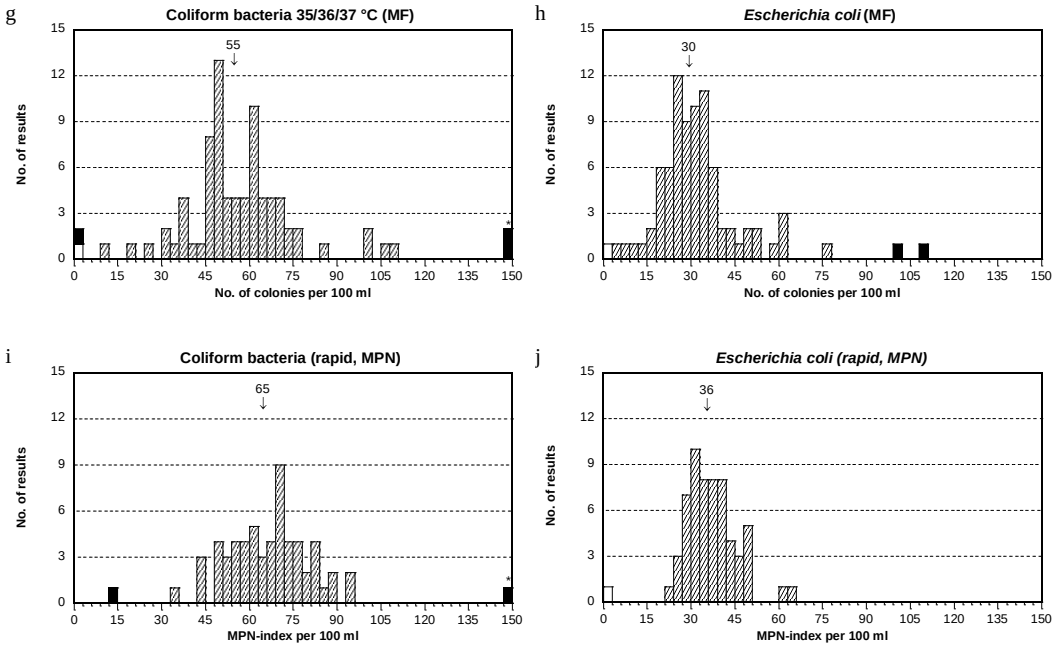


Figure 1g-j ***Mixture B****, see figure 1a-b for explanations*

Intestinal enterococci

- *E. hirae* was the target organism for this analysis. Mixture B also contained a strain of *Staphylococcus saprophyticus* which can form reddish colonies on m-Ent and sometimes be reckoned as suspected intestinal enterococci.

k

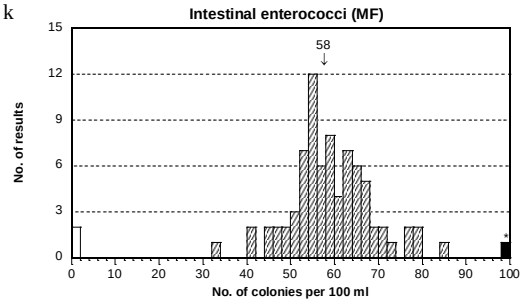


Figure 1k ***Mixture B****, see figure 1a-b for explanations*

Pseudomonas aeruginosa

- Mixture B contained no *P. aeruginosa*. Two false positive results were reported.

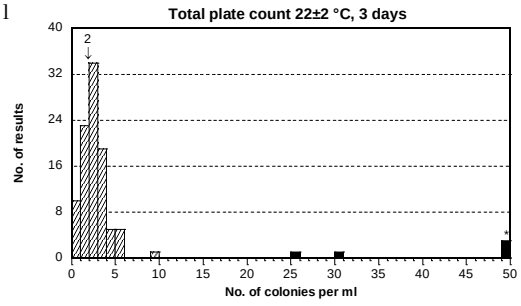
Culturable microorganisms 22°C, 3 days

- Results were good considering the low average value, 2 cfu per ml. *S. capitis* did not grow at 22°C while the four other strains did but in low numbers. Few high outliers were reported and because of the low average value, the relative dispersion of the results became very large (44 %).

Culturable microorganisms 36°C, 2 days

- *S. capitis* grew at 36°C and is responsible for the majority of the colonies counted for in this analysis. The other microorganisms present in mixture B formed only few colonies. The relative dispersion of the results was very small.

l



m

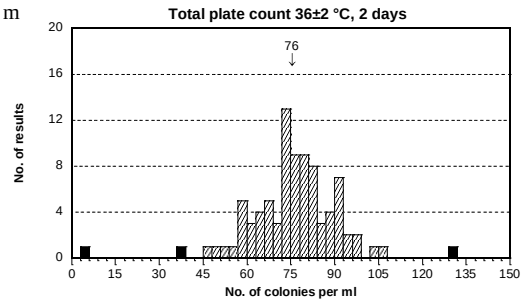


Figure 1l-m ***Mixture B****, see figure 1a-b for explanations*

Mixture C

The composition of mixture C is presented in **Table 1.** The microorganisms detected for each analysis are listed in **Table 6**, as well as the results average, their dispersion (CV) and the percentages of false results and outliers. The results dispersion was small to medium for all analyses.

Table 6 *The outcome of each analysis in mixture C; see Table 4 for explanations.*

Analysis	**Organisms**	**cfu/ vol**[1]	**CV**[2] **(%)**	**F+**	**F-**	**Outl <**	**Outl >**
Susp. coliform bacteria (MF)	*E. coli MUG-* *K. oxytoca*	703					
Coliform bacteria (MF)	*E. coli MUG-* *K. oxytoca*	690	11	-	1	4	0
Susp. thermotol. colif. bact. (MF)	*E. coli MUG-* *K. oxytoca*	219					
E. coli (MF)	*E. coli MUG-* *{K. oxytoca}*	218 *	15 *	-	0 #	2	5
Coliform bact. (rapid method)	*E. coli MUG-* *K. oxytoca*	777	11	-	0	0	2
E. coli (rapid method)	—	0	-	5	-	-	-
Susp. intest. enterococci (MF)	*E. faecium*	87					
Intest. enterococci (MF)	*E. faecium*	59	29	-	4	0	0
Susp. *P. aeruginosa* (MF)	*P. aeruginosa*	25					
P. aeruginosa (MF)	*P. aeruginosa*	23	20	-	5	0	0
Culturable microorganisms (total count) 22±2 °C, 3 days	*P. fluorescens* *K. oxytoca* *E. coli* *(E. faecium)* *(P. aeruginosa)*	20	18	-	0	0	1
Culturable microorganisms (total count) 36±2 °C, 2 days	*K. oxytoca* *E. coli* *(E. faecium)* *(P. aeruginosa)*	9	17	-	0	0	1

* Values without both the outliers and the 9 accepted ”0” results

\# Nine ”0” results were reported and considered as correct based on the method used

Coliform bacteria (MF)

- The target organisms for this analysis were *E. coli* and *K. oxytoca* which form typical colonies on LES and LTTC.

Suspected thermotolerant coliform bacteria

- Suspected thermotolerant coliform bacteria were reported by 43 laboratories. Colonies that grows on m-FC and LTTC at 44/44.5 °C were from *E. coli*. No assessment is done for this analysis.

E. coli (MF)

- *E. coli* and *K. oxytoca* appear with typical colonies on LES and LTTC at 35-37 °C. In the confirmation step, *K. oxytoca* could grow in broth at 44 °C and moreover be positive for indol reaction. However, *K. oxytoca* does not produce gas and is *β*-glucuronidase negative. The high outliers reported could be due to the count of *K. oxytoca* colonies interpreted as *E. coli* based on the indol test.
- Only *E. coli* grows on m-FC and LTTC at 44/44.5 °C and, hence, no *K. oxytoca* will be present for confirmation.
- The *E. coli* strain in mixture C is often considered as *β*-glucuronidase negative. However the strain can appear slightly positive by a confirmation step in broth complemented with MUG reagent. The strain does not form typical colonies on chromogenic medium based on the detection of *β*-glucuronidase activity, e.g. Chromocult Coliform Agar® (Merck). Therefore, for laboratories that primarily detected *E. coli* based on *β*-glucuronidase activity a null result is correct. When confirmation is practiced, the correct answer may vary based on the interpretation of fluorescence that will be done. These outcomes explain the bar with 9 zero results in the histogram.

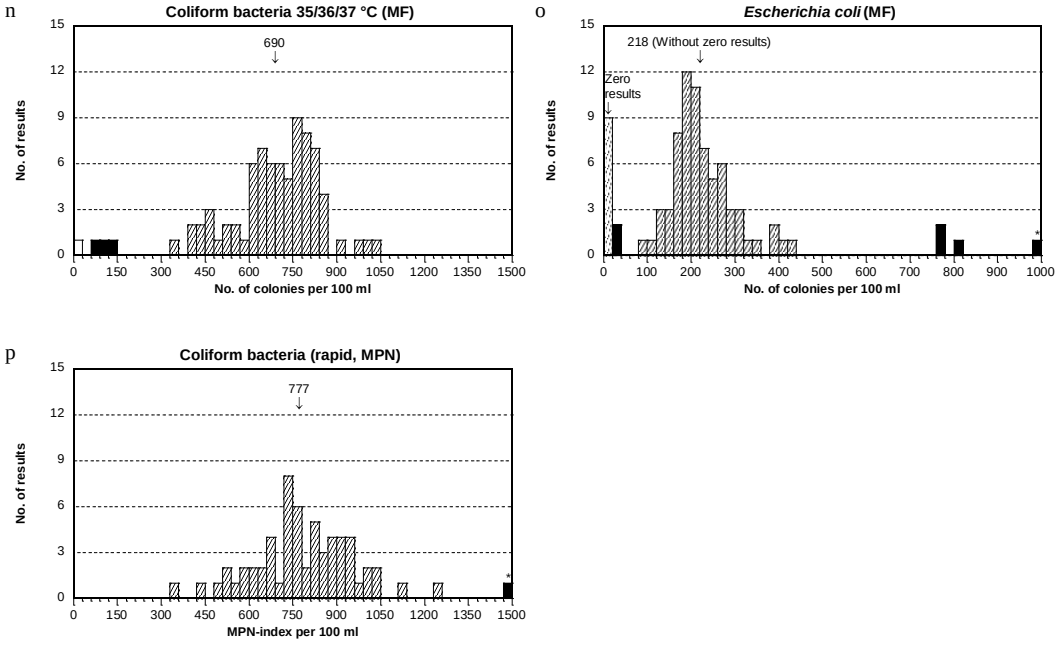


Figure 1n-p ***Mixture C****, see figure 1a-b for explanations*

- Because of the different methods used for this analysis and the different interpretation of what is an *E. coli*, the average value was calculated as usual with the outliers excluded, but here also without the 9 accepted zero results.

Coliform bacteria (rapid methods, MPN)

- Both *E. coli* and *K. oxytoca* produce *β*-galactosidase and are detected as coliform bacteria with methods based on the activity of this enzyme, e.g. Colilert®-18/24 Quanti-Tray® that uses the ONPG substrate.

E. coli (rapid methods, MPN)

- The *E. coli* strain in mixture C is *β*-glucuronidase negative or slightly positive but does not fluoresce with Colilert® -18/24 Quanti-Tray®. The bacteria cannot be detected as *E. coli* with this method. Earlier tests performed at National Food Agency show that fluorescence does not appear even after incubation up till 22 hours.

Intestinal enterococci

- A strain of *E. faecium* was included in mixture C. The colonies of this strain can differ in size and vary in colony appearance being more or less purple. Sometimes colonies produce only weak blackness on bile-esculine-azide agar in the confirmation step, or even no blackness at all for the smallest. This can explain the zero results and low outliers reported. It happened that low values were obtained also with this strain when the filters that gave low results for *E. durans* in mixture A were used. This might be a second explanation to the low results.
- For all the reasons mentioned above, the results dispersion was quite high (29 %), which was much higher than for the enterococci in mixture A and B.

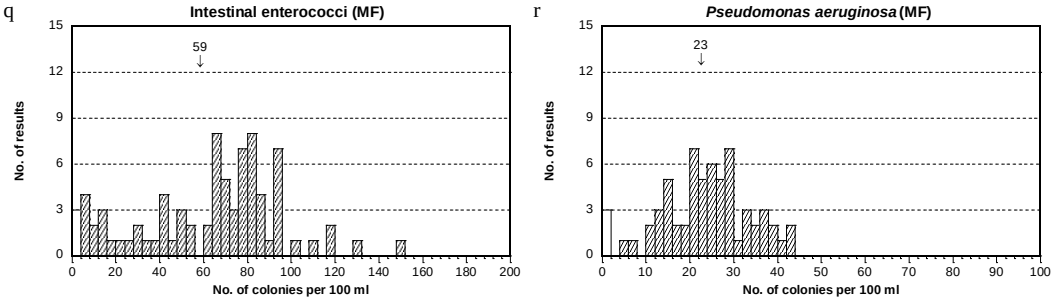


Figure 1q-r ***Mixture C****, see figure 1a-b for explanations*

Pseudomonas aeruginosa

- Colonies from mixture C were not as clearly blue-green as those from mixture A. On the most outer part of the filter, they could instead be light green-yellow on PACN. Even if these colonies fluoresce under UV light, confirmation steps would probably be performed due to their appearance.

- The dispersion of the results was the same as for mixture A, in spite the average was lower, 23 and 67 cfu/100 ml, respectively. In both cases the dispersion was larger than usual, which can be explained by the presence of coloured background flora in mixture A and various coloured colonies in mixture C.

Culturable microorganisms 22±2 °C, 3 days and 36±2 °C, 2 days

- All strains present in mixture C grew at 22 °C, but colonies of *P. fluorescens* are the most abundant.
- At 36±2 °C the strain *P. fluorescens* did not grow and the majority of colonies were the coliform bacteria.
- Despite the low average value at 36±2 °C, the dispersion is not higher than at 22 °C, which could have been expected. On the other hand, the dispersion from results at 22 °C is higher than usual. It is known that the strain of *P. fluorescens* leads to a larger variation than many other strains at this temperature.

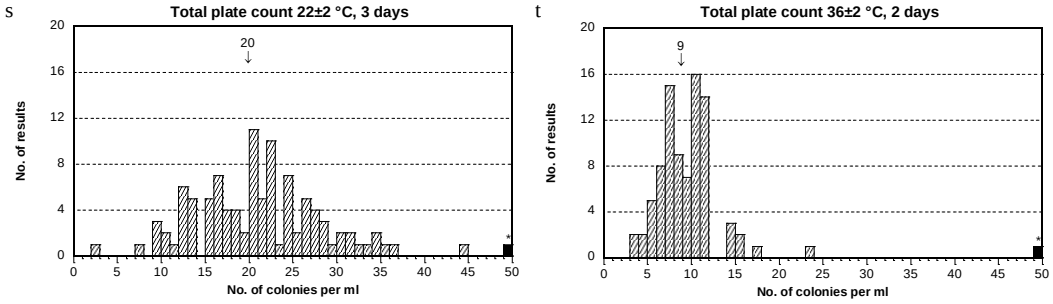


Figure 1s-t ***Mixture C****, see figure 1a-b for explanations*

Outcome of the methods

Method information by use of internet

According to EN ISO/IEC 17043, for which the proficiency testing program organized by the National Food Agency is accredited since early 2012, the provider shall be able to group results according to the methods used. Therefore, it is mandatory to also report information for the methods for which results that will be assessed are reported. The method information is reported via our website www.slv.se/absint, after logging on.

General information regarding methods outcome

The number of results for the various methods can be seen in the descriptive part of **Annex A**. Although method information is available for all numerical results, it is not always easy to interpret. For example, sometimes the medium used differs from what is stated in the standard. Results from such laboratories are usually not shown in this report. They will be omitted or placed in the group "Other/Unknown" together with results from laboratories with methods used only by a few participants.

Method information from laboratories with outliers or false results for a particular analysis will not be included in the compilations, to make fair method comparisons. Instead, the number of low deviant results (false negatives included) and high deviant results (false positives included) are presented separately, together with the mean etc. The numbers of false results indicate if a particular method leads to more of such results than others. For methods with 6 or fewer results, results dispersion is not calculated and will normally not be discussed in the comparisons. The judgements done are partly subjective.

Tables and figures legends

Tot n	total number of laboratories that reported method and result
n	number of results, outliers and false results excluded
Mv	mean value for a method – outliers and false results excluded
Med	median value for an analyses not assessed
CV	Coefficient of variation = relative standard deviation in percent of mean, calculated from the squared-root transformed results.
<	number of low outliers and/or false negative results
>	number of high outliers or false positive results
229	results close to the mean value
601	highlight low results
278	highlight high results or many deviant results
47	highlight results of the group "Other/Unknown" not evaluated

Results based on differences in use of methods

Coliform bacteria (MF)

In many cases, laboratories reported the primary medium used, which differs from the one described in the reported standard method. It is unclear if it is the medium or the method reported that is correct, which makes it difficult to compare methods appropriately. Here, we have chosen to consider the reported medium as correct.

The medium m-Endo Agar LES was used 3 to 4 times more than Lactose TTC Agar by laboratories. With the use of Lactose TTC Agar, a higher average value was obtained for mixture A and B but lower for mixture C in comparison with the use of m-Endo Agar LES. None of the mixture caused difficulties for this analysis. The differences may be by chance only or could reflect growth differences of the strains present in each mixture on those media.

Coliform bacteria MF

Medium	**Tot**	**A**					**B**					**C**				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***80***	***74***	***237***	***19***	***4***	***1***	***76***	***55***	***16***	***2***	***2***	***76***	***690***	***11***	***4***	***0***
m-Endo Agar LES	56	54	229	18	2	0	54	53	14	1	1	53	724	9	3	0
Lactose TTC Agar	17	14	278	22	1	1	16	58	21	0	1	17	601	13	0	0
Chromocult [1]	2	2	220	–	0	0	2	86	–	0	0	2	624	–	0	0
Other/unknown	5	4	216	–	1	0	4	47	–	1	0	4	663	–	1	0

1 Chromocult Coliform Agar® (Merck)

Suspected thermotolerant coliform bacteria (MF)

The two most used media for this analysis were m-FC Agar (described in several national standard methods) and Lactose TTC Agar (EN ISO 9308-1). Incubation was done at 44 or 44.5°C.

Results obtained for this analysis can further be separated according to the standard methods most widely used. These were EN ISO 9308-1 and 3 standards from Nordic countries, i.e. SS 028167 from Sweden, SFS 4088 from Finland and NS 4792 from Norway. In Sweden and according to the standard EN ISO 9308-1 incubation is done at 44 °C. This temperature is also used in most of the Finnish laboratories and in some of the Norwegian laboratories. For the others, incubation takes place at 44.5°C.

As this analysis is not evaluated, only median values are presented in the table. More than half of the laboratories using the standard method SS 028167 got a positive results for the analysis, contrary to the laboratories using other methods. Small, bluish, atypical colonies of *E. cloacae* usually appear at 44 °C and were probably more or less counted by the laboratories.

For mixture B, higher average value was obtained when using the Finnish standard than when using the Swedish or Norwegian ones. This is related to the way the large grey colonies of *C. sakazakii* were interpreted. The average is lower if they were not taken into account because they were grey on m-FC Agar. How they were taken into account was probably different among the laboratories.

The results for mixture C were more homogenous as only *E. coli* was present.

Thermotolerant coliform bacteria MF

Standard, Method	Tot	A					B					C				
	n	n	Med	CV	<	>	n	Med	CV	<	>	n	Med	CV	<	>
Total	***43***	***43***	***0***	–	–	–	***43***	***35***	–	–	–	***43***	***219***	–	–	–
EN ISO 9308-1	9	9	0	–	–	–	9	35	–	–	–	9	234	–	–	–
SS 028167	11	11	30	–	–	–	11	28	–	–	–	11	222	–	–	–
SFS 4088	17	17	0	–	–	–	17	45	–	–	–	17	200	–	–	–
NS 4792	5	5	0	–	–	–	5	24	–	–	–	5	180	–	–	–
Other/unknown	1	1	0	–	–	–	1	32	–	–	–	1	160	–	–	–

E. coli (MF)

E. coli was quantified after confirmation of colonies that grew either at 36±2 °C or 44/44.5 °C. Different media are used for the different temperatures and correspond to the analysis of coliform bacteria or thermotolerant coliform bacteria. The results are presented for each temperature of incubation. Results where it is not clear which incubation temperature was used for the primary growth medium are not included.

E. coli was present in mixture B and C. No method difference could be seen for mixture B at any temperature. On the other hand, for mixture C results were higher with use of Lactose TTC Agar compared to both m-Endo Agar LES and m-FC Agar. However, at 44/44.5 °C it seems that there are large differences between the laboratories using the various Nordic standards. For mixture C, Swedish and Finnish standard seem to give higher and lower results than average on m-FC Agar, respectively. However there are too few results to draw any certain conclusion.

E. coli MF (from 36±2 °C)

Medium	Tot	A					B					C				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***49***	***48***	***0***	–	***0***	***1***	***47***	***34***	***18***	***1***	***0***	***48***	***158***	***44***	***0***	***1***
m-Endo Agar LES	36	35	0	–	0	1	35	33	16	1	0	36	137	50	0	0
Lactose TTC Agar	10	10	0	–	0	0	9	35	27	0	0	9	228	23	0	0
Chromocult [1]	2	2	0	–	0	0	2	30	–	0	0	2	242	–	0	1
Other/unknown	1	1	0	–	0	0	1	49	–	0	0	1	220	–	0	0

1 Chromocult Coliform Agar® (Merck)

E. coli MF (from 44 °C)

Medium	Tot	A					B					C				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***14***	***14***	***0***	–	***0***	***0***	***13***	***25***	***14***	***0***	***1***	***13***	***188***	***33***	***0***	***1***
m-FC Agar	8	8	0	–	0	0	8	24	14	0	0	7	169	49	0	1
Lactose TTC Agar	4	4	0	–	0	0	3	23	–	0	1	4	221	–	0	0
Other/unknown	2	2	0	–	0	0	2	32	–	0	0	2	197	–	0	0

E. coli MF (from 44 °C)

Standard, Method	Tot	A					B					C				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***14***	***14***	***0***	***–***	***0***	***0***	***13***	***25***	***14***	***0***	***1***	***13***	***188***	***33***	***0***	***1***
EN ISO 9308-1	4	4	0	–	0	0	3	23	–	0	1	4	221	–	0	0
SS 028167	2	2	0	–	0	0	2	27	–	0	0	2	324	–	0	0
SFS 4088	3	3	0	–	0	0	3	24	–	0	0	3	76	–	0	0
NS 4792	3	3	0	–	0	0	3	23	–	0	0	2	207	–	0	1
Other/unknown	2	2	0	–	0	0	2	32	0	0	0	2	197	14	0	0

Coliform bacteria and E. coli (rapid methods with MPN)

The rapid method used for these two analyses is almost exclusively Colilert® Quanti-Tray® from IDEXX Inc. Of 60 reporting laboratories, some used trays with 51 wells and others trays with 97 wells, and for still others it is difficult to know which type of trays they used. Analyses were performed either without sample dilution, or with and without dilution. In few cases other methods were used, as national standard, some not being rapid methods, like the classic method with MPN quantification of cfu in tubes. In one case qualitative analysis was made using Colilert substrate. Results with no stated method are not evaluated.

No obvious differences appeared in the results of the two analyses depending on types of trays used. Most of the outliers were obtained with 97 wells trays which were the most used. Two outliers were obtained also by another rapid method.

Coliform bacteria, rapid method with MPN

Medium	Tot	A					B					C				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***60***	***58***	***256***	***11***	***1***	***1***	***59***	***65***	***10***	***0***	***1***	***59***	***785***	***10***	***0***	***1***
Colilert Quanti-51	20	20	251	12	0	0	20	63	11	0	0	20	765	11	0	0
Colilert Quanti-97	32	31	264	11	1	0	31	67	8	0	1	31	806	10	0	1
Colilert Quanti-?	7	7	240	11	0	0	7	70	12	0	0	7	733	7	0	0
Other/unknown	1	0	–	–	0	1	1	35	–	0	0	1	920	–	0	0

E. coli, rapid method with MPN

Medium	Tot	A					B					C				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***59***	***58***	***0***	***–***	***0***	***1***	***58***	***37***	***11***	***1***	***0***	***56***	***0***	***–***	***0***	***3***
Colilert Quanti-51	20	20	0	–	0	0	20	35	11	0	0	20	0	–	0	0
Colilert Quanti-97	33	32	0	–	0	1	32	37	11	1	0	31	0	–	0	2
Colilert Quanti-?	5	5	0	–	0	0	5	41	12	0	0	5	0	–	0	0
Other/unknown	1	1	0	–	0	0	1	35	–	0	0	0	0	–	0	1

Intestinal enterococci (MF)

For this analysis, the method XX-EN ISO 7899-2:2000 was almost always the one used. In some cases an earlier version of this method was used, i.e. ISO 7899-

2:1984. The medium used (with 1 obvious and 2 probable exceptions) was m-Enterococcus Agar, often referred to also as Slanetz & Bartley Agar in comments. Temperature of incubation was always 36±2 °C, and confirmation was in the majority of the cases performed with Bile-esculine-azide agar at 44 °C. Seven laboratories also performed the catalase test.

Intestinal enterococci MF

Medium	**Tot**	**A**					**B**					**C**				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***80***	***71***	***566***	***9***	***9***	***0***	***77***	***58***	***8***	***2***	***1***	***77***	***59***	***29***	***3***	***0***
m-Enterococcus A	77	68	566	9	9	0	74	58	8	2	1	74	60	29	3	0
KF Streptococcus A	1	1	560	–	0	0	1	53	–	0	0	1	85	–	0	0
Other/unknown	2	2	577	–	0	0	2	68	–	0	0	2	38	–	0	0

Pseudomonas aeruginosa (MF)

The method XX-EN ISO 16266:2008 (with or without modification) was used by almost all the 60 laboratories reporting results for this analysis. An alternative was the identical and now withdrawn CEN-method EN 12780:2002 (with or without modification). Incubation was done at 36±2°C with one exception and laboratories used ”Pseudomonas Agar base” with cetrimid and/or nalidixic acid (C/N-supplement). In two cases Pseudomonas Isolation agar was used. Different confirmation tests were performed when necessary.

Method and medium used did not differ for this analysis, making any discussion of these irrelevant. However, the added supplements differ. Several laboratories reported to add both cetrimide and nalidixic acid to the medium, quite many added only cetrimide, while few added only nalidixic acid. One laboratory reported the use of Irgasan in Pseudomonas Agar base. In some cases the supplement added was not clear.

Mixture A and C contained *P. aeruginosa*. For mixture A the addition of only nalidixic acid seemed to give lower results. This is however not the case for mixture C in which another strain of *P. aeruginosa* was included. The laboratory that used Irgasan reported higher results for both mixtures A and C. No other possible differences are visible.

Pseudomonas aeruginosa MF

Selective substrate	**Tot**	**A**					**B**					**C**				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***64***	***58***	***67***	***20***	***1***	***5***	***62***	***0***	***–***	***0***	***2***	***60***	***23***	***20***	***3***	***0***
Cetrimide+Nalidix.	35	32	66	15	0	3	35	0	–	0	0	34	23	22	1	0
Cetrimide	20	17	70	26	1	2	18	0	–	0	2	18	22	19	1	0
Nalidixic acid	5	5	51	17	0	0	5	0	–	0	0	5	24	5	0	0
Irgasan	1	1	126	–	0	0	1	0	–	0	0	1	33	–	0	0
Other/unknown	3	3	71	–	0	0	3	0	–	0	0	2	28	–	1	0

Culturable microorganisms at 22±2 and 36±2 °C

Around 100 and 90 results were reported for the analyses at 22 °C and 36 °C, respectively. Only 4 and 5 laboratories used another method than XX-EN ISO 6222:1999 for the analyses at 22 °C and 36 °C, respectively, and none of these obtained any deviant results.

Because of the almost exclusive use of XX-EN ISO 6222:1999, we looked at potential results difference depending of the culture medium and magnification to read the plates.

For mixture A and B, at 22 °C, there is a possible trend that results obtained with ”Plate Count Agar” are lower than with ”Yeast extract Agar”. However, this was not true for the analysis performed at 36±2 °C. Although the results are very similar, it seems that results are slightly higher when higher magnification is used. However, this is not confirmed for mixture B and C at 36 °C. Outliers were obtained independently of the magnification.

Culturable microorganisms at 22 °C, 3 days

Medium	**Tot**	**A**					**B**					**C**				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***99***	***98***	***38***	***11***	***0***	***1***	***94***	***2***	***44***	***0***	***5***	***98***	***20***	***18***	***0***	***1***
Yeast extract Agar	83	82	39	9	0	1	80	2	42	0	3	82	20	16	0	1
Plate Count Agar	14	14	32	16	0	0	13	1	52	0	1	14	21	21	0	0
Other/unknown	2	2	29	–	0	0	1	0	–	0	1	2	9	–	0	0

Magnification	**Tot**	**A**					**B**					**C**				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***99***	***98***	***38***	***11***	***0***	***1***	***94***	***2***	***44***	***0***	***5***	***98***	***20***	***18***	***0***	***1***
None	24	24	36	10	0	0	23	1	61	0	1	24	19	19	0	0
1,1–4,9×	43	43	37	12	0	0	41	2	39	0	2	43	20	18	0	0
5–11,9×	32	31	40	9	0	1	30	2	40	0	2	31	21	18	0	1
> 12×	0	0	–	–	–	–	0	–	–	–	–	0	–	–	–	–
Unknown	0	0	–	–	–	–	0	–	–	–	–	0	–	–	–	–

Culturable microorganisms at 36±2 °C, 2 days

Medium	**Tot**	**A**					**B**					**C**				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***81***	***80***	***38***	***9***	***0***	***1***	***78***	***75***	***8***	***2***	***1***	***80***	***9***	***17***	***0***	***1***
Yeast extract Agar	72	71	38	9	0	1	70	76	7	1	1	71	8	15	0	1
Plate Count Agar	7	7	37	14	0	0	7	69	11	0	0	7	8	26	0	0
Other/unknown	2	2	35	–	0	0	1	48	–	1	0	2	16	–	0	0

Magnification	**Tot**	**A**					**B**					**C**				
	n	n	Mv	CV	<	>	n	Mv	CV	<	>	n	Mv	CV	<	>
Total	***81***	***80***	***38***	***9***	***0***	***1***	***78***	***75***	***8***	***2***	***1***	***80***	***9***	***17***	***0***	***1***
None	19	19	36	11	0	0	18	74	10	1	0	19	9	20	0	0
1,1–4,9×	39	39	37	9	0	0	38	76	7	1	0	39	8	18	0	0
5–11,9×	23	22	42	8	0	1	22	75	8	0	1	22	9	13	0	1
> 12×	0	0	–	–	–	–	0	–	–	–	–	0	–	–	–	–
Unknown	0	0	–	–	–	–	0	–	–	–	–	0	–	–	–	–

The outcome of deviating results – assessment

The results of all laboratories are listed in **Annex A**. A summary of the results of each laboratory – false results excluded – is illustrated by a box plot based on their z-scores (**Figure 2)**. The smaller, and the more centred around zero the box of a laboratory is, the closer its results are to the general mean values calculated for all laboratory results.

The laboratories are not grouped or ranked based on their results. However, ***the assessment*** aims to clearly give information regarding ***the number of false results and outliers*** which are presented below the box plots. These results are also are highlighted in **Annex A**, where also the minimum and maximum accepted values for each analysis are stated in the summarizing rows at the end.

In cases where it is obvious, it is also stated if a laboratory has mixed up the analytical results. If mixtures have been mixed up, it is shown by crossing of their sample numbers in **Annex A**. One laboratory seemed to have mixed up the results from mixture A and B, except for the analysis of culturable microorganisms. No laboratory seemed to have mixed results for single analyses. In a few cases, it is suspected that laboratories have missed to give their results for the volumes asked for, namely 100 ml in all analyses except for culturable microorganisms where 1 ml is appropriate.

Laboratories that have not reported results or reported too late can compare their results with results from other laboratories presented in **Annex A**.

Z-values listed in **Annex B** are the base for the box plots but they are not commented or evaluated. They can be used by laboratories in their follow-up process.

In the scheme protocol (3) the calculation of uncertainty of measurement of the assigned value is described. The assigned value for an analysis is calculated from the squared-root transformed results and is the squared-root of "Mean" in Annex A, and there denoted as mv. The standard uncertainty of measurement (u) correspond to the standard deviation of the assigned value (s) divided by the number of results squared-root transformed, i.e.: $u = s/\sqrt{n_{mv}}$ where n_{mv} is the number of results in Annex A, except the deviating ones. Here is the relative uncertainty (u_{rel}) used and expressed as per cent by multiplication by 100.

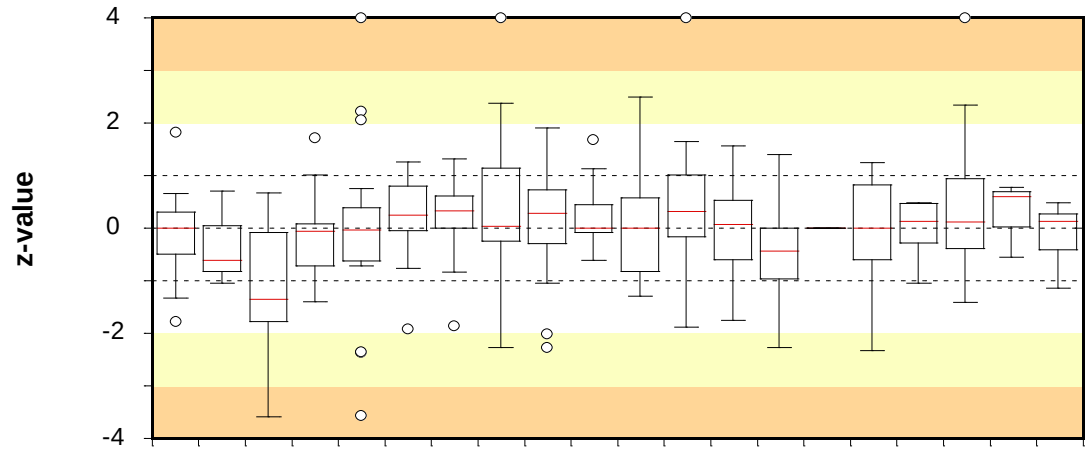
Description of the result processing and recommendations on follow-up work are given in the scheme protocol (3). A PDF file of that document is available on the website www.slv.se/absint.

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.*

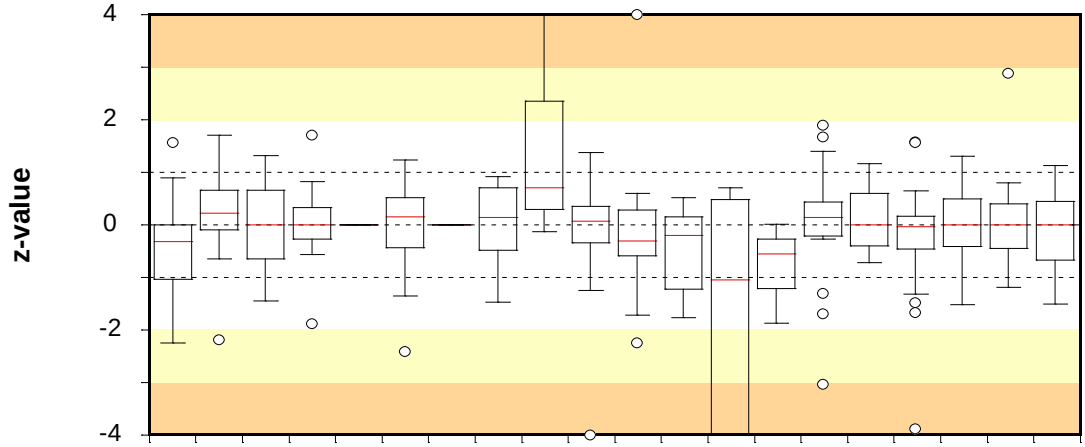
- *Standardised values are calculated from the formula z = (x – mv) / s*
- *Standardised values > +4 and < –4 have in the plots received the values +4 and –4, respectively.*
- *False results do not generate z values and are not included in 'No. of results'. False positive results cannot be illustrated in the box plots. The no. of false positives and false negatives are clear from the table beneath the plots.*
- *The outliers in the table are included in the plots after recalculation to standardised values with the same s values as the rest of the results.*
- *The horizontal line in each box indicates the median for the laboratory.*
- *The two box area parts include 25% of the results above and below the median, respectively. The lines reaching out from the box and/or the circles include 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 by fields with colours of different intensity in order to simplify localisation of the laboratory results.*

---

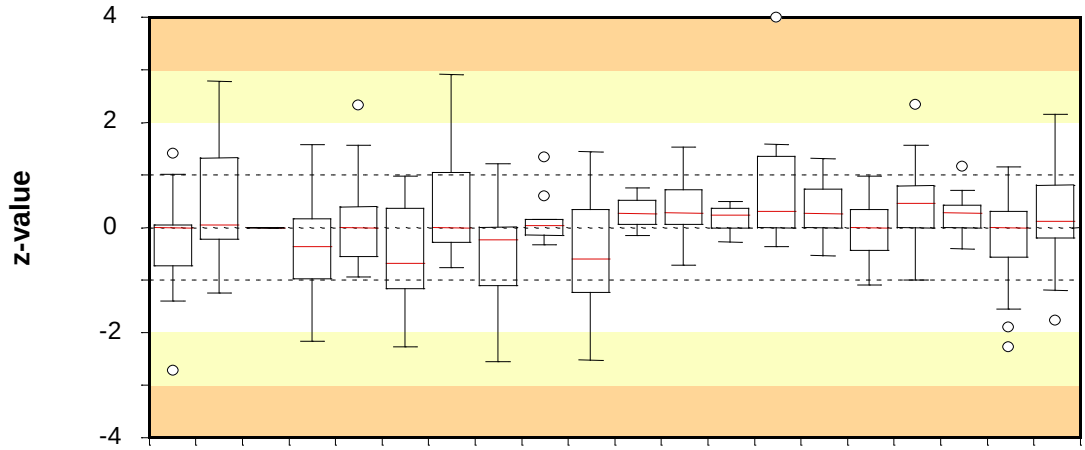
* < [smallest value of the box - 1.5 × (largest value of the box - smallest value of the box)] or > [largest value of the box + 1.5 × (largest value of the box - smallest value of the box)]



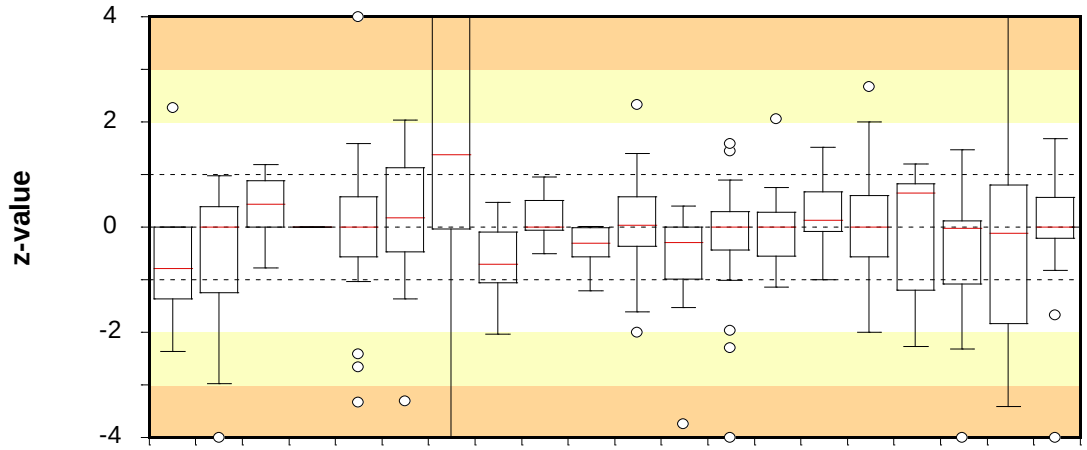
Lab no.	1131	1149	1237	1254	1290	1545	1594	1611	1753	1868	1970	2050	2386	2637	2670	2704	2745	3042	3055	3076
No. of results	15	3	12	24	17	18	24	23	24	15	17	24	18	15	-	21	9	23	3	9
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	-	1	-	-	1	-	-	-	1	-	-	-	-	-	3	-	-



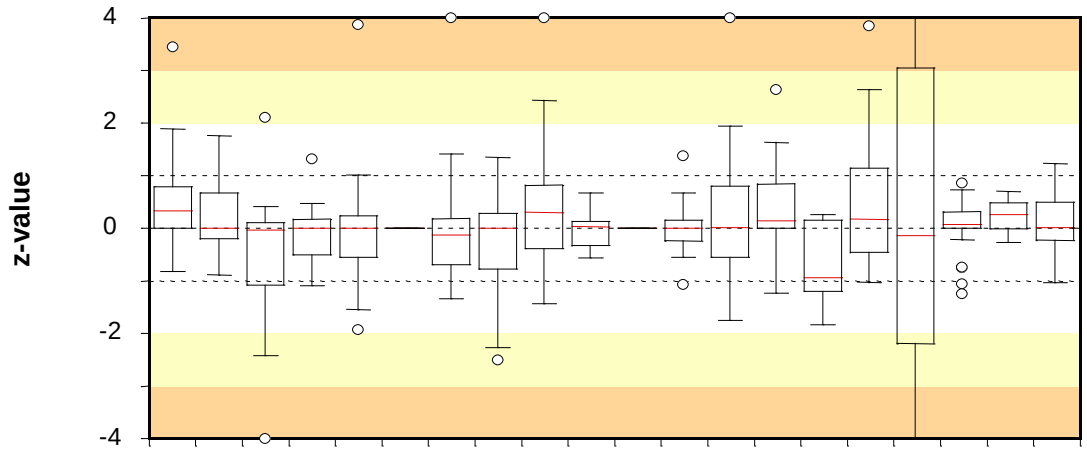
Lab no.	3159	3162	3305	3339	3475	3511	3533	3588	3730	4015	4064	4180	4278	4288	4319	4339	4343	4356	4539	4633
No. of results	21	23	24	18	-	15	-	18	3	17	14	16	5	3	20	24	24	24	18	21
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-	-	1	1	1	1	3	-	-	-	-	-	-
Low outliers	-	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	1	-	-	-
High outliers	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-



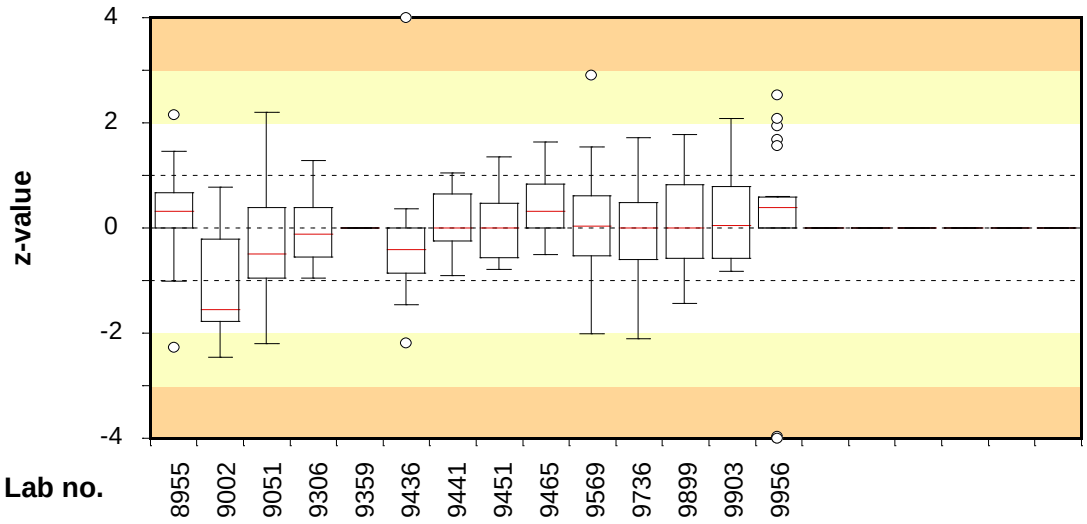
Lab no.	4713	4723	4889	4980	5018	5094	5120	5197	5201	5220	5352	5447	5553	5893	5950	6180	6233	6253	6456	6563
No. of results	21	12	-	20	23	12	24	14	9	12	3	15	3	9	24	24	18	9	21	24
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-



Lab no.	6731	6852	7096	7191	7248	7282	7302	7330	7442	7564	7596	7626	7688	7728	7876	7896	7906	7930	7946	7962
No. of results	8	9	18	-	24	15	18	15	15	6	24	24	23	18	24	18	6	24	22	22
False positive	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	2	-
False negative	-	-	-	-	-	-	3	-	-	-	-	-	1	-	-	-	-	-	-	-
Low outliers	-	1	-	-	-	-	2	-	-	-	-	1	1	-	-	-	-	1	-	1
High outliers	-	-	-	-	1	-	7	-	-	-	-	-	-	-	-	-	-	-	2	-



Lab no.	7968	8068	8177	8255	8260	8329	8380	8428	8435	8569	8598	8626	8628	8663	8742	8766	8809	8862	8891	8898
No. of results	24	23	20	23	9	-	24	14	18	9	-	9	18	24	6	23	14	23	3	24
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
False negative	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-
Low outliers	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
High outliers	-	-	-	-	1	-	1	-	2	-	-	-	1	-	-	1	2	-	-	-



No. of results	24	11	18	12	-	24	12	18	24	24	23	24	18	24
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Low outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	3
High outliers	-	-	-	-	-	1	-	-	-	-	-	-	-	-

References

1. Anonymous 1998. Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption. Official Journal of the European Communities. 5.12.98, L 330/32-54 *(there are national translations).*
2. Peterz, M., Steneryd, A.-C. 1993. Freeze-dried mixed cultures as reference samples in quantitative and qualitative microbiological examinations of food. J. Appl. Bacteriol. 74:143-148.
3. Anonymous 2012. Proficiency Testing Schemes, Protocol, Microbiology, Drinking water & Food. National Food Administration, Uppsala, 26 p.
4. Kelly, K. 1990. Outlier detection in collaborative studies. J. Assoc. Off. Chem. 73:58-64.
5. Niemi, R. M., Mentu, J., Siitonen, A., Niemelä, S. I. 2003 Confirmation of *Escherichia coli* and its distinction from *Klebsiella* species by gas and indole formation at 44 and 44,5 °C. Journal of Applied Microbiology 95, 1242-1249.

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*** *in a row indicate that the samples probably are mixed up. False positive and false negative values are excluded, as well as other outliers, in*

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
1131	2 1 3	200	63	727	200	63	727	-	-	-	0	34	264	185	66	1120	0	39	0
1149	3 2 1	184	35	620	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1237	2 3 1	-	-	-	210	67	350	-	-	-	-	-	-	201	44	501	-	-	-
1254	2 3 1	-	-	-	130	51	680	-	-	-	0	26	210	210	54	660	<1	26	<1
1290	2 3 1	-	-	-	185	10	390	-	-	-	<1	8	390	-	-	-	-	-	-
1545	1 2 3	360	42	810	360	42	810	360	11	260	0	11	260	-	-	-	-	-	-
1594	2 1 3	290	41	860	290	41	860	0	14	190	0	25	240	290	43	870	0	35	0
1611	1 2 3	350	88	500	350	84	400	0	46	190	0	40	200	326	67	784	0	32	0
1753	2 3 1	218	62	836	218	62	836	-	-	-	0	38	282	275	69	876	0	49	0
1868	1 3 2	238	50	784	238	50	784	-	-	-	0	25	236	365	64	982	0	36	0
1970	1 3 2	290	58	750	290	48	750	37	48	170	0	48	**0**	-	-	-	-	-	-
2050	1 3 2	-	-	-	209	61	755	-	-	-	0	35	282	206	81	**1874**	0	39	0
2386	2 1 3	260	69	680	260	69	680	0	62	180	0	35	180	-	-	-	-	-	-
2637	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	345	57	727	<1	33	<1
2670	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2704	3 2 1	-	-	-	210	49	610	-	-	-	0	44	180	222	83	945	<1	45	<1
2745	1 2 3	280	57	650	280	57	650	0	33	250	0	33	250	-	-	-	-	-	-
3042	2 3 1	-	-	-	**>100**	**220**	500	-	-	-	0	**110**	400	200	53	1000	0	31	0
3055	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3076	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3159	3 1 2	-	-	-	210	38	470	-	-	-	0	15	150	178	53,1	831	<1	28,8	<1
3162	1 2 3	270	50	600	270	50	600	-	-	-	0	27	**0**	308	73	816	0	35	0
3305	2 3 1	-	-	-	300	45	600	-	-	-	<1	38	300	340	57	890	<1	27	<1
3339	2 3 1	100	70	650	100	70	650	-	-	-	0	30	190	-	-	-	-	-	-
3475	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3511	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	288	78	831	0	43	0
3533	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3588	3 1 2	270	71	830	270	71	830	0	34	132	0	17	132	-	-	-	-	-	-
3730	2 3 1	100	45	600	-	-	-	0	23	440	-	-	-	-	-	-	-	-	-
4015	2 1 3	243	61	773	243	61	773	85	50	291	0	32	196	344	59	866	0	27	0
4064	3 1 2	262	47	775	262	47	775	-	-	-	0	38	**775**	-	-	-	-	-	-
4180	3 1 2	-	-	-	220	47	762	-	-	-	0	-	117	-	-	-	-	-	-
4278	3 1 2	-	-	-	**0**	**2**	**66**	-	-	-	-	-	-	-	-	-	-	-	-
4288	1 2 3	<1	<1	<1	**<1**	**<1**	**<1**	-	-	-	-	-	-	-	-	-	-	-	-
4319	1 3 2	273	57	665	263	57	665	0	54	240	0	34	140	345	70	734	0	43	**220**
4339	1 2 3	-	-	-	200	75	809	<1	51	250	<1	32	270	260	78	726	<1	38	<1
4343	1 2 3	297	45	640	297	45	640	-	-	-	0	28	**37**	248	49	517	0	36	0
4356	1 3 2	280	55	750	280	55	750	0	43	200	0	28	180	220	49	870	<1	31	<1
4539	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	280	52	855	0	29	0
4633	1 3 2	-	-	-	182	55	516	0	25	130	0	25	130	270	75	583	0	35	0
4713	3 1 2	130	52	590	130	52	590	<1	15	220	<1	21	240	210	56	740	<1	36	<1
4723	2 1 3	545	35	703	545	35	703	30	2	145	0	26	215	-	-	-	-	-	-
4889	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4980	1 3 2	-	-	-	-	-	-	0	24	160	0	24	160	344	83,1	624	<1	50,4	<1
5018	1 2 3	320	64	560	320	64	560	-	-	-	0	26	**0**	411	69	649	0	32	0
5094	2 3 1	330	37	800	330	37	800	0	24	200	0	18	200	-	-	-	-	-	-
5120	3 2 1	180	45	670	180	45	670	110	58	330	0	27	210	214	93	770	0	64	0
5197	1 3 2	-	-	-	-	-	-	-	-	-	0	18	180	-	-	-	-	-	-
5201	1 2 3	225	49	665	225	49	665	-	-	-	0	49	220	-	-	-	-	-	-
5220	3 2 1	-	-	-	-	-	-	-	-	-	0	20	180	-	-	-	-	-	-
5352	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5447	2 1 3	-	-	-	191	68	827	-	-	-	0	35	331	-	-	-	-	-	-
5553	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5893	3 2 1	-	-	-	-	-	-	-	-	-	<1	34	**760**	-	-	-	-	-	-
5950	2 3 1	270	49	845	270	49	845	21	48	196	0	29	260	251	70	689	0	38	0
6180	1 3 2	290	73	780	290	73	780	0	48	230	0	38	152	248	59	950	<1	32	<1
6233	1 2 3	-	-	-	-	-	-	0	45	240	-	-	-	290	69	1230	0	34	0
6253	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	300	71	710	0	40	0
6456	3 1 2	-	-	-	245	48	765	-	-	-	0	26	195	158	62	831	0	32	0
6563	2 1 3	182	66	760	182	66	760	182	66	760	0	33	380	164	84	722	0	45	0
6731	3 2 1	-	-	-	-	-	-	-	-	-	-	-	-	**>1**	**>1**	**>1**	0	**>1**	0
6852	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	280	**13**	350	<1	27	<1
7096	2 3 1	-	-	-	240	65	840	-	-	-	0	35	170	-	-	-	-	-	-
7191	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7248	1 2 3	305	38	741	305	38	741	0	3	88	0	3	88	225	76,9	935,2	0	50,5	0
7282	2 3 1	-	-	-	-	-	-	-	-	-	0	18	160	-	-	-	-	-	-
7302	~~2~~ ~~3~~ 1	60	200	900	60	**200**	810	-	-	-	**35**	**0**	216	**66**	**292**	631	**40**	**0**	0
7330	3 1 2	-	-	-	-	-	-	-	-	-	0	22	169	-	-	-	-	-	-
Mean		**238**	**54**	**663**	**237**	**55**	**690**	**16**	**35**	**220**	**0**	**30**	**218**	**257**	**65**	**777**	**0**	**36**	**0**
CV (%)		38	23	18	19	16	11	153	29	23	-	21	15	11	10	11	-	11	-

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-values 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.
$z = (x - mv) / s$. $u_{rel,mv}$ is the relative standard uncertainty of mv in per cent. For calculation see the scheme protocol (3); also briefly described in the text.
** The 9 zero results for E. coli (MF) in sample C are considered to be correct and not false negative, even though they are marked.*

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				
-	-	-	-	-	-	-	-	-	-	-	-	31	1	9	-	-	-	**1131**
-	-	-	-	-	-	-	-	-	-	-	-	33	3	13	-	-	-	**1149**
-	-	-	-	-	-	-	-	-	-	-	-	31	2	9	27	**38**	10	**1237**
-	-	-	670	68	30	-	-	-	55	0	42	38	2	27	33	75	10	**1254**
-	-	-	525	62	71	-	-	-	66	<1	**<1**	35	**30**	15	35	103	11	**1290**
690	54	67	690	54	67	59	0	31	59	0	31	45	2	22	44	75	11	**1545**
600	62	88	600	62	84	50	0	26	50	0	26	46	3	23	48	76	11	**1594**
560	52	116	**0**	52	116	400	0	36	**400**	0	36	60	2	16	40	73	4	**1611**
773	55	90	773	55	85	90	0	33	90	0	33	31	0	13	41	53	6	**1753**
445	55	88	-	-	-	-	-	-	-	-	-	33	2	28	-	-	-	**1868**
460	51	23	460	51	23	150	0	29	150	0	29	30	3	35	39	73	6	**1970**
-	-	-	600	55	12	-	-	-	118	0	18	43	2	32	47	95	7	**2050**
620	52	91	620	52	14	100	0	21	100	0	21	49	5	21	31	57	10	**2386**
-	-	-	640	55	27	-	-	-	-	-	-	42	<1	16	30	66	5	**2637**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2670**
-	-	-	490	65	6	-	-	-	-	-	-	45	0	7	45	79	11	**2704**
-	-	-	-	-	-	-	-	-	-	-	-	42	1	13	-	-	-	**2745**
-	-	-	630	55	84	-	-	-	**1000**	0	15	49	2	17	43	77	10	**3042**
-	-	-	-	-	-	-	-	-	-	-	-	43	1	26	-	-	-	**3055**
-	-	-	-	-	-	50	0	14	50	0	14	42	2	17	40	81	9	**3076**
-	-	-	660	58	7	-	-	-	-	-	-	34	5	26	38	66	9	**3159**
530	70	70	530	40	70	80	0	34	80	0	37	41	2	26	45	98	11	**3162**
600	65	100	600	65	100	34	<1	13	34	<1	13	35	1	24	30	65	11	**3305**
600	58	83	600	58	83	60	0	22	60	0	22	39	2	22	42	98	7	**3339**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3475**
-	-	-	350	49	79	-	-	-	-	-	-	31	2	30	29	79	9	**3511**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3533**
540	54	97	540	54	79	71	0	14	71	0	14	45	3	22	39	86	5	**3588**
-	-	-	-	-	-	-	-	-	-	-	-	**129**	3	19	-	-	-	**3730**
132	115	0	**83**	59	**0**	-	-	-	-	-	-	40	3	15	-	-	-	**4015**
480	47	7	480	**0**	7	-	-	-	-	-	-	34	2	17	34	56	8	**4064**
-	-	-	440	56	79	-	-	-	38	0	**0**	39	2	11	30	79	8	**4180**
-	-	-	-	-	-	-	-	-	-	-	-	42	3	13	-	-	-	**4278**
-	-	-	-	-	-	-	-	-	-	-	-	24	1	20	-	-	-	**4288**
545	77	29	540	77	15	-	-	-	-	-	-	17	2	34	38	81	10	**4319**
-	-	-	640	63	40	50	<1	27	50	<1	27	35	4	19	35	67	7	**4339**
613	98	86	613	60	19	72	0	21	72	0	21	52	2	33	39	74	6	**4343**
630	56	93	630	56	93	100	0	37	100	0	37	38	3	20	28	74	7	**4356**
453	55	73	453	54	45	800	0	20	90	0	20	38	9	22	41	72	10	**4539**
-	-	-	500	64	76	-	-	-	-	-	-	35	2	24	32	90	11	**4633**
570	47	88	570	47	61	110	<1	20	110	<1	5	46	2	28	-	-	-	**4713**
555	118	118	555	55	118	-	-	-	-	-	-	49	2	44	-	-	-	**4723**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4889**
600	64	80	600	64	8	38	0	0	38	0	**0**	30	1	15	29	60	8	**4980**
530	51	136	530	51	36	75	0	24	75	0	24	44	1	15	50	78	11	**5018**
600	45	91	-	-	-	50	0	200	-	-	-	46	0	12	33	68	5	**5094**
500	78	95	500	78	95	59	0	38	59	0	34	39	1	34	46	74	15	**5120**
-	-	-	**0**	70	51	-	-	-	59	0	29	38	0	25	22	73	5	**5197**
-	-	-	-	-	-	-	-	-	-	-	-	43	2	21	-	-	-	**5201**
-	-	-	720	53	80	-	-	-	-	-	-	20	2	10	32	82	3	**5220**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	79	11	**5352**
-	-	-	673	56	83	-	-	-	-	-	-	44	2	22	39	67	9	**5447**
-	-	-	540	63	68	-	-	-	-	-	-	-	-	-	-	-	-	**5553**
-	-	-	530	70	65	-	-	-	-	-	-	-	-	-	37	93	14	**5893**
600	57	93	600	57	93	100	0	35	100	0	35	40	2	22	48	91	10	**5950**
590	110	105	590	55	41	56	0	18	56	0	18	39	2	20	35	73	10	**6180**
630	58	93	630	58	93	43	0	28	43	0	28	42	5	20	44	87	10	**6233**
500	59	100	-	-	-	-	-	-	-	-	-	36	4	22	-	-	-	**6253**
-	-	-	570	45	80	-	-	-	-	-	-	48	0	27	44	59	7	**6456**
560	48	57	560	48	30	70	0	26	70	0	26	50	2	36	55	65	9	**6563**
-	-	-	-	-	-	-	-	-	-	-	-	30	1	12	28	106	3	**6731**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	88	10	**6852**
-	-	-	640	63	94	-	-	-	100	0	21	40	3	16	47	87	8	**7096**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**7191**
331	59	64	331	59	64	75	0	28	75	0	28	37	**55**	18	43	65	7	**7248**
-	-	-	740	32	83	-	-	-	130	0	25	40	2	29	54	90	5	**7282**
50	560	130	**50**	**560**	130	0	**64**	29	**0**	**64**	29	54	**153**	**573**	**140**	90	**196**	**7302**
465	58	77	465	58	77	42	0	22	42	0	22	23	1	9	32	59	7	**7330**
486	**69**	**77**	**566**	**58**	**59**	**134**	**0**	**26**	**67**	**0**	**23**	**38**	**2**	**20**	**38**	**76**	**9**	**Mean**
22	28	26	9	8	29	92	-	34	20	-	20	11	44	18	9	8	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
7442	3 2 1	194	49	835	194	49	835	-	-	-	0	27	213	277	72	768	0	42	0
7564	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7596	3 2 1	153	53	700	153	30	700	0	18	260	0	18	260	345	48	816	0	22	0
7626	2 1 3	22	52	560	**22**	52	560	0	52	200	0	31	200	200	56	590	0	34	0
7688	2 3 1	-	-	-	78	62	649	-	-	-	0	33	170	261	65	1046	0	35	0
7728	3 2 1	-	-	-	210	61	695	-	-	-	0	61	170	-	-	-	-	-	-
7876	2 1 3	245	52	745	245	52	745	-	-	-	<1	52	180	261,3	55,6	920,8	<1	41,3	<1
7896	1 2 3	-	-	-	210	60	430	<1	45	280	<1	60	430	-	-	-	-	-	-
7906	3 2 1	173	18	309	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7930	1 3 2	130	61	770	130	61	700	-	-	-	0	31	210	222	43	430	0	25	0
7946	3 1 2	450	107	450	250	107	450	142	27	470	0	26	167	**1600**	35	920	0	35	**161**
7962	1 3 2	170	65	690	170	65	690	0	30	24	0	46	**0**	276	64	517	0	39	0
7968	3 2 1	335	71	705	335	71	705	198	60	219	0	37	215	211	72	766	0	32	0
8068	1 3 2	200	45	970	200	45	970	210	17	148	0	30	**0**	249	69	921	0	40	0
8177	1 2 3	270	62	120	270	62	**120**	-	-	-	0	62	**0**	270	66	620	0	36	0
8255	3 1 2	-	-	-	150	57	720	0	39	194	0	21	**0**	340	61	730	0	31	0
8260	1 3 2	700	49	439	**700**	49	439	<1	35	234	<1	14	234	-	-	-	-	-	-
8329	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8380	1 3 2	190	50	600	190	50	600	<1	32	160	<1	32	160	210	50	770	<1	28	<1
8428	1 3 2	-	-	-	-	-	-	-	-	-	0	38	190	-	-	-	-	-	-
8435	3 2 1	500	48	800	500	48	800	0	33	174	0	33	**800**	-	-	-	-	-	-
8569	1 3 2	240	49	790	240	49	790	0	52	220	0	25	220	-	-	-	-	-	-
8598	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8626	3 1 2	152	54	790	152	54	790	0	49	318	0	32	318	-	-	-	-	-	-
8628	3 2 1	-	-	-	400	38	1000	-	-	-	<1	27	**1000**	-	-	-	-	-	-
8663	1 3 2	250	66	730	250	66	730	0	76	190	0	40	290	190	89	950	0	45	0
8742	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8766	2 1 3	291	58	600	291	58	600	-	-	-	<1	44	**<1**	218	94	917	<1	61	<1
8809	1 2 3	1980	100	650	580	100	650	-	-	-	0	**100**	240	-	-	-	-	-	-
8862	3 1 2	175	61	799	175	61	799	-	-	-	<1	32	236	199	66	805	<1	37	**4**
8891	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8898	2 1 3	250	55	823	250	55	823	-	-	-	0	29	232	200	61	689	0	29	0
8955	2 1 3	-	-	-	270	73	770	-	-	-	0	51	310	280	77	730	0	39	0
9002	2 1 3	120	44	460	120	20	460	-	-	-	0	24	**0**	-	-	-	-	-	-
9051	1 3 2	409	100	536	409	100	536	409	28	245	0	20	245	-	-	-	-	-	-
9306	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	204	74	1013	0	32	0
9359	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9436	2 1 3	245	32	645	245	32	645	<1	11	191	<1	23	191	261	60	770	<1	30	<1
9441	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	207	62	738	<1	41	<1
9451	3 1 2	300	64	900	300	60	900	52	22	180	0	22	180	-	-	-	-	-	-
9465	1 2 3	246	46	664	246	46	664	-	-	-	0	32	238	308	70	770	<1	42	<1
9569	2 1 3	163	77	620	163	77	620	-	-	-	<1	77	130	330	75	1046	<1	50	<1
9736	2 3 1	0	24	649	**0**	24	649	-	-	-	0	24	216	277	83	665	0	24	0
9899	3 2 1	212	48	865	212	48	865	103	63	222	0	28	351	185	89	566	0	49	0
9903	3 2 1	197	45	1025	197	45	1025	185	28	273	0	21	273	-	-	-	-	-	-
9956	3 1 2	-	-	-	290	108	**90**	190	74	254	<1	59	**35**	365	71	867	<1	38	<1
n		61	61	61	79	80	80	43	43	43	84	83	84	61	61	61	61	60	61
Min		0	0	0	0	0	0	0	2	24	0	0	0	66	13	350	0	0	0
Max		1980	200	1025	700	220	1025	409	76	760	35	110	1000	1600	292	1874	40	64	220
Median		245	52	703	241,5	54,5	704	0	35	219	0	30	213	261	66	770	0	36	0
Mean		**238**	**54**	**663**	**237**	**55**	**690**	**16**	**35**	**220**	**0**	**30**	**218**	**257**	**65**	**777**	**0**	**36**	**0**
CV (%)		38	23	18	19	16	11	153	29	23	-	21	15	11	10	11	-	11	-
False positive		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	3
False negative		0	0	0	3	1	1	0	0	0	0	1	0*	0	0	0	0	1	0
Outliers, low		0	0	0	1	1	3	0	0	0	0	0	2	1	1	0	0	0	0
Outliers, high		0	0	0	1	2	0	0	0	0	0	2	4	1	1	1	0	0	0
Low limit OK		0	0	0	60	10	350	0	2	24	0	3	88	158	35	350	0	22	0
High limit OK		1980	200	1025	580	108	1025	409	76	760	0	77	430	411	94	1230	0	64	0
mv *(√Mean)*		15,432	7,364	25,750	15,386	7,388	26,261	4,041	5,897	14,839	0,000	5,488	14,761	16,027	8,084	27,868	0,000	6,036	0,000
s *(CV*mv/100)*		5,826	1,688	4,666	2,859	1,186	2,758	6,195	1,708	3,379	0,000	1,130	2,235	1,823	0,822	3,075	0,000	0,673	0,000
$u_{rel,mv}$ (%) *(100*s/ √n_{mv})*		4,8	2,9	2,3	2,2	1,8	1,2	23,4	4,4	3,5		2,3	1,7	1,5	1,3	1,4		1,5	
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				
505	42	132	-	-	-	-	-	-	-	-	-	41	3	24	-	-	-	**7442**
-	-	-	-	-	-	-	-	-	-	-	-	38	1	12	38	75	7	**7564**
530	55	75	530	55	75	58	0	26	58	0	26	41	4	31	42	85	17	**7596**
600	53	65	600	53	65	2600	0	12	40	0	12	35	1	20	41	58	8	**7626**
-	-	-	**220**	60	**0**	-	-	-	25	0	27	30	2	27	34	80	14	**7688**
-	-	-	595	56	73	-	-	-	66	0	14	39	1	16	39	69	11	**7728**
470	67	95	470	67	95	75	<1	25	75	<1	25	34	2	17	45	82	11	**7876**
-	-	-	710	64	79	-	-	-	52	<1	10	35	3	16	38	75	6	**7896**
-	-	-	-	-	-	-	-	-	-	-	-	45	0	24	30	91	11	**7906**
400	53	89	**12**	53	89	66	0	29	66	0	29	51	2	12	34	82	6	**7930**
560	53	85	560	53	85	26	**1**	7	26	**1**	7	15	**25**	10	51	45	15	**7946**
63	65	94	**63**	65	43	110	0	20	110	0	-	53	5	24	34	73	8	**7962**
965	77	66	965	77	66	81	0	24	81	0	24	45	3	20	48	82	11	**7968**
620	66	84	620	66	53	56	0	39	56	0	39	31	1	31	45	82	8	**8068**
510	53	73	519	53	5	-	-	-	-	-	-	28	2	20	30	59	7	**8177**
-	-	-	610	58	77	-	-	-	50	0	23	31	2	18	32	78	10	**8255**
-	-	-	-	-	-	-	-	-	-	-	-	38	1	28	-	-	-	**8260**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**8329**
440	72	68	440	72	68	1300	<1	17	**990**	<1	17	34	4	26	40	73	7	**8380**
-	-	-	710	**0**	48	-	-	-	48	0	15	38	0	22	40	48	10	**8428**
450	62	150	450	62	150	3100	0	12	**3100**	0	12	45	3	24	36	71	6	**8435**
-	-	-	-	-	-	-	-	-	-	-	-	39	2	16	-	-	-	**8569**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**8598**
-	-	-	-	-	-	-	-	-	-	-	-	36	1	20	-	-	-	**8626**
-	-	-	640	68	80	-	-	-	50	<1	10	44	1	20	44	73	6	**8628**
510	89	94	510	85	60	100	0	23	100	0	23	40	1	25	35	77	9	**8663**
-	-	-	-	-	-	-	-	-	-	-	-	40	2	15	30	62	4	**8742**
468	55	77	468	55	66	126	<1	33	126	<1	33	49	1	16	48	**130**	7	**8766**
2	52	0	**1**	46	**0**	-	-	-	-	-	-	22	**92**	2	30	**3**	23	**8809**
673	115	109	590	61	82	38	<1	32	38	<1	32	32	3	20	43	76	8	**8862**
-	-	-	-	-	-	-	-	-	-	-	-	40	3	18	-	-	-	**8891**
595	109	94	595	55	94	86	0	29	86	0	29	36	2	30	42	73	10	**8898**
-	-	-	600	66	71	-	-	-	56	0	24	30	0	21	55	81	7	**8955**
400	45	60	400	45	53	-	-	-	-	-	-	36	0	26	-	-	-	**9002**
491	89	75	491	62	32	39	0	20	39	0	20	33	4	12	24	71	6	**9051**
-	-	-	-	-	-	-	-	-	-	-	-	36	1	21	35	92	7	**9306**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**9359**
482	40	74	482	40	73	1118	<1	21	**236**	<1	21	34	1	12	31	65	7	**9436**
-	-	-	-	-	-	-	-	-	-	-	-	47	2	18	45	73	11	**9441**
490	61	110	490	61	110	80	0	24	80	0	20	32	1	22	38	92	7	**9451**
664	67	83	664	67	81	78	0	41	78	0	41	45	3	27	38	89	9	**9465**
450	59	71	440	59	10	35	<1	23	35	<1	23	41	1	24	40	78	10	**9569**
518	67	94	518	67	66	85	0	42	85	0	42	28	3	13	44	60	8	**9736**
653	99	94	653	57	48	48	0	16	48	0	16	27	3	20	30	86	14	**9899**
572	106	80	572	51	41	91	0	38	91	0	38	47	3	21	33	76	10	**9903**
149	79	66	**149**	79	66	80	<1	24	80	<1	24	43	5	22	42	80	10	**9956**
58	58	58	80	80	80	50	50	50	64	64	63	102	102	102	86	86	86	**n**
2	40	0	0	0	0	0	0	0	0	0	0	15	0	2	22	3	3	**Min**
965	560	150	965	560	150	3100	64	200	3100	64	42	129	153	573	140	130	196	**Max**
530	59	87	572	58	70	75	0	24,5	66	0	24	39	2	20	39	76	9	**Median**
486	**69**	**77**	**566**	**58**	**59**	**134**	**0**	**26**	**67**	**0**	**23**	**38**	**2**	**20**	**38**	**76**	**9**	**Mean**
22	28	26	9	8	29	92	-	34	20	-	20	11	44	18	9	8	17	**CV (%)**
0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	**False pos.**
0	0	0	2	2	3	0	0	0	1	0	3	0	0	0	0	0	0	**False neg.**
0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	2	0	**Outliers <**
0	0	0	0	1	0	0	0	0	5	0	0	1	5	1	1	1	1	**Outliers >**
2	40	0	331	32	5	0	0	0	25	0	5	15	0	2	22	45	3	**Low limit**
965	560	150	965	85	150	3100	0	200	150	0	42	60	9	44	55	106	23	**High limit**
22,052	8,328	8,801	23,795	7,638	7,709	11,596	0,000	5,060	8,184	0,000	4,834	6,153	1,321	4,459	6,168	8,694	2,933	**mv**
4,917	2,354	2,263	2,105	0,600	2,261	10,725	0,000	1,708	1,625	0,000	0,957	0,669	0,583	0,821	0,578	0,704	0,510	**s**
2,9	3,7	3,4	1,0	0,9	3,3	13,1		4,8	2,6		2,6	1,1	4,5	1,8	1,0	0,9	1,9	**$u_{rel,mv}$ (%)**
																		x
																		z

Annex B *Z-values calculated from the laboratory results. Susp. = Suspected on the membrane filters before confirmation. z = (x - mv) / s. Z-values are calculated also for outliers (excluding false negative results) in the same way as ordinary z-values. From false*

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
1131	2 1 3				-0,435	0,463	0,255				0,000	0,304	0,665	-1,330	0,049	1,820	0,000	0,310	0,000
1149	3 2 1											*							
1237	2 3 1				-0,313	0,672	**-2,738**							-1,014	-1,764	-1,784			
1254	2 3 1				-1,394	-0,208	-0,067				0,000	-0,344	-0,121	-0,842	-0,894	-0,708	0,000	-1,392	0,000
1290	2 3 1				-0,624	**-3,562**	**-2,361**				0,000	**-2,354**	**2,231**						
1545	1 2 3				1,255	-0,765	0,798				0,000	-1,921	0,610						
1594	2 1 3				0,575	-0,830	1,111				0,000	-0,432	0,327	0,550	-1,856	0,529	0,000	-0,178	0,000
1611	1 2 3				1,162	1,498	**-2,270**				0,000	0,741	-0,277	1,113	0,124	0,043	0,000	-0,564	0,000
1753	2 3 1				-0,217	0,410	0,962				0,000	0,599	0,909	0,305	0,271	0,562	0,000	1,432	0,000
1868	1 3 2				0,014	-0,267	0,631				0,000	-0,432	0,269	1,689	-0,102	1,128	0,000	-0,054	0,000
1970	1 3 2				0,575	-0,388	0,408				0,000	1,275							
2050	1 3 2				-0,325	0,356	0,441				0,000	0,379	0,909	-0,918	1,114	**4,000**	0,000	0,310	0,000
2386	2 1 3				0,258	0,774	-0,067				0,000	0,379	-0,602						
2637	3 1 2													1,397	-0,649	-0,294	0,000	-0,433	0,000
2670	2 3 1																		
2704	3 2 1				-0,313	-0,327	-0,567				0,000	1,014	-0,602	-0,618	1,249	0,934	0,000	0,998	0,000
2745	1 2 3				0,471	0,136	-0,278				0,000	0,227	0,470						
3042	2 3 1					**4,000**	-1,414				0,000	**4,000**	**2,344**	-1,034	-0,977	1,221	0,000	-0,696	0,000
3055	2 3 1																		
3076	2 1 3																		
3159	3 1 2				-0,313	-1,031	-1,661				0,000	-1,429	-1,124	-1,473	-0,969	0,312	0,000	-0,995	0,000
3162	1 2 3				0,366	-0,267	-0,640				0,000	-0,258		0,836	0,560	0,227	0,000	-0,178	0,000
3305	2 3 1				0,677	-0,573	-0,640				0,000	0,599	1,145	1,323	-0,649	0,639	0,000	-1,248	0,000
3339	2 3 1				-1,884	0,825	-0,278				0,000	-0,009	-0,437						
3475	1 2 3																		
3511	2 1 3													0,518	0,910	0,312	0,000	0,774	0,000
3533	2 1 3																		
3588	3 1 2				0,366	0,875	0,924				0,000	-1,208	-1,464						
3730	2 3 1																		
4015	2 1 3				0,071	0,356	0,559				0,000	0,150	-0,340	1,383	-0,490	0,507	0,000	-1,248	0,000
4064	3 1 2				0,280	-0,449	0,572				0,000	0,599	**4,000**						
4180	3 1 2				-0,194	-0,449	0,487				0,000		-1,765						
4278	3 1 2					**-4,000**	**-4,000**												
4288	1 2 3																		
4319	1 3 2				0,291	0,136	-0,172				0,000	0,304	-1,310	1,397	0,344	-0,252	0,000	0,774	
4339	1 2 3				-0,435	1,072	0,791				0,000	0,150	0,747	0,054	0,910	-0,300	0,000	0,190	0,000
4343	1 2 3				0,646	-0,573	-0,349				0,000	-0,174	**-3,882**	-0,153	-1,318	-1,668	0,000	-0,054	0,000
4356	1 3 2				0,471	0,024	0,408				0,000	-0,174	-0,602	-0,655	-1,318	0,529	0,000	-0,696	0,000
4539	1 3 2													0,388	-1,061	0,446	0,000	-0,967	0,000
4633	1 3 2				-0,663	0,024	-1,285				0,000	-0,432	-1,503	0,222	0,701	-1,211	0,000	-0,178	0,000
4713	3 1 2				-1,394	-0,149	-0,715				0,000	-0,801	0,327	-0,842	-0,730	-0,216	0,000	-0,054	0,000
4723	2 1 3				**2,784**	-1,241	0,092				0,000	-0,344	-0,044						
4889	2 1 3																		
4980	1 3 2										0,000	-0,521	-0,945	1,383	1,255	-0,939	0,000	1,579	0,000
5018	1 2 3				0,875	0,516	-0,941				0,000	-0,344		**2,329**	0,271	-0,778	0,000	-0,564	0,000
5094	2 3 1				0,972	-1,100	0,734				0,000	-1,102	-0,277						
5120	3 2 1				-0,689	-0,573	-0,137				0,000	-0,258	-0,121	-0,767	1,897	-0,039	0,000	**2,917**	0,000
5197	1 3 2										0,000	-1,102	-0,602						
5201	1 2 3				-0,135	-0,327	-0,172				0,000	1,339	0,032						
5220	3 2 1										0,000	-0,899	-0,602						
5352	2 1 3																		
5447	2 1 3				-0,548	0,723	0,905				0,000	0,379	1,536						
5553	3 1 2																		
5893	3 2 1										0,000	0,304	**4,000**						
5950	2 3 1				0,366	-0,327	1,018				0,000	-0,091	0,610	-0,101	0,344	-0,527	0,000	0,190	0,000
6180	1 3 2				0,575	0,974	0,605				0,000	0,599	-1,088	-0,153	-0,490	0,961	0,000	-0,564	0,000
6233	1 2 3													0,550	0,271	**2,342**	0,000	-0,305	0,000
6253	1 2 3													0,710	0,416	-0,397	0,000	0,428	0,000
6456	3 1 2				0,093	-0,388	0,507				0,000	-0,344	-0,356	-1,896	-0,255	0,312	0,000	-0,564	0,000
6563	2 1 3				-0,663	0,620	0,474				0,000	0,227	**2,117**	-1,767	1,315	-0,325	0,000	0,998	0,000
6731	3 2 1																0,000		0,000
6852	2 3 1													0,388	**-4,000**	**-2,978**	0,000	-1,248	0,000
7096	2 3 1				0,037	0,568	0,987				0,000	0,379	-0,771						
7191	3 1 2																		
7248	1 2 3				0,727	-1,031	0,348				0,000	**-3,324**	**-2,407**	-0,563	0,834	0,882	0,000	1,590	0,000
7282	2 3 1										0,000	-1,102	-0,945						
7302	2 3 1				**-2,673**	**4,000**	0,798						-0,029	**-4,000**	**4,000**	-0,894			0,000
7330	3 1 2										0,000	-0,706	-0,788						
7442	3 2 1				-0,510	-0,327	0,956				0,000	-0,258	-0,075	0,338	0,488	-0,051	0,000	0,660	0,000
7564	1 2 3																		
7596	3 2 1				-1,055	-1,611	0,071				0,000	-1,102	0,610	1,397	-1,405	0,227	0,000	-1,999	0,000
7626	2 1 3				**-3,741**	-0,149	-0,941				0,000	0,071	-0,277	-1,034	-0,730	-1,164	0,000	-0,305	0,000
7688	2 3 1				**-2,293**	0,410	-0,285				0,000	0,227	-0,771	0,071	-0,026	1,455	0,000	-0,178	0,000
7728	3 2 1				-0,313	0,356	0,037				0,000	**2,056**	-0,771						
7876	2 1 3				0,093	-0,149	0,375				0,000	1,525	-0,602	0,076	-0,763	0,805	0,000	0,580	0,000
7896	1 2 3				-0,313	0,302	**-2,003**				0,000	1,999	**2,673**						
7906	3 2 1																		
7930	1 3 2				-1,394	0,356	0,071				0,000	0,071	-0,121	-0,618	-1,856	**-2,319**	0,000	-1,539	0,000
7946	3 1 2				0,149	**2,491**	-1,830				0,000	-0,344	-0,822	**4,000**	**-2,636**	0,801	0,000	-0,178	
7962	1 3 2				-0,821	0,568	0,003				0,000	1,146		0,322	-0,102	-1,668	0,000	0,310	0,000
7968	3 2 1				1,020	0,875	0,106				0,000	0,527	-0,044	-0,823	0,488	-0,062	0,000	-0,564	0,000
8068	1 3 2				-0,435	-0,573	1,771				0,000	-0,009		-0,136	0,271	0,806	0,000	0,428	0,000
8177	1 2 3				0,366	0,410	**-4,000**				0,000	**2,112**		0,222	0,049	-0,965	0,000	-0,054	0,000
8255	3 1 2				-1,098	0,136	0,207				0,000	-0,801		1,323	-0,333	-0,276	0,000	-0,696	0,000

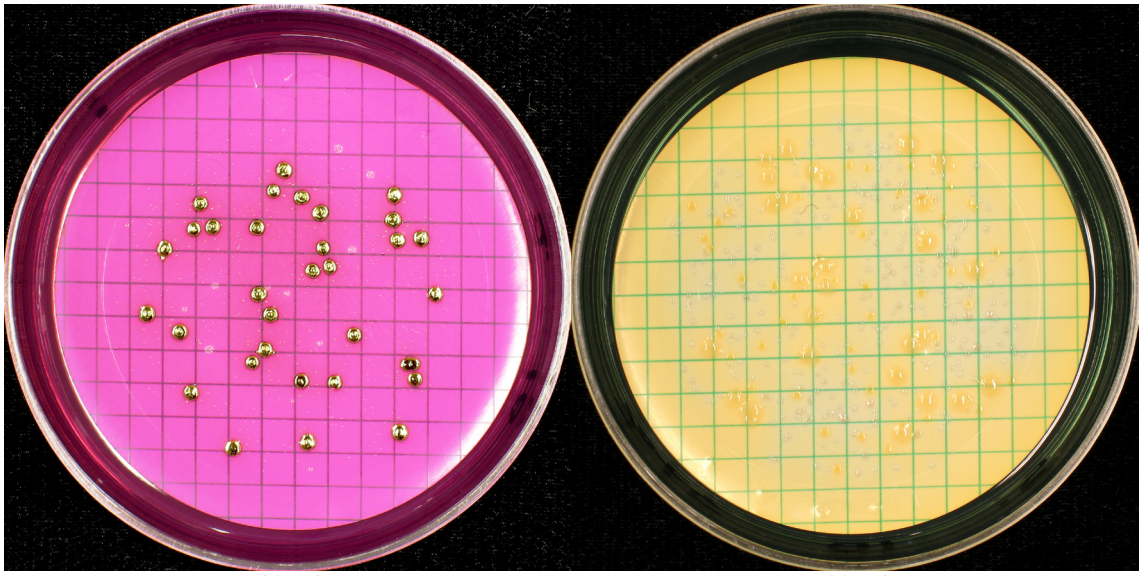
positive results can no z-valurs be calculated. Z-values from outliers are not real z-values but a practical means to express also the results from the outliers. Very low and high values are here limited to –4 and +4, respectively.

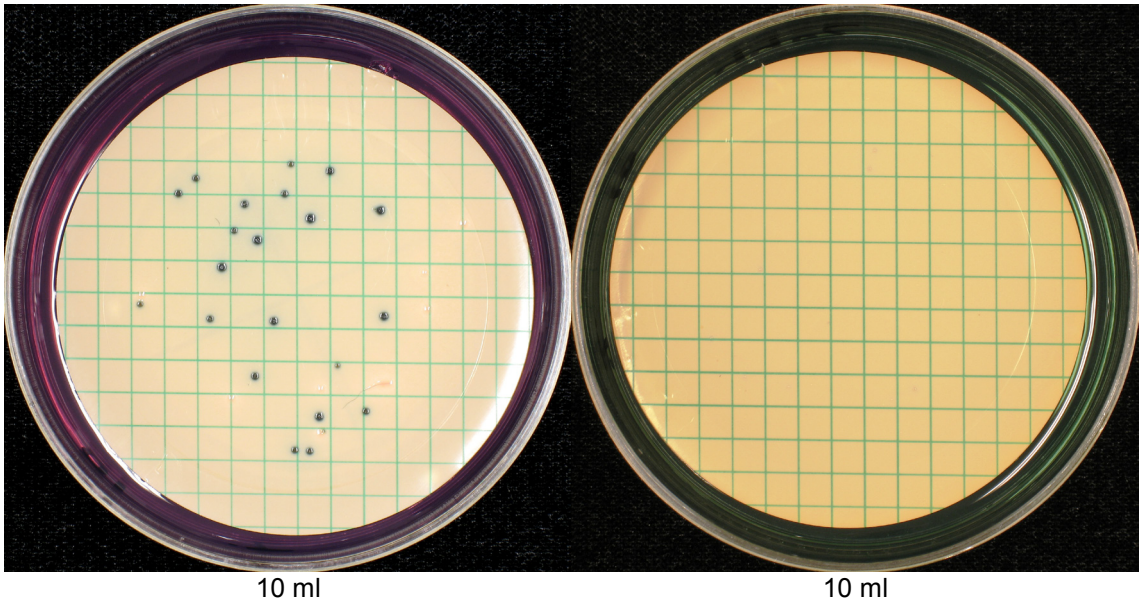
Susp. intestinal enterococci (MF)			Intestinal enterococci (MF)			Susp. *Pseudomonas aeruginosa* (MF)			*Pseudomonas aeruginosa* (MF)			Total plate count 22 °C, 3 days			Total plate count 36±2 °C, 2 days			Lab no.
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
												-0,875	-0,551	-1,777				1131
							*					-0,611	0,704	-1,039				1149
												-0,875	0,159	-1,777	-1,681	**-3,592**	0,450	1237
			0,993	1,014	-0,987				-0,472	0,000	1,721	0,017	0,159	0,897	-0,733	-0,048	0,450	1254
			-0,419	0,394	0,317				-0,037	0,000		-0,355	**4,000**	-0,714	-0,436	**2,067**	0,753	1290
			1,175	-0,482	0,211				-0,309	0,000	0,767	0,829	0,159	0,281	0,805	-0,048	0,753	1545
			0,333	0,394	0,644				-0,685	0,000	0,277	0,940	0,704	0,410	1,315	0,034	0,753	1594
				-0,710	1,354				**4,000**	0,000	1,218	**2,380**	0,159	-0,559	0,271	-0,213	-1,831	1611
			1,904	-0,369	0,668				0,802	0,000	0,952	-0,875	**-2,266**	-1,039	0,406	**-2,008**	-0,949	1753
												-0,611	0,159	1,013				1868
			-1,115	-0,827	-1,288				**2,501**	0,000	0,576	-1,010	0,704	1,773	0,133	-0,213	-0,949	1970
			0,333	-0,369	-1,877				1,649	0,000	-0,618	0,604	0,159	1,458	1,189	1,495	-0,564	2050
			0,525	-0,710	-1,755				1,118	0,000	-0,263	1,265	1,569	0,150	-1,039	-1,625	0,450	2386
			0,714	-0,369	-1,111							0,489	**-2,266**	-0,559	-1,195	-0,809	-1,368	2637
																		2670
			-0,788	0,707	**-2,326**							0,829	**-2,266**	**-2,208**	0,934	0,276	0,753	2704
												0,489	-0,551	-1,039				2745
			0,620	-0,369	0,644				**4,000**	0,000	-1,004	1,265	0,159	-0,409	0,673	0,115	0,450	3042
												0,604	-0,551	0,779				3055
									-0,685	0,000	-1,141	0,489	0,159	-0,409	0,271	0,435	0,132	3076
			0,900	-0,036	**-2,239**							-0,482	1,569	0,779	-0,007	-0,809	0,132	3159
			-0,367	**-2,187**	0,291				0,468	0,000	1,305	0,373	0,159	0,779	0,934	1,712	0,753	3162
			0,333	0,707	1,013				-1,448	0,000	-1,283	-0,355	-0,551	0,535	-1,195	-0,897	0,753	3305
			0,333	-0,036	0,620				-0,269	0,000	-0,150	0,137	0,159	0,281	0,541	1,712	-0,564	3339
																		3475
			-2,416	-1,062	0,521							-0,875	0,159	1,239	-1,354	0,276	0,132	3511
																		3533
			-0,265	-0,482	0,521				0,149	0,000	-1,141	0,829	0,704	0,281	0,133	0,823	-1,368	3588
												4,000	0,704	-0,122				3730
			-4,000	0,073								0,256	0,704	-0,714				4015
			-0,896		**-2,239**							-0,482	0,159	-0,409	-0,583	-1,719	-0,205	4064
			-1,339	-0,257	0,521				-1,243	0,000		0,137	0,159	-1,391	-1,195	0,276	-0,205	4180
												0,489	0,704	-1,039				4278
												-1,875	-0,551	0,016				4288
			-0,265	1,895	-1,696							**-3,034**	0,159	1,670	-0,007	0,435	0,450	4319
			0,714	0,499	-0,612				-0,685	0,000	0,379	-0,355	1,164	-0,122	-0,436	-0,722	-0,564	4339
			0,458	0,181	-1,482				0,186	0,000	-0,263	1,581	0,159	1,565	0,133	-0,130	-0,949	4343
			0,620	-0,257	0,855				1,118	0,000	1,305	0,017	0,704	0,016	-1,516	-0,130	-0,564	4356
			-1,193	-0,482	-0,443				0,802	0,000	-0,378	0,017	**2,879**	0,281	0,406	-0,296	0,450	4539
			-0,681	0,604	0,446							-0,355	0,159	0,535	-0,885	1,126	0,753	4633
			0,038	-1,303	0,045				1,418	0,000	**-2,714**	0,940	0,159	1,013				4713
			-0,112	-0,369	1,395							1,265	0,159	**2,646**				4723
																		4889
			0,333	0,604	**-2,158**				-1,243	0,000		-1,010	-0,551	-0,714	-1,354	-1,346	-0,205	4980
			-0,367	-0,827	-0,756				0,293	0,000	0,068	0,717	-0,551	-0,714	1,562	0,196	0,753	5018
												0,940	**-2,266**	-1,212	-0,733	-0,636	-1,368	5094
			-0,681	1,989	0,901				-0,309	0,000	1,042	0,137	-0,551	1,670	1,062	-0,130	1,845	5120
				1,214	-0,251				-0,309	0,000	0,576	0,017	**-2,266**	0,658	**-2,556**	-0,213	-1,368	5197
												0,604	0,159	0,150				5201
			1,443	-0,596	0,546							**-2,512**	0,159	-1,579	-0,885	0,514	**-2,357**	5220
															-0,148	0,276	0,753	5352
			1,020	-0,257	0,620							0,717	0,159	0,281	0,133	-0,722	0,132	5447
			-0,265	0,499	0,237													5553
			-0,367	1,214	0,156										-0,148	1,349	1,587	5893
			0,333	-0,146	0,855				1,118	0,000	1,131	0,256	0,159	0,281	1,315	1,201	0,450	5950
			0,235	-0,369	-0,578				-0,431	0,000	-0,618	0,137	0,159	0,016	-0,436	-0,213	0,450	6180
			0,620	-0,036	0,855				-1,001	0,000	0,478	0,489	1,569	0,016	0,805	0,900	0,450	6233
												-0,229	1,164	0,281				6253
			0,038	-1,548	0,546							1,158	**-2,266**	0,897	0,805	-1,438	-0,564	6456
			-0,062	-1,182	-0,987				0,113	0,000	0,277	1,372	0,159	1,875	**2,159**	-0,897	0,132	6563
												-1,010	-0,551	-1,212	-1,516	**2,275**	**-2,357**	6731
															0,271	0,976	0,450	6852
			0,714	0,499	0,878				1,118	0,000	-0,263	0,256	0,704	-0,559	1,189	0,900	-0,205	7096
																		7191
			-2,661	0,073	0,129				0,293	0,000	0,478	-0,106	**4,000**	-0,264	0,673	-0,897	-0,564	7248
			1,619	**-3,299**	0,620				1,980	0,000	0,174	0,256	0,159	1,127	**2,042**	1,126	-1,368	7282
			-4,000	**4,000**	1,633						0,576	1,786	**4,000**	**4,000**	**4,000**	1,126	**4,000**	7302
			-1,060	-0,036	0,471				-1,048	0,000	-0,150	**-2,029**	-0,551	-1,777	-0,885	-1,438	-0,564	7330
												0,373	0,704	0,535				7442
												0,017	-0,551	-1,212	-0,007	-0,048	-0,564	7564
			-0,367	-0,369	0,421				-0,350	0,000	0,277	0,373	1,164	1,349	0,541	0,747	**2,336**	7596
			0,333	-0,596	0,156				-1,144	0,000	-1,431	-0,355	-0,551	0,016	0,406	-1,531	-0,205	7626
			-4,000	0,181					-1,959	0,000	0,379	-1,010	0,159	0,897	-0,583	0,356	1,587	7688
			0,284	-0,257	0,369				-0,037	0,000	-1,141	0,137	-0,551	-0,559	0,133	-0,550	0,753	7728
			-1,005	0,913	0,901				0,293	0,000	0,174	-0,482	0,159	-0,409	0,934	0,514	0,753	7876
			1,354	0,604	0,521				-0,599	0,000	-1,746	-0,355	0,704	-0,559	-0,007	-0,048	-0,949	7896
												0,829	**-2,266**	0,535	-1,195	1,201	0,753	7906
			-4,000	-0,596	0,763				-0,037	0,000	0,576	1,477	0,159	-1,212	-0,583	0,514	-0,949	7930
			-0,062	-0,596	0,668				-1,898		**-2,286**	**-3,408**	**4,000**	-1,579	1,684	**-2,820**	1,845	7946
			-4,000	0,707	-0,509				1,418	0,000		1,684	1,569	0,535	-0,583	-0,213	-0,205	7962
			3,453	1,895	0,183				0,502	0,000	0,068	0,829	0,704	0,016	1,315	0,514	0,753	7968
			0,525	0,810	-0,190				-0,431	0,000	1,474	-0,875	-0,551	1,349	0,934	0,514	-0,205	8068
			-0,481	-0,596	**-2,420**							-1,288	0,159	0,016	-1,195	-1,438	-0,564	8177
			0,429	-0,036	0,471				-0,685	0,000	-0,040	-0,875	0,159	-0,264	-0,885	0,196	0,450	8255

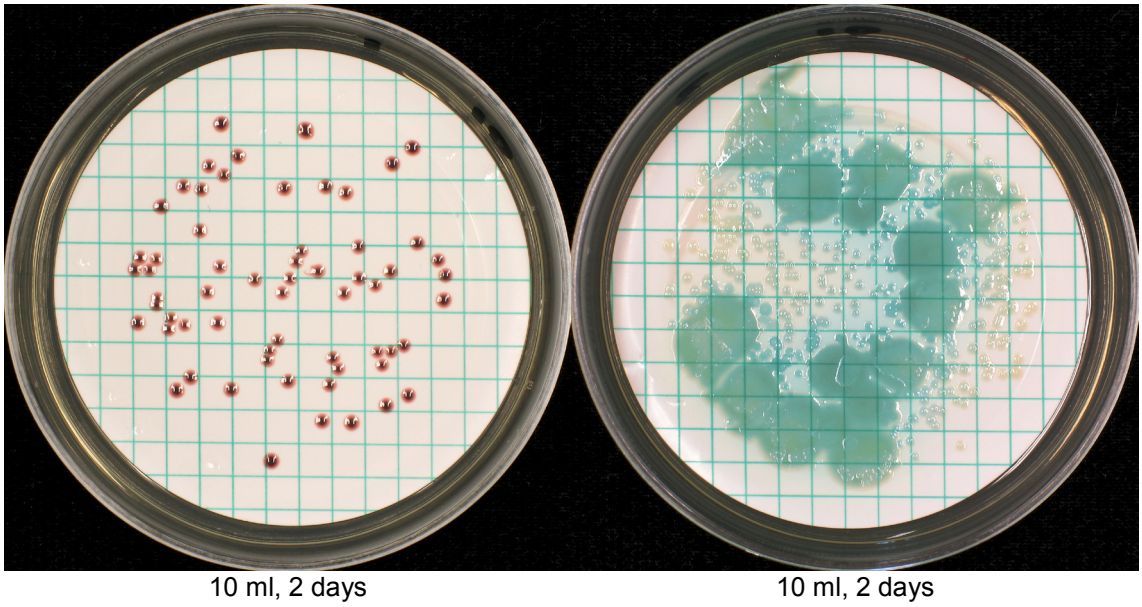
Lab no.	Sample			Suspected coliform bacteria (MF)			Coliform bacteria (MF)			Susp. thermotolerant coliform bact. (MF)			*E. coli* (MF)			Coliform bacteria ("rapid" MPN)			*E. coli* ("rapid" MPN)		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
8260	1	3	2				**3,873**	-0,327	-1,925				0,000	-1,545	0,240						
8329	2	1	3																		
8380	1	3	2				-0,560	-0,267	-0,640				0,000	0,150	-0,945	-0,842	-1,232	-0,039	0,000	-1,106	0,000
8428	1	3	2										0,000	0,599	-0,437						
8435	3	2	1				**2,440**	-0,388	0,734				0,000	0,227	**4,000**						
8569	1	3	2				0,037	-0,327	0,669				0,000	-0,432	0,032						
8598	1	3	2																		
8626	3	1	2				-1,070	-0,033	0,669				0,000	0,150	1,374						
8628	3	2	1				1,614	-1,031	1,944				0,000	-0,258	**4,000**						
8663	1	3	2				0,149	0,620	0,275				0,000	0,741	1,015	-1,230	1,642	0,961	0,000	0,998	0,000
8742	2	1	3																		
8766	2	1	3				0,585	0,192	-0,640				0,000	1,014		-0,692	1,960	0,785	0,000	**2,635**	0,000
8809	1	2	3				**3,042**	**2,201**	-0,278				0,000	**3,994**	0,327						
8862	3	1	2				-0,755	0,356	0,727				0,000	0,150	0,269	-1,053	0,049	0,164	0,000	0,069	
8891	3	1	2																		
8898	2	1	3				0,149	0,024	0,880				0,000	-0,091	0,211	-1,034	-0,333	-0,527	0,000	-0,967	0,000
8955	2	1	3				0,366	0,974	0,540				0,000	1,464	1,273	0,388	0,841	-0,276	0,000	0,310	0,000
9002	2	1	3				-1,550	**-2,458**	-1,745				0,000	-0,521							
9051	1	3	2				1,692	**2,201**	-1,127				0,000	-0,899	0,399						
9306	3	1	2													-0,957	0,631	1,288	0,000	-0,564	0,000
9359	3	1	2																		
9436	2	1	3				0,093	-1,459	-0,313				0,000	-0,612	-0,421	0,071	-0,411	-0,039	0,000	-0,830	0,000
9441	2	1	3													-0,899	-0,255	-0,228	0,000	0,545	0,000
9451	3	1	2				0,677	0,302	1,356				0,000	-0,706	-0,602						
9465	1	2	3				0,104	-0,511	-0,179				0,000	0,150	0,298	0,836	0,344	-0,039	0,000	0,660	0,000
9569	2	1	3				-0,916	1,169	-0,493				0,000	**2,909**	-1,503	1,173	0,701	1,455	0,000	1,537	0,000
9736	2	3	1					**-2,098**	-0,285				0,000	-0,521	-0,029	0,338	1,249	-0,677	0,000	-1,689	0,000
9899	3	2	1				-0,289	-0,388	1,142				0,000	-0,174	1,778	-1,330	1,642	-1,326	0,000	1,432	0,000
9903	3	2	1				-0,472	-0,573	**2,087**				0,000	-0,801	0,788						
9956	3	1	2				0,575	**2,532**	**-4,000**				0,000	1,941	**-3,957**	1,689	0,416	0,513	0,000	0,190	0,000
n				0	0	0	76	79	79	0	0	0	83	82	75	61	61	61	60	59	58
Min							-3,741	-4,000	-4,000				0,000	-3,324	-3,957	-4,000	-4,000	-2,978	0,000	-1,999	0,000
Max							3,873	4,000	2,087				0,000	4,000	4,000	4,000	4,000	4,000	0,000	2,917	0,000
Median							0,054	0,024	0,071				0,000	0,031	-0,044	0,071	0,049	-0,039	0,000	-0,054	0,000
Mean							0,002	0,051	-0,152				0,000	0,097	0,109	0,000	0,000	0,066	0,000	0,000	0,000
SD							1,166	1,255	1,246				0,000	1,166	1,479	1,225	1,225	1,116	0,000	1,000	0,000
z<-3							1	2	3				0	1	2	1	1	0	0	0	0
-3≤z<-2							2	2	4				0	1	1	0	1	2	0	0	0
2<z≤3							2	4	1				0	3	4	1	0	1	0	2	0
z>3							2	2	0				0	2	4	1	1	1	0	0	0

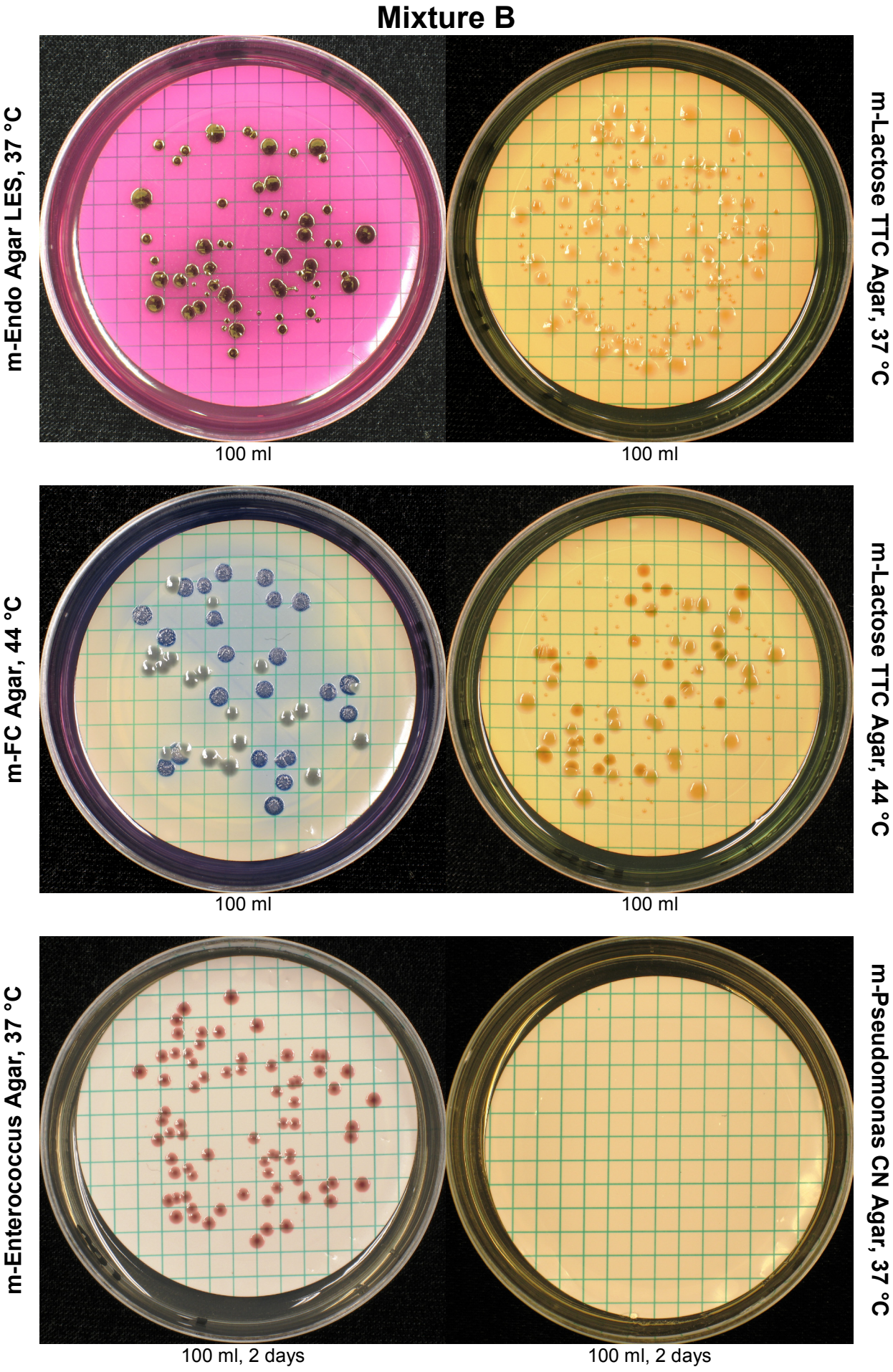
Susp. intestinal enterococci (MF)			Intestinal enterococci (MF)			Susp. *Pseudomonas aeruginosa* (MF)			*Pseudomonas aeruginosa* (MF)			Total plate count 22 °C, 3 days			Total plate count 36±2 °C, 2 days			Lab no.
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
												0,017	-0,551	1,013				**8260**
																		8329
			-1,339	1,412	0,237				**4,000**	0,000	-0,743	-0,482	1,164	0,779	0,271	-0,213	-0,564	**8380**
			1,354		-0,345				-0,773	0,000	-1,004	0,017	**-2,266**	0,281	0,271	**-2,508**	0,450	**8428**
			-1,226	0,394	**2,007**				**4,000**	0,000	-1,431	0,829	0,704	0,535	-0,291	-0,380	-0,949	**8435**
												0,137	0,159	-0,559				**8569**
																		8598
												-0,229	-0,551	0,016				**8626**
			0,714	1,014	0,546				-0,685	0,000	-1,746	0,717	-0,551	0,016	0,805	-0,213	-0,949	**8628**
			-0,576	**2,635**	0,016				1,118	0,000	-0,040	0,256	-0,551	0,658	-0,436	0,115	0,132	**8663**
												0,256	0,159	-0,714	-1,195	-1,164	-1,831	**8742**
			-1,027	-0,369	0,183				1,871	0,000	0,952	1,265	-0,551	-0,559	1,315	**3,846**	-0,564	**8766**
			-4,000	-1,425								**-2,186**	**4,000**	**-3,707**	-1,195	**-4,000**	**3,656**	**8809**
			0,235	0,288	0,595				-1,243	0,000	0,860	-0,742	0,704	0,016	0,673	0,034	-0,205	**8862**
												0,256	0,704	-0,264				**8891**
			0,284	-0,369	0,878				0,671	0,000	0,576	-0,229	0,159	1,239	0,541	-0,213	0,450	**8898**
			0,333	0,810	0,317				-0,431	0,000	0,068	-1,010	**-2,266**	0,150	**2,159**	0,435	-0,564	**8955**
			-1,803	-1,548	-0,190							-0,229	**-2,266**	0,779				**9002**
			-0,777	0,394	-0,908				-1,193	0,000	-0,378	-0,611	1,164	-1,212	**-2,195**	-0,380	-0,949	**9051**
												-0,229	-0,551	0,150	-0,436	1,275	-0,564	**9306**
																		9359
			-0,874	**-2,187**	0,369				**4,000**	0,000	-0,263	-0,482	-0,551	-1,212	-1,039	-0,897	-0,564	**9436**
												1,050	0,159	-0,264	0,934	-0,213	0,753	**9441**
			-0,788	0,288	1,229				0,468	0,000	-0,378	-0,742	-0,551	0,281	-0,007	1,275	-0,564	**9451**
			0,937	0,913	0,571				0,399	0,000	1,640	0,829	0,704	0,897	-0,007	1,051	0,132	**9465**
			-1,339	0,073	**-2,011**				-1,395	0,000	-0,040	0,373	-0,551	0,535	0,271	0,196	0,450	**9569**
			-0,492	0,913	0,183				0,637	0,000	1,721	-1,288	0,704	-1,039	0,805	-1,346	-0,205	**9736**
			0,836	-0,146	-0,345				-0,773	0,000	-0,871	-1,430	0,704	0,016	-1,195	0,823	1,587	**9899**
			0,058	-0,827	-0,578				0,834	0,000	1,390	1,050	0,704	0,150	-0,733	0,034	0,450	**9903**
			-4,000	**2,083**	0,183				0,468	0,000	0,068	0,604	1,569	0,281	0,541	0,356	0,450	**9956**
0	0	0	78	78	77	0	0	0	63	62	60	102	102	102	86	86	86	**n**
			-4,000	-3,299	-2,420				-1,959	0,000	-2,714	-3,408	-2,266	-3,707	-2,556	-4,000	-2,357	**Min**
			3,453	4,000	2,007				4,000	0,000	1,721	4,000	4,000	4,000	4,000	3,846	4,000	**Max**
			-0,062	-0,036	0,291				0,113	0,000	0,068	0,137	0,159	0,016	0,133	-0,007	0,132	**Median**
			-0,359	0,051	0,000				0,317	0,000	0,000	0,039	0,196	0,039	0,047	-0,044	0,047	**Mean**
			1,494	1,092	1,000				1,452	0,000	1,000	1,071	1,305	1,071	1,084	1,215	1,084	**SD**
																		Summa
			7	1	0				0	0	0	2	0	1	0	2	0	24
			2	2	6				0	0	2	3	10	1	2	3	2	46
			0	2	1				1	0	0	1	1	1	3	2	1	31
			1	1	0				5	0	0	1	5	1	1	1	2	31

Mixture A


m-Endo Agar LES, 37 °C
m-Lactose TTC Agar, 37 °C
10 ml
10 ml

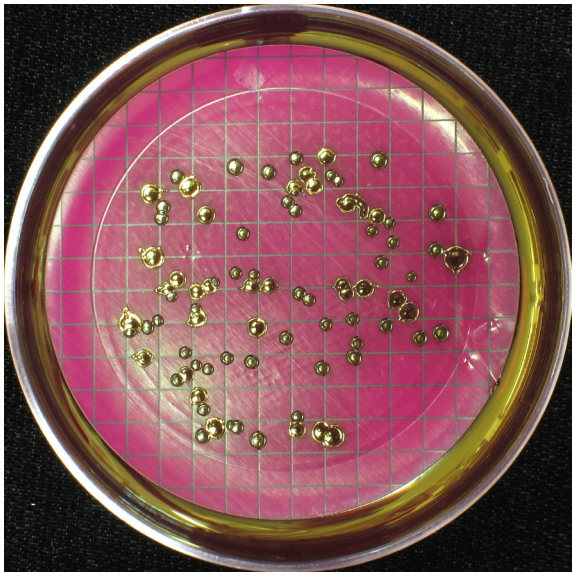

m-FC Agar, 44 °C
m-Lactose TTC Agar, 44 °C
10 ml
10 ml


m-Enterococcus Agar, 37 °C
m-Pseudomonas CN Agar, 37 °C
10 ml, 2 days
10 ml, 2 days


Mixture B
m-Endo Agar LES, 37 °C
m-Lactose TTC Agar, 37 °C
100 ml
100 ml
m-FC Agar, 44 °C
m-Lactose TTC Agar, 44 °C
100 ml
100 ml
m-Enterococcus Agar, 37 °C
m-Pseudomonas CN Agar, 37 °C
100 ml, 2 days
100 ml, 2 days

Mixture C

m-Endo Agar LES, 37 °C



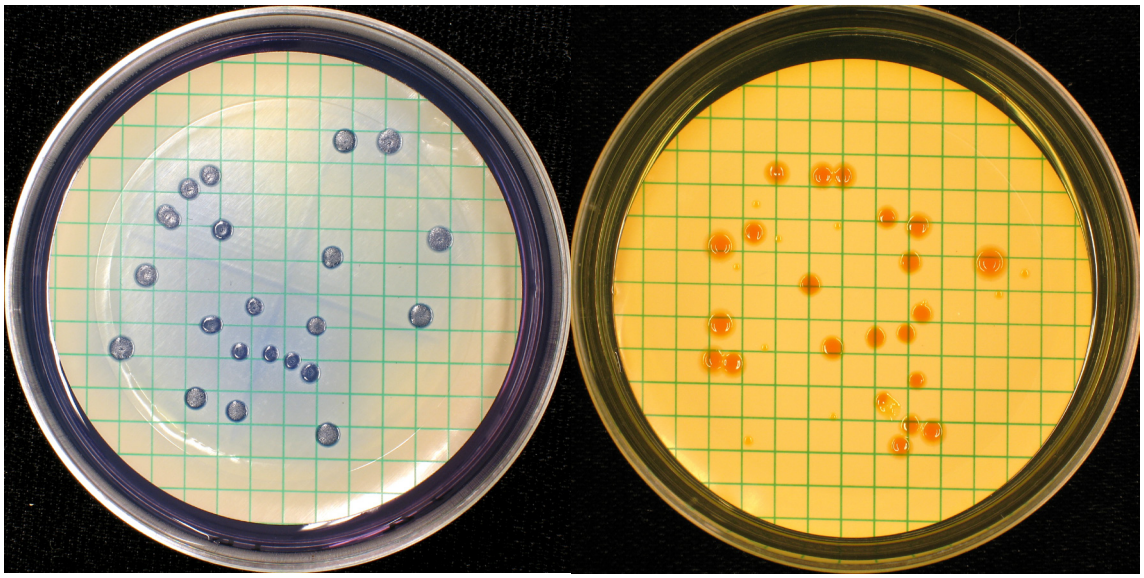
10 ml

Missing

10 ml

m-Lactose TTC Agar, 37 °C

m-FC Agar, 44 °C

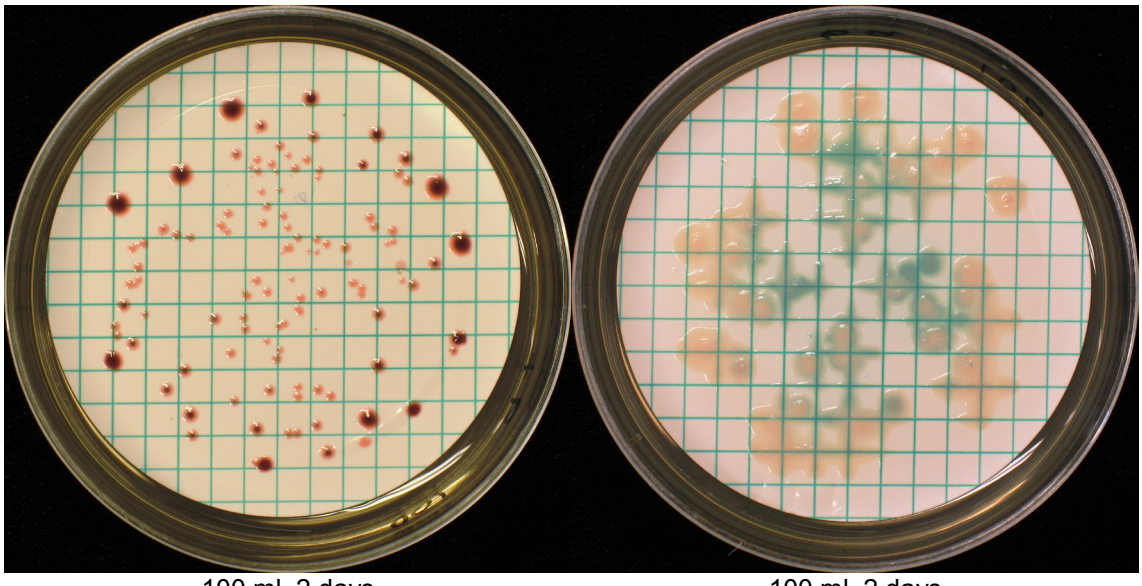


10 ml

10 ml

m-Lactose TTC Agar, 44 °C

m-Enterococcus Agar, 37 °C



100 ml, 2 days

100 ml, 2 days

m-Pseudomonas CN Agar, 37 °C

Rapporter som utgivits 2011

1. Lunch och lärande – skollunchens betydelse för elevernas prestation och situation i klassrummet av M Lennernäs.
2. Kosttillskott som säljs via Internet – en studie av hur kraven i lagstiftningen uppfylls av A Wedholm Pallas, A Laser Reuterswärd och U Beckman-Sundh.
3. Vetenskapligt underlag till råd om bra mat i äldreomsorgen. Sammanställt av E Lövestram.
4. Livsmedelssvinn i hushåll och skolor – en kunskapssammanställning av R Modin.
5. Riskprofil för material i kontakt med livsmedel av K Svensson, Livsmedelsverket och G Olafsson, Rikisendurskodun (Environmental and Food Agency of Iceland).
6. Proficiency Testing – Food Microbiology, January 2011 by C Normark and I Boriak
7. Proficiency Testing – Food Chemistry, Nutritional Components of Food, Round N 47.
8. Proficiency Testing – Food Chemistry, Trace Elements in Food, Round T-22 by C Åstrand and Lars Jorhem.
9. Riksprojekt 2010. Listeria monocytogenes i kyld ätfärdig mat av C Nilsson och M Lindblad.
10. Kontroll av restsubstanser i levande djur och animaliska livsmedel. Resultat 2010 av I Nordlander, Å Kjellgren, A Glynn, B Aspenström-Fagerlund, K Granelli, I Nilsson, C Sjölund Livsmedelsverket och K Girma, Jordbruksverket.
11. Proficiency Testing – Food Microbiology, April 2011 by C Normark, I Boriak, M Lindqvist and I Tillander.
12. Bär – analys av näringsämnen av V Öhrvik, I Mattisson, A Staffas och H S Strandler.
13. Proficiency Testing – Drinking Water Microbiology, 2011:1, March by T Šlapokas, C Lantz and M Lindqvist.
14. Kontrollprogrammet för tvåskaliga blötdjur – Årsrapport 2009-2010 – av av I Nordlander, M Persson, H Hallström, M Simonsson, Livsmedelsverket och B Karlsson, SMHI.
15. Margariner och matfettsblandningar – analys av fettsyror av R Åsgård och S Wretling.
16. Proficiency Testing – Food Chemistry, Nutritional Components of Food, Round N 48.
17. Kontroll av bekämpningsmedelsrester i livsmedel 2009 av A Jansson, X Holmbäck och A Wannberg.
18. Klimatpåverkan och energianvändning från livsmedelsförpackningar av M Wallman och K Nilsson.
19. Klimatpåverkan i kylkedjan – från livsmedelsindustri till konsument av K Nilsson och U Lindberg.
20. Förvara maten rätt så håller den längre – vetenskapligt underlag om optimal förvaring av livsmedel av R Modin och M Lindblad.
21. Råd om mat för barn 0-5 år. Vetenskapligt underlag med risk- och nyttovärderingar och kunskapsöversikter.
22. Råd om mat för barn 0-5 år. Hanteringsrapport som beskriver hur risk- och nyttovärderingar, tillsammans med andra faktorer, har lett fram till Livsmedelsverkets råd.
23. Proficiency Testing – Food Chemistry, Trace Elements in Food, Round T-23 by C Åstrand and L Jorhem.
24. Proficiency Testing – Food Chemistry, Vitamins in Food, Round V-9 by A Staffas and H S Strandler.
25. Nordiskt kontrollprojekt om nyckelhålsmärkning 2011 av I Lindeberg.
26. Rapport från GMO-projektet 2011. Undersökning av förekomsten av GMO i livsmedel av Z Kurowska.
27. Fat Quality – Trends in fatty acid composition over the last decade by I Mattisson, S Trattner and S Wretling.
28. Proficiency Testing – Drinking Water Microbiology, 2011:2, September by T Šlapokas and M Lindqvist.
29. Kontrollen roll skiljer sig mellan livsmedelsbranscherna av T Ahlström, G Jansson och S Sylvén.
30. Kommuners och Livsmedelsverkets rapportering av livsmedelskontrollen 2011 av C Svärd och L Eskilsson.
31. Proficiency Testing – Food Microbiology, October 2011 by C Normark and I Boriak.

Rapporter som utgivits 2012

1. Fisk, skaldjur och fiskprodukter – analys av näringsämnen av V Öhrvik, A von Malmborg, I Mattisson, S Wretling och C Åstrand.
2. Normerande kontroll av dricksvattenanläggningar 2007-2010 av T Lindberg.
3. Tidstrender av tungmetaller och organiska klorerade miljöföroreningar i baslivsmedel av J Ålander, I Nilsson, B Sundström, L Jorhem, I Nordlander, M Aune, L Larsson, J Kuivinen, A Bergh, M Isaksson och A Glynn.
4. Proficiency Testing – Food Microbiology, January 2012 by C Normark, I Boriak and L Nachin.
5. Mögel och mögelgifter i torkad frukt av E Fredlund och J Spång.
6. Mikrobiologiska dricksvattenrisker ur ett kretsloppsperspektiv – behov och åtgärder av R Dryselius.
7. Market Basket 2010 – chemical analysis, exposure estimation and health-related assessment of nutrients and toxic compounds in Swedish food baskets.
8. Proficiency Testing – Food Microbiology, April 2012 by L Nachin, C Normark, I Boriak and I Tillander.
9. Kontroll av restsubstanser i levande djur och animaliska livsmedel. Resultat 2010 av I Nordlander, Å Kjellgren, A Glynn, B Aspenström-Fagerlund, K Granelli, I Nilsson, C Sjölund Livsmedelsverket och K Girma, Jordbruksverket.
10. Råd om fullkorn 2009 - bakgrund och vetenskapligt underlag av W Becker, L Busk, I Mattisson och S Sand.
11. Nordiskt kontrollprojekt 2012. Märkning av allergener och ”kan innehålla spår av allergener” – resultat av de svenska kontrollerna av U Fäger.
12. Proficiency Testing – Drinking Water Microbiology, 2012:1, March by T Šlapokas, M Lindqvist and K Mykkänen.
13. Länsstyrelsens rapportering av livsmedelskontroll inom primärproduktionen 2010-2011 av L Eskilsson och K Bäcklund Stålenheim.
14. Vetenskapligt underlag för råd om mängden frukt och grönsaker till vuxna och barn av H Eneroth.
15. Kommuners och Livsmedelsverkets rapportering av livsmedelskontrollen 2011 av L Eskilsson.
16. Sammanställning av resultat från en projektinriktad kontrollkurs om skyddade beteckningar 2012 av P Elvingsson.
17. Nordic Expert Survey on Future Foodborne and Waterborne Outbreaks by T Andersson, Å Fulke, S Pesonen and J Schlundt.
18. Riksprojekt 2011. Kontroll av märkning – redlighet och säkerhet av C Spens, U Colberg, A Göransdotter Nilsson och P Bergkvist.
19. Från nutritionsforskning till kostråd – så arbetar Livsmedelsverket av I Mattisson, H Eneroth och W Becker.
20. Proficiency Testing – Food Microbiology, October 2012 by L Nachin ,C Normark and I Boriak
21. Dioxin- och PCB-halter i fisk och andra livsmedel 2000-2011 av T Cantillana och M Aune.
22. Kommuners rapportering av dricksvattenkontrollen 2011 av C Forslund.
23. Kontroll av kontaminanter i livsmedel 2011 – Resultat från kontrollprogrammen för dioxiner och dioxinlika PCB, PAH, nitrat, mykotoxiner och tungmetaller av A Wannberg, F Broman och H Omberg.
24. Proficiency Testing – Drinking Water Microbiology, 2012:2, September by T Šlapokas and K Mykkänen.

LIVSMEDELS VERKET
NATIONAL FOOD AGENCY, Sweden

ISSN 1104-7089