Rapport 27 – 2013

Proficiency Testing

Drinking Water Microbiology

– September 2013

by Tommy Šlapokas and Kirsi Mykkänen

LIVSMEDELS VERKET
NATIONAL FOOD AGENCY, Sweden

Internal and external control for microbiological analyses of food and drinking water

All analytical activities require 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 required by accreditation bodies for accredited laboratories and can be done by taking part in proficiency testing (PT) schemes.

In a proficiency test, identical test material is analysed by a number of laboratories using their routine methods. The laboratories report their results to the organiser that evaluates them and compiles them in a report.

The National Food Agency's PT program offers

- External and independent evaluation of laboratories analytical competence.
- Improved knowledge of analytical methods used by laboratories with respect to various types of organisms.
- Expert support
- Tool for inspections regarding accreditation.
- Free extra material for follow-up analyses

For more information visit our website: www.slv.se/absint

The National Food Agency's reference material

As a complement to the proficiency testing, National Food Agency also produces reference material (RM) for internal quality control: a total of 7 RM for food and drinking water microbiological analyses, including pathogens, are available.

Information available on our website: www.slv.se/RM

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Proficiency testing

Drinking Water Microbiology

September 2013

1457
ISO/IEC 17043

Coliform bacteria and ***Escherichia coli*** with membrane filter method (MF)

Coliform bacteria and ***Escherichia coli***, (rapid methods with MPN)

Intestinal enterococci with MF

Pseudomonas aeruginosa with MF

Culturable microorganisms (total count) 3 days incubation at **22±2 °C**

Culturable microorganisms (total count) 2 days incubation at **36±2 °C**

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Abbreviations and explanations

Common media in text and/or tables

LES	m-Endo Agar LES (according to SS 028167)
LTTC	m-Lactose TTC Agar with Tergitol (acc.to EN-ISO 9308-:2000)
m-FC	m-FC Agar (acc. to SS 028167)
m-Ent	m-Enterococcus Agar (according to EN ISO 8799-2:2000)
PACN	Pseudomonas Agar base with cetrimide and nalidixic acid (according to EN ISO 16266:2008)
YeA	Yeast extract Agar (acc. to EN ISO 6222:1999)
CCA	Chromocult Coliform Agar® (Merck; ISO/DIS 9308-1:2013)
Colilert	Colilert® Quanti-Tray® (IDEXX Inc.; ISO 9308-2:2012)

Other abbreviations

MF	Membrane filter (method)
MPN	”Most Probable Number” (quantification based on statistical distributions)
ISO	"International Organization for Standardization" and their standards
EN	European standard from "Comité Européen de Normalistion" (CEN)
NMKL	"Nordisk Metodikkomité for næringsmidler" and their standards
DS, NS, SFS, SS	National standards from Denmark, Norway, Finland and Sweden

Method tables for the analytical parameters

Tot n	total number of laboratories that reported methods and numerical results
n	number of results except false results and outliers
Mv	mean value (with deviating results excluded)
Med	median value (with deviating results included)
CV	coefficient of variation = relative standard deviation in percentage of the mean, calculated from square root transformed results
F	number of false positive or false negative results
<	number of low outliers
>	number of high outliers
	global results for the analysis
601	remarkably low result
278	remarkably high result, high CV or many deviating results

Contents

General information on results evaluation

The histograms and calculation of outliers are described in the section "Evaluation of numerical results" with further references to the scheme protocol (1).

The proficiency testing program organised by the National Food Agency is accredited according to EN ISO/IEC 17043. Because it states that results might be grouped based on the method used, it is mandatory for participants to give such information. For each parameter at least some method variants are accounted for.

The method information gathered is not always easy to interpret. Sometimes there is inconsistency between the standard referred to and the information given regarding various method details. Results from laboratories with ambiguous details are either excluded or placed in the group "Other/Unknown" in the tables, together with results from methods used only by some individual laboratories.

Outliers and false results are not included in the calculation of mean value and measure of dispersion for the various method groups. The numbers of low and high outliers, as well as false results, are instead explicitly given in various tables together with the group means etc. The measure of dispersion is not shown for groups with 4 or fewer results.

Results of the PT round September 2013

General outcome

Test items were sent to 108 laboratories, 35 in Sweden, 56 in other Nordic countries and 17 in other countries. 98 laboratories reported results.

The percentages of false results and outliers are compiled in **table 1**. These deviating results are excluded in most calculations.

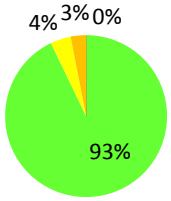
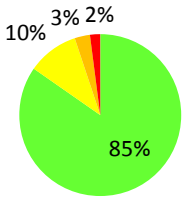
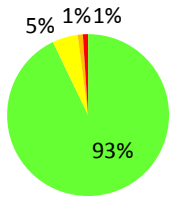
Microorganisms and parameters of analyses are also compiled in table 1. For the MF analyses the parameters *suspected colonies* of coliform bacteria, thermo-tolerant coliform bacteria, intestinal enterococci and *Pseudomonas aeruginosa* on primary media for quantification could be reported as well. The results from suspected colonies are only used as basis for interpretations and discussions.

All reported results are compiled in **annex A**. Individual results for each laboratory are also shown on our website after logging in (www.slv.se/absint).

Standardized z-scores for all evaluated results are given in **annex B** and photographs with examples of colony appearance on various media are presented in **annex C**.

Interpretation of laboratory performance is described after all analytical parameters and illustrated by a box plot together with the number of deviating results for each laboratory.

Table 1 *Microorganisms in each mixture and percentages of deviating results (F%: false positive or false negative, X%: outliers)*

Mixture	**A**			**B**			**C**		
% participants with 0 deviating results 1 deviating result 2 deviating results >2 deviating results									
No. of evaluable results	560			561			557		
No. of deviating results *	10 (2 %)			22 (4 %)			10 (2 %)		
Microorganisms	*Escherichia coli* *Citrobacter freundii* *Enterococcus faecalis* *Pseudomonas aeruginosa* *(Clostridium perfringens)*			*Escherichia coli* *Cronobacter sakazakii* *Enterococcus hirae* *Staphylococcus saprophyticus* *Staphylococcus capitis*			*Klebsiella oxytoca* *Enterobacter aerogenes* *Burkholderia cepacia* *Pseudomonas fluorescens*		
Analysis	**Target**	**F%**	**X%**	**Target**	**F%**	**X%**	**Target**	**F%**	**X%**
Coliform bacteria (MF)	*E. coli* *C. freundii*	0	4	*E. coli* *C. sakazakii*	3	4	*K. oxytoca* *E. aerogenes*	0	1
Susp. thermo-tolerant colif. bact. (MF)	*E. coli*	–	–	*E. coli* *C. sakazakii*	–	–	–	–	–
E. coli (MF)	*E. coli*	0	4	*E. coli*	1	4	–	6	–
Coliform bacteria (rapid method)	*E. coli* *C. freundii*	0	0	*E. coli* *C. sakazakii*	0	0	*K. oxytoca* *E. aerogenes*	0	0
E. coli (rapid meth.)	*E. coli*	0	0	*E. coli*	0	0	*[K. oxytoca]*	2	–
Intestinal enterococci (MF)	*E. faecalis*	0	3	*E. hirae* *[S. saprophyticus]*	0	1	–	0	–
Pseudomonas aeruginosa (MF)	*P. aeruginosa*	0	0	–	0	–	*[B. cepacia]*	0	–
Culturable micro–organisms (total count), 22 °C, 3 days	*E. faecalis* *E. coli* *C. freundii* *P. aeruginosa*	0	0	*(E. hirae)* *(E. coli)* *(C. sakazakii)* *(S. saprophyticus)*	0	3	*P. fluorescens* *K. oxytoca* *E. aerogenes* *(B cepacia)*	1	1
Culturable micro–organisms (total count), 36 °C, 2 days	*E. faecalis* *E. coli* *C. freundii* *P. aeruginosa*	0	3	*S. capitis* *(E. hirae)* *(E. coli)* *(C. sakazakii)* *(S. saprophyticus)*	0	12	*K. oxytoca* *E. aerogenes* *(B cepacia)*	0	3

* In total 23 out of 98 laboratories (23 %) reported at least one deviating result

– Organism missing *or* numerical result missing *or* "X%" not relevant when target organism is absent

( ) The organism contributes with only very few colonies

[ ] The organism is false positive on the primary growth medium

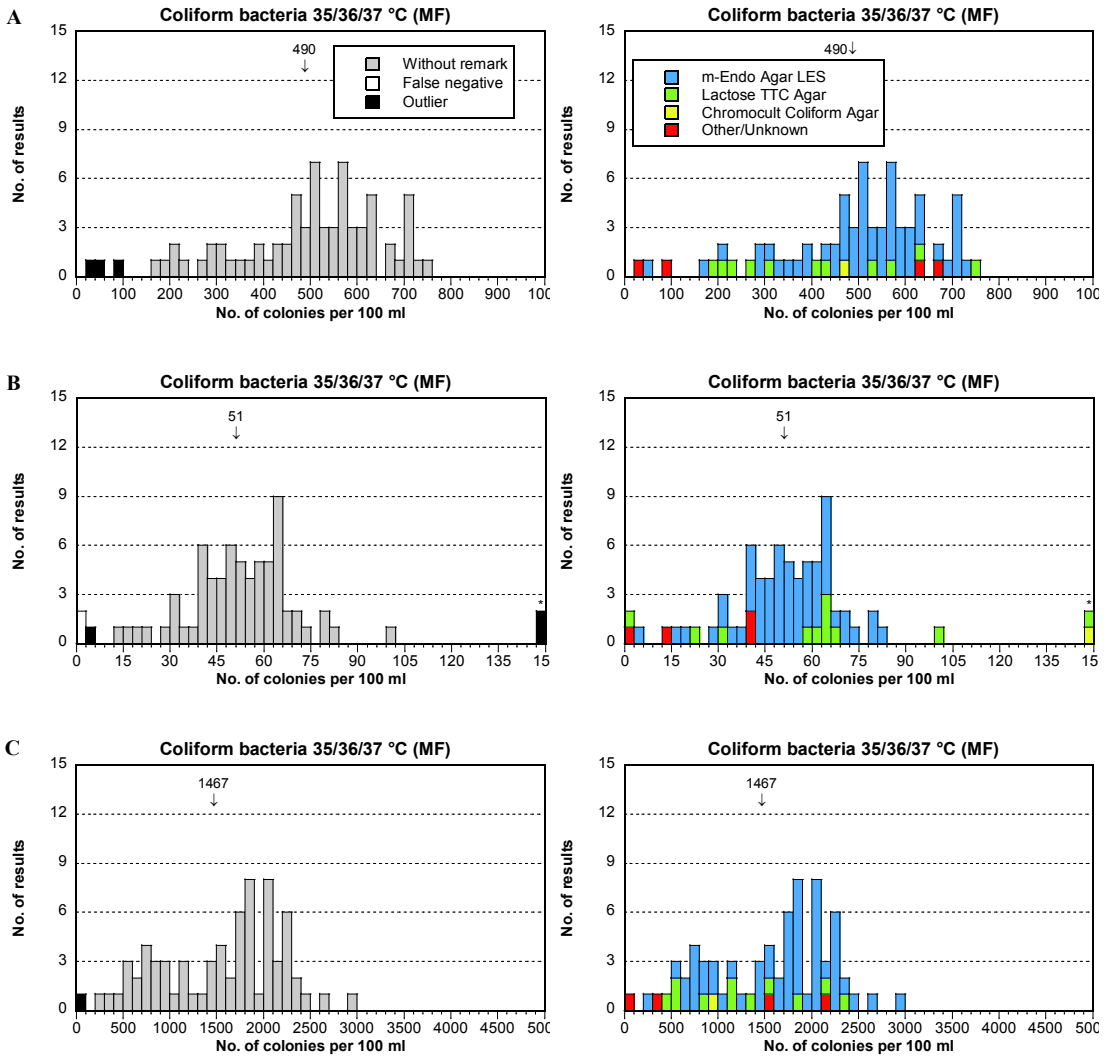
{ } The organism may give different results depending on the methods or definitions used

Coliform bacteria (MF)

In a few cases when the primary medium reported was not the one prescribed in the standard referred to, we have assumed the medium to be correct. The medium Endo Agar reported by some participants is here included in m-Endo Agar LES (LES).

From the table it is clear that 5 times as many laboratories are using LES compared to LTTC. The results indicate lower results with LTTC in mixtures A and C than

Medium	Tot	A						B						C					
	n	n	Mv	CV	F	<	>	n	Mv	CV	F	<	>	n	Mv	CV	F	<	>
Total	72	69	**490**	16	0	3	0	67	**51**	17	2	1	2	70	**1467**	23	0	1	0
m-Endo Agar LES	56	55	**507**	14	0	1	0	55	**51**	15	0	1	0	55	**1561**	21	0	0	0
Lactose TTC Agar	11	11	**387**	24	0	0	0	9	57	20	1	0	1	11	**1167**	27	0	0	0
Chromocult C Agar	1	1	**470**	–	0	0	0	0	–	–	0	0	1	1	**900**	–	0	0	0
Other/Unknown	4	2	**645**	–	0	2	0	3	**28**	–	1	0	0	3	**1169**	–	0	1	0



with LES. In mixture B there is a tendency of higher results with LTTC compared to LES. The dispersion, and thus the uncertainty are higher for LTTC in all mixtures. Although there are tails with low results in all diagrams, it is difficult to see any method difference as the cause. For about ten laboratories there are low results for coliform bacteria in at least two mixtures, possibly indicating some other systematic cause. These tails with low values are causing lower averages and higher dispersion than in the corresponding analyses with the rapid method Colilert® Quanti-Tray®.

Mixture A

- *E. coli* and *C. freundii* form colonies in the analysis of coliform bacteria and could be counted from the volume 10 ml. The colonies are typical with a metallic sheen on LES and have different nuances of yellow on LTTC. Also the oxidase negative enterococci grow with small yellow colonies on LTTC. As often, it was difficult to distinguish the yellow colour in the medium from individual colonies, as the whole medium turns yellow due to a lot of target colonies present.
- Two out of three low outliers was obtained by use of an odd or unknown medium. The cause of these and the other low results are, however, not clear. The low results on LTTC compared to LES might be due to difficulties to distinguish *C. freundii* as coliform bacterium. The colonies are pale yellow with a darker middle.

Mixture B

- The colonies of both *E. coli* and *C. sakazakii* grow as typical coliform bacteria on LES and LTTC, but with somewhat different appearance. Individual yellow colour beneath the colonies on LTTC is, as usually, difficult to see. Also this mixture includes an oxidase negative enterococcus strain that appears with small, yellow colonies on LTTC. The whole medium turns yellow.
- There was a tail of low results present even in this mixture, including two false negative results and one outlier. The reason for the low values is unclear also here. Two high outliers were also present.

Mixture C

- The two coliform bacteria *K. oxytoca* and *E. aerogenes* appeared on the media for coliform bacteria. *E. aerogenes* appears sometimes with more or less red, atypical, colonies with only weak metallic sheen in the middle on LES. If there is any doubt, the oxidase test will confirm that it is a coliform bacterium.
- Also here were an unexpected number of low results present. However, only one was regarded as an outlier. Low values will be the result if reddish colonies on LES are not reckoned as coliform bacteria. However, LTTC had lower average than LES, indicating some problem also there (photo missing).
- There is a tendency to two peaks in the histogram. The right-hand side peak includes both the two coliform bacteria while the other incudes only *K. oxytoca*. The average indicated does not represent any of the peaks but is rather in between. The median of 1700 cfu/100 ml is therefor closer to the sum of coliform bacteria according to the rapid method (about 2000 cfu/100 ml).

Suspected thermo-tolerant coliform bacteria (MF)

The two most commonly used growth media are m-FC and LTTC. The incubation temperature is 44 or 44.5 °C. Here, results were separated based on the method standards most commonly used, to get a further division. They are EN ISO 9308-1 with LTTC and three standards with m-FC from the Nordic countries, namely SS 028167 from Sweden, SFS 4088 from Finland and NS 4792 from Norway. They were sometimes used a bit modified.

The table shows the medians instead of mean values because no outliers have been identified. The analysis is not included in performance assessment.

Standard, Method	Tot	A						B						C					
	n	n	Med	CV	F	<	>	n	Med	CV	F	<	>	n	Med	CV	F	<	>
Total	39	39	**278**	–	–	–	–	39	**31**	–	–	–	–	38	**0**	–	–	–	–
EN ISO 9308-1	9	9	**380**	–	–	–	–	9	**51**	–	–	–	–	9	**0**	–	–	–	–
SS 028167	11	11	**255**	–	–	–	–	11	**28**	–	–	–	–	10	**0**	–	–	–	–
SFS 4088	15	15	**240**	–	–	–	–	15	**25**	–	–	–	–	15	**0**	–	–	–	–
NS 4792	3	3	**210**	–	–	–	–	3	**43**	–	–	–	–	3	**0**	–	–	–	–
Other/Unknown	1	1	**12**	–	–	–	–	1	**12**	–	–	–	–	1	**9**	–	–	–	–

The Swedish standard states incubation at 44 °C and all laboratories reporting results used 44 °C. The temperature 44 °C is also used as stated in EN ISO 9308-1. The three laboratories using Norwegian standard has incubated 44.5 °C. All laboratories using Finnish standard reported 44 °C.

In this round there are too few results for Norwegian standard, NS 4792, with the incubation temperature 44.5 °C to compare with Swedish and Finnish standard. No general tendency can be seen. In the mixtures A and B the laboratories using EN ISO 9308-1 with LTTC at 44 °C got higher results than laboratories using m-FC according to Swedish, Finnish or Norwegian standard. One possible explanation is that colonies of intestinal enterococci have been included as suspected thermo-tolerant coliform bacteria. Alternatively, the temperature might have been too low leading to growth of *C. freundii* that have been included.

Mixture A

- At 44 °C only the *E. coli* strain should grow. With somewhat lower temperature also small colonies of *C. freundii* might appear.

Mixture B

- Beside the strain of *E. coli*, *C. sakazakii* grow with greyish colonies on m-FC and pale yellow colonies on LTTC at 44 °C.

Mixture B

- No suspected thermo-tolerant coliform bacteria were present in the mixture.

Escherichia coli (MF)

E. coli is quantified after confirmation of colonies that have grown either at 36±2 °C or at 44/44.5 °C. Different primary growth media are used at the two temperatures, LTTC or LES at the low temperature and LTTC or m-FC at the high temperature. The results from the two temperatures are here compiled in separate tables. In some cases, the incubation temperature stated for the primary growth medium was ambiguous. These 10 results are not specifically shown but are only included in the table "All results".

E. coli was present in mixture A and B. The averages of accepted results are approximately the same for LTTC and LES in both these mixtures at 36±2 °C. No particular difference in numbers or proportion deviating results between these methods was seen in any mixture.

In thes round, compared to the previous one, there is a small tendency to lower results with m-FC compared to LTTC at 44/44.5 °C. However, there are only four results for LTTC. There are indications that the m-FC results with Norwegian standard, NS 4792, are lower in average than those with Finnish standard, SFS 4088, in mixture A but not in mixture B.

All results

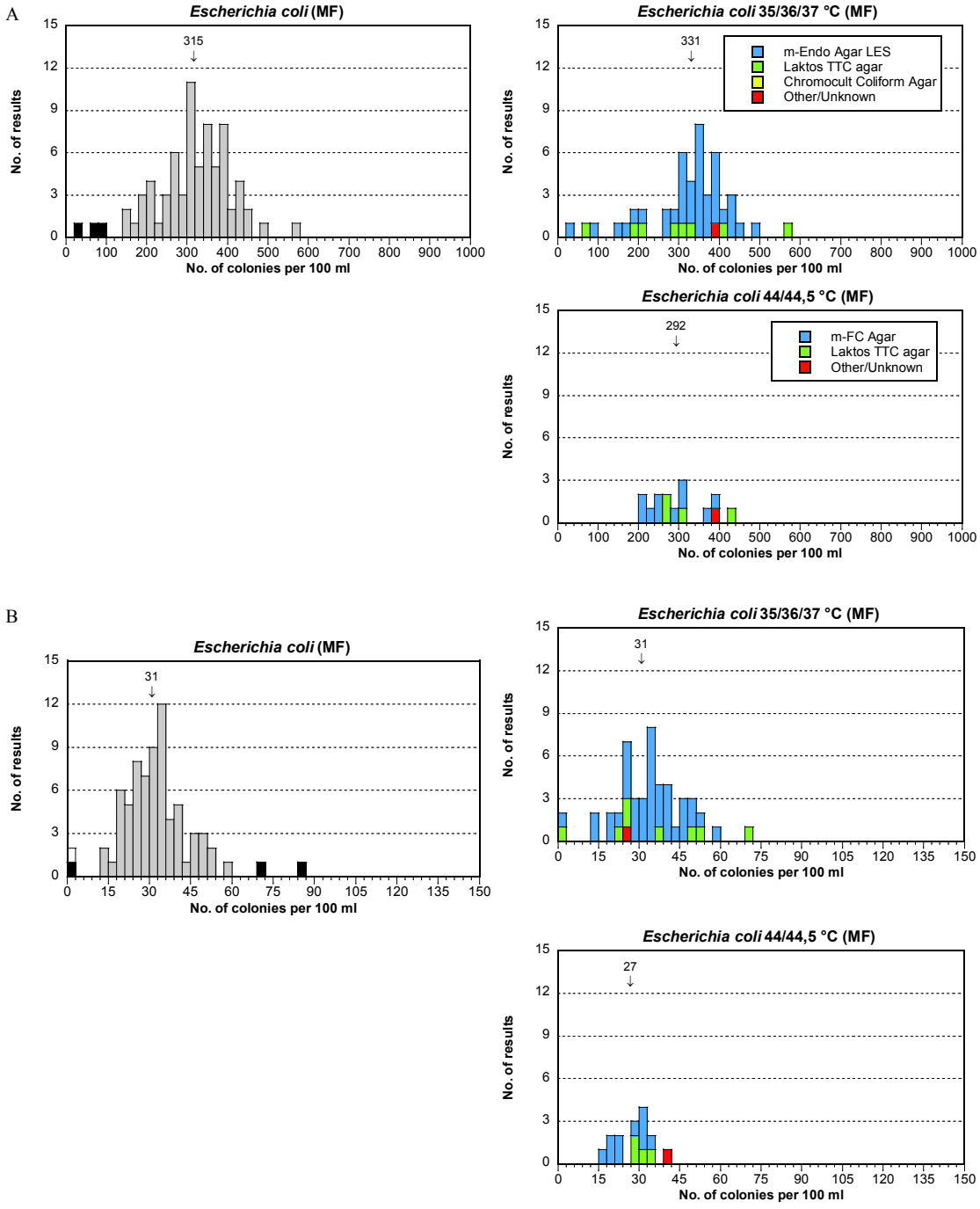
Medium	**Tot**	**A**						**B**						**C**					
	n	n	Mv	CV	F	<	>	n	Mv	CV	F	<	>	n	Mv	CV	F	<	>
Total	73	70	**315**	13	0	3	0	69	**31**	16	1	1	2	68	**0**	–	4	0	0

From 36±2 °C

Medium	**Tot**	**A**						**B**						**C**					
	n	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>
Total	*48*	*45*	***331***	*13*	*0*	*3*	*0*	*45*	***33***	*16*	*1*	*1*	*1*	*44*	***0***	–	*3*	–	–
m-Endo Agar LES	39	37	**333**	12	0	2	0	38	**33**	16	0	1	0	36	**0**	–	2	–	–
Lactose TTC Agar	8	7	**316**	19	0	1	0	6	**34**	19	1	0	1	7	**0**	–	1	–	–
Chromocult C Agar	0	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–
Other/Unknown	1	1	**380**	–	0	0	0	1	**26**	–	0	0	0	1	**0**	–	0	–	–

From 44/44.5 °C

Medium/Standard	**Tot**	**A**						**B**						**C**					
	n	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>
Total	*15*	*15*	***292***	*11*	*0*	*0*	*0*	*15*	***27***	*12*	*0*	*0*	*0*	*14*	***0***	–	*1*	*0*	*0*
<u>*Medium*</u>																			
m-FC Agar	10	10	**274**	11	0	0	0	10	**25**	13	0	0	0	9	**0**	–	1	–	–
Lactose TTC Agar	4	4	**317**	–	0	0	0	4	**29**	–	0	0	0	4	**0**	–	0	–	–
Other/Unknown	1	1	**380**	–	0	0	0	1	**39**	–	0	0	0	1	**0**	–	0	–	–
<u>*Standard*</u>																			
EN ISO 9308-1	6	6	**337**	10	0	0	0	6	**28**	15	0	0	0	6	**0**	–	0	–	–
SS 028167	0	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–
SFS 4088	4	4	**312**	–	0	0	0	4	**26**	–	0	0	0	4	**0**	–	0	–	–
NS 4792	3	3	**220**	–	0	0	0	3	**29**	–	0	0	0	2	**0**	–	1	–	–
Other/Unknown	2	2	**241**	–	0	0	0	2	**24**	–	0	0	0	2	**0**	–	0	–	–



Mixture A

- Except some low outliers, the results were well dispersed. The cause of the low outliers is not clear.
- A confirmation step is needed if *E. coli* is quantified from the primarily analysis at 36±2 °C as *C. freundii* will also grow there. *C. freundii* is excluded as *E. coli* due to its lack of both indol production and *β*-glucuronidase activity. At 44/44.5 °C only colonies of *E. coli* will appear.

Mixture B

- The dispersion of the results was good, except some deviating results.
- Confirmation is needed when *E. coli* is quantified from the primary analysis at 36±2 °C. Both the strain of *E. coli* and *C. sakazakii* grow as typical coliform bacteria. *C. sakazakii* will be excluded as *E. coli* due to its lack of indol production and *β*-glucuronidase activity.
- Both strains will also grow at 44/44.5 °C but the colonies of *C. sakazakii* are atypical, greyish on m-FC. Colonies of *C. sakazakii* suspected as presumptive *E. coli*, e.g. on LTTC, will be excluded after confirmation, as described above.

Mixture C

- No *E. coli* was included in the mixture. Four false positive results were present. When confirmed, colonies of *K. oxytoca* from incubation at 36±2 °C may grow in broth at 44 °C, however without gas production. Because the strain produces indol it may be taken for *E. coli* if there is no test of gas production or *β*-glucuronidase activity. Both these tests are negative for the strain of *K. oxytoca*.

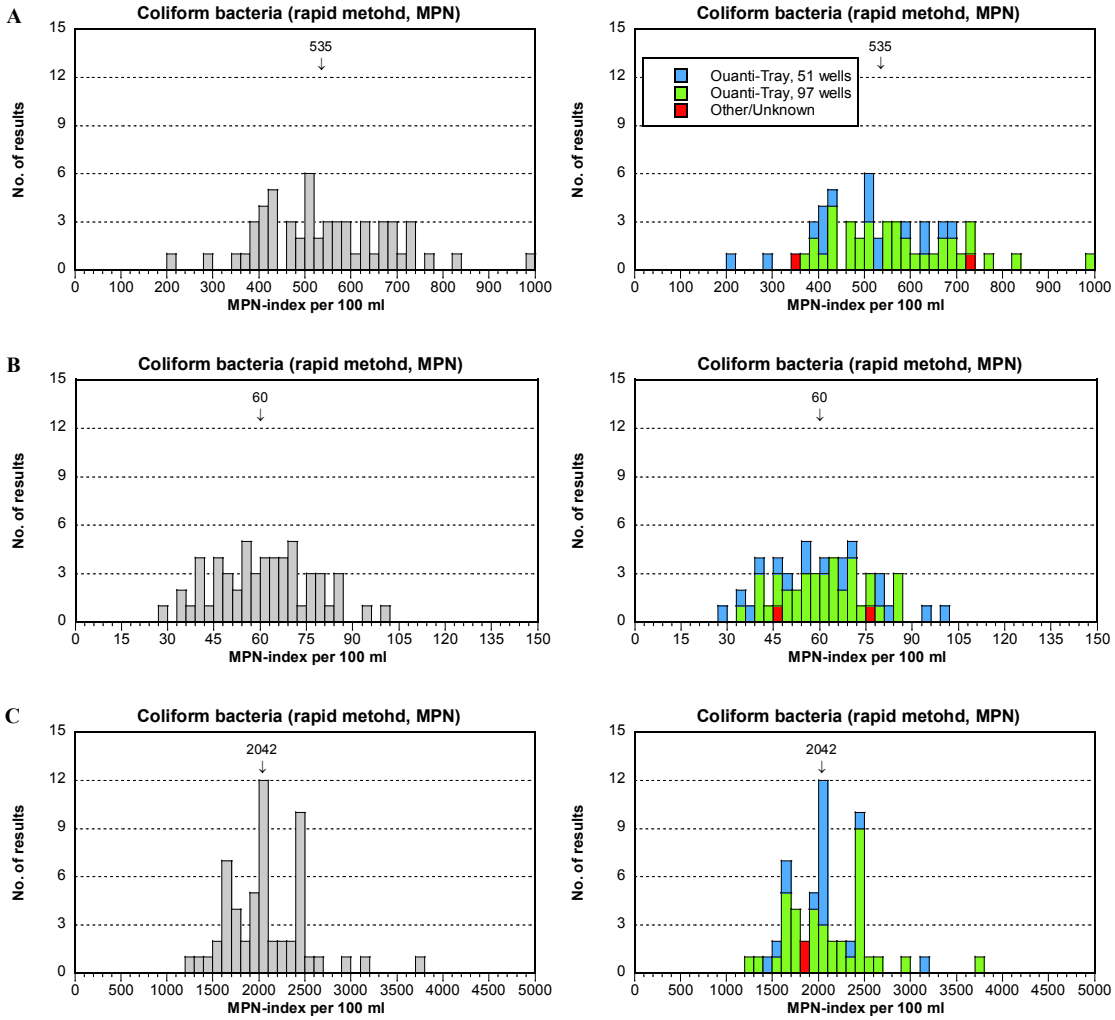
Coliform bacteria & *E. coli* (rapid method, MPN)

The rapid method used for both these parameters was almost exclusively Colilert® Quanti-Tray® from the manufacturer IDEXX Inc. All laboratories stating that they have analysed this parameter have this time also used a rapid method. Out of the 54 laboratories that reported Colilert some used trays with 51 wells, while others used trays with 97 wells (a few of which, probably incorrectly, have reported 96 wells). The laboratories have often analysed both diluted and undiluted samples. One laboratory included in the group Other/Unknown has reported the use of "Colilert 24 hours".

In mixture A there is a tendency that the trays with 51 wells gave a bit lower results than the trays with 97 wells. Neither for the coliform bacteria in the other mixtures nor for *E. coli* in any mixture were such tendencies present. No deviating result was reported.

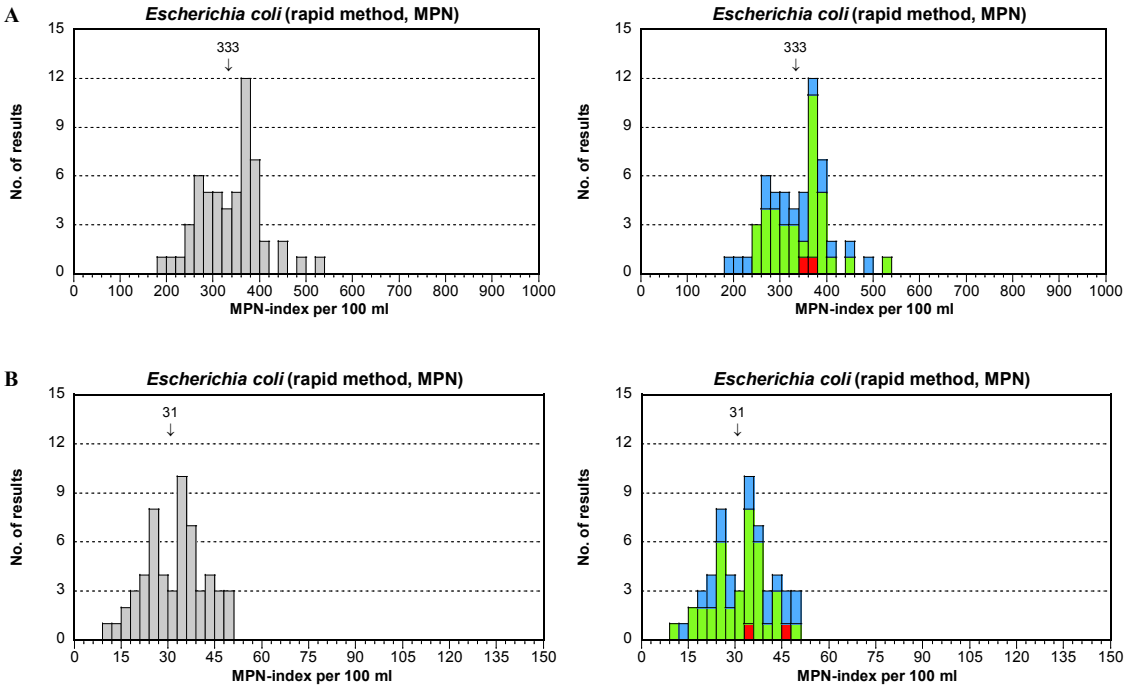
Coliform bacteria, Rapid method with MPN

Medium	Tot	A						B						C					
	n	n	Mv	CV	F	<	>	n	Mv	CV	F	<	>	n	Mv	CV	F	<	>
Total, Rapid meth.	56	56	**535**	13	0	0	0	56	**60**	13	0	0	0	56	**2042**	11	0	0	0
Colilert Quanti-51	17	17	**482**	14	0	0	0	17	**60**	18	0	0	0	17	**1996**	9	0	0	0
Colilert Quanti-97	37	37	**562**	12	0	0	0	37	**60**	11	0	0	0	37	**2076**	11	0	0	0
Colilert Quanti-?	0	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–
Other/Unknown	2	2	**521**	–	0	0	0	2	**60**	–	0	0	0	2	**1800**	–	0	0	0
Not rapid method	0	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–



E. coli, Rapid method with MPN

Medium	Tot	A						B						C					
	n	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>
Total, Rapid meth.	56	56	**333**	10	0	0	0	56	**31**	16	0	0	0	55	**0**	–	1	–	–
Colilert Quanti-51	18	18	**322**	12	0	0	0	18	**32**	18	0	0	0	17	**0**	–	1	–	–
Colilert Quanti-97	36	36	**337**	9	0	0	0	36	**30**	15	0	0	0	35	**0**	–	0	–	–
Colilert Quanti-?	0	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–
Other/Unknown	2	2	**363**	–	0	0	0	2	**39**	–	0	0	0	2	**0**	–	0	–	–
Not rapid method	0	0	–	–	–	–	–	0	–	–	–	–	–	0	–	–	–	–	–



Mixture A

- Both *E. coli* and *C. freundii* are typical coliform bacteria, producing *β*-galactosidase and detected by methods based on the activity of this enzyme (ONPG positive), e.g. Colilert®-18/24 Quanti-Tray® where ONPG is a substrate.
- Only the *E. coli* strain produces *β*-glucuronidase and is detected as *E. coli* by methods based on the activity of this enzyme.
- The average results for both coliform bacteria and *E. coli* were slightly higher with Colilert®-18 Quanti-Tray® compared to the MF-method and had fewer deviating results, as is often the case.

Mixture B

- The strains of *E. coli* and *C. sakazakii* produce the enzyme *β*-galactosidase and contribute to the coliform bacteria obtained with Colilert®-18 Quanti-Tray®.
- The average for coliform bacteria is somewhat higher with this rapid method (61 cfu/100 ml) than with the MF-method (51 cfu/100 ml). For *E. coli* the averages were equal.

Mixture C

- Both *K. oxytoca* and *E. aerogenes* are typical coliform bacteria with the enzyme *β*-galactosidase and were detected based on this enzyme (ONPG positive), e.g. Colilert®-18/24 Quanti-Tray®.
- The average result was somewhat higher with Colilert®-18 Quanti-Tray® compared to the MF-method.
- No strain possesses the enzyme *β*-glucuronidase, implying zero results for *E. coli*. However, one false positive result was reported.

Intestinal enterococci (MF)

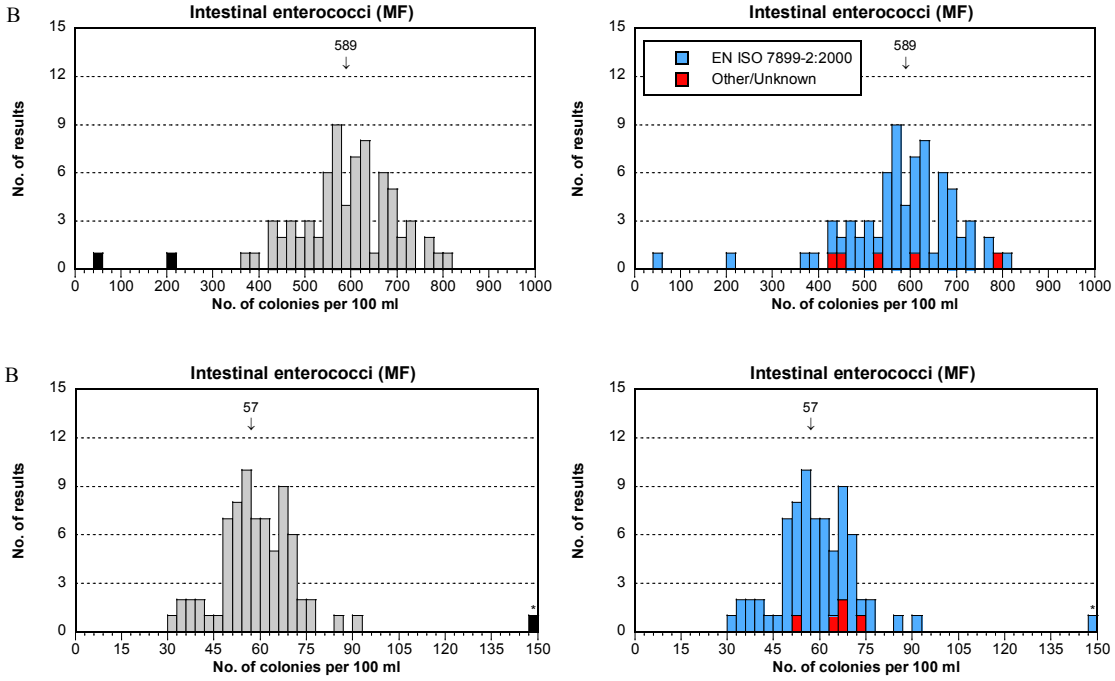
The method XX-EN ISO 7899-2:2000 was almost always used. In only 5 cases another method reference, like national standards, has been stated. Also in these cases the medium m-Enterococcus Agar has been used as primary medium. Sometimes the medium is in the comments referred to as Slanetz & Bartley Agar, which is the same medium. Such comments are sometimes also found when XX-EN ISO 7899-2:2000 is given as reference.

The temperature for incubation was always 36±2 °C, and confirmation was in 77% of the cases performed with Bile-esculine-azide agar (BEA Agar) as is stated in XX-EN ISO 7899-2:2000. Confirmation was in 12% performed on Bile-esculine agar (without azide; BE Agar). It is difficult to know if this difference is real or is due to terminology mixing-up. The temperature for confirmation was in 89% of the laboratories 44 °C and in 7% 44.5 °C.

The method for presumptive intestinal enterococci does not differ for the vast majority of the about 80 results obtained, making most discussions about method differences impossible. There was no difference in the confirmation outcome in relation to BEA Agar or BE Agar.

Intestinal enterococci MF

Standard	**Tot**	**A**						**B**						**C**					
	n	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>
Total	75	72	**589**	8	0	2	0	74	**57**	10	0	0	1	74	**0**	–	0	–	–
EN ISO 7899-2	70	67	**591**	8	0	2	0	69	**57**	10	0	0	1	69	**0**	–	0	–	–
Other	5	5	**554**	13	0	0	0	5	**64**	6	0	0	0	5	**0**	–	0	–	–



Mixture A

- One typical strain of *E. faecalis* was present in the mixture.
- The dispersion of the results was good.

Mixture B

- One strain of *E. hirae* constituted the intestinal enterococci.
- There was also a strain of *Staphylococcus saprophyticus* in the mixture whose colonies appear reddish on m-Ent and in those cases might be counted as suspected intestinal enterococci.
- The dispersion of the results was good.

Pseudomonas aeruginosa (MF)

The method XX-EN ISO 16266:2008 – with or without modification – was used by 59 out of the 62 laboratories reporting results for this analysis. Some of the laboratories have reported the method by reference to the identical, currently withdrawn, CEN standard EN 12780:2002, with or without modification. Incubation was always done at 36±2°C. Except in 5 cases where Pseudomonas Isolation agar was reported, the laboratories used what is interpreted as "Pseudomonas Agar base" with cetrimide and/or nalidixic acid (C/N-supplement). Various confirmation tests were performed when necessary.

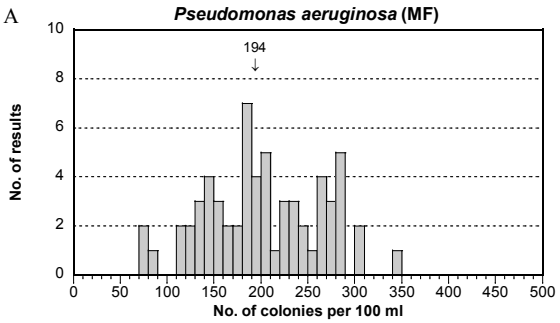
Method and primary medium used do not differ for the majority of the reported results, making any discussion of method or medium issues irrelevant. However, the added supplements differ among the laboratories. Several laboratories reported the addition of both cetrimide and nalidixic acid to the medium. Quite many added only cetrimide, while a few added only nalidixic acid. In 2 laboratories it is not clear which supplement they added.

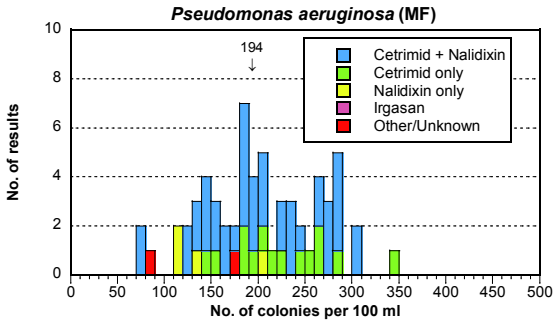
Only mixture A contained *P. aeruginosa*. In spite of few results, the addition of nalidixic acid only seemed to give lowest results with the current strain. This is in accordance with the outcome for one out of two strains in the September round 2012.

Pseudomonas aeruginosa MF

Selective additive	Tot	A						B						C					
	n	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>
Total	75	62	**194**	16	0	0	0	61	**0**	–	0	–	–	61	**0**	–	0	–	–
Cetrimide+Nalidix.	42	42	**196**	16	0	0	0	41	**0**	–	0	–	–	41	**0**	–	0	–	–
Cetrimide	14	14	**220**	12	0	0	0	14	**0**	–	0	–	–	14	**0**	–	0	–	–
Nalidixic acid	4	4	**137**	–	0	0	0	4	**0**	–	0	–	–	4	**0**	–	0	–	–
Irgasan	0	0	–	–	–	–	–	0	**0**	–	–	–	–	0	**0**	–	–	–	–
Other/unknown	2	2	**121**	–	0	0	0	2	**0**	–	0	–	–	2	**0**	–	0	–	–

A





Mixture A

- One typical strain of *P. aeruginosa* was included.
- The distribution of results was good and no deviating results were present.

Mixture B

- Mixture B contained no *P. aeruginosa* and there were no false positive results.

Mixture C

- Mixture C contained no *P. aeruginosa* but another bacterium that can grow on the medium, namely a strain of *Burkholderia cepacia*.
- The strain is atypical with small, pale colonies and will normally be eliminated by confirmation. The strain does not fluoresce on Kings Agar B when illuminated by UV light at 365 nm, which *P. aeruginosa* normally does. The fluorescence as well as the blue green pigmentation is also absent on the primary growth medium.
- No false positive results were present.

Culturable microorganisms 22 °C, 3 days

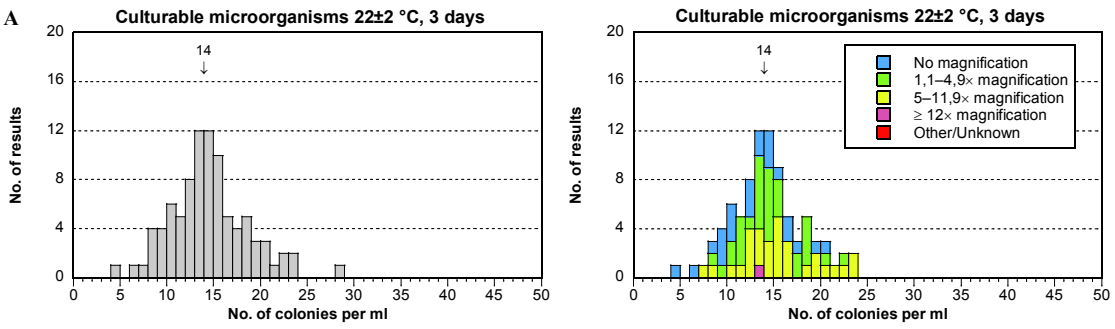
Only 5 out of 91 laboratories reported another method than XX-EN ISO 6222:1999. There were no outliers among these 5 laboratories.

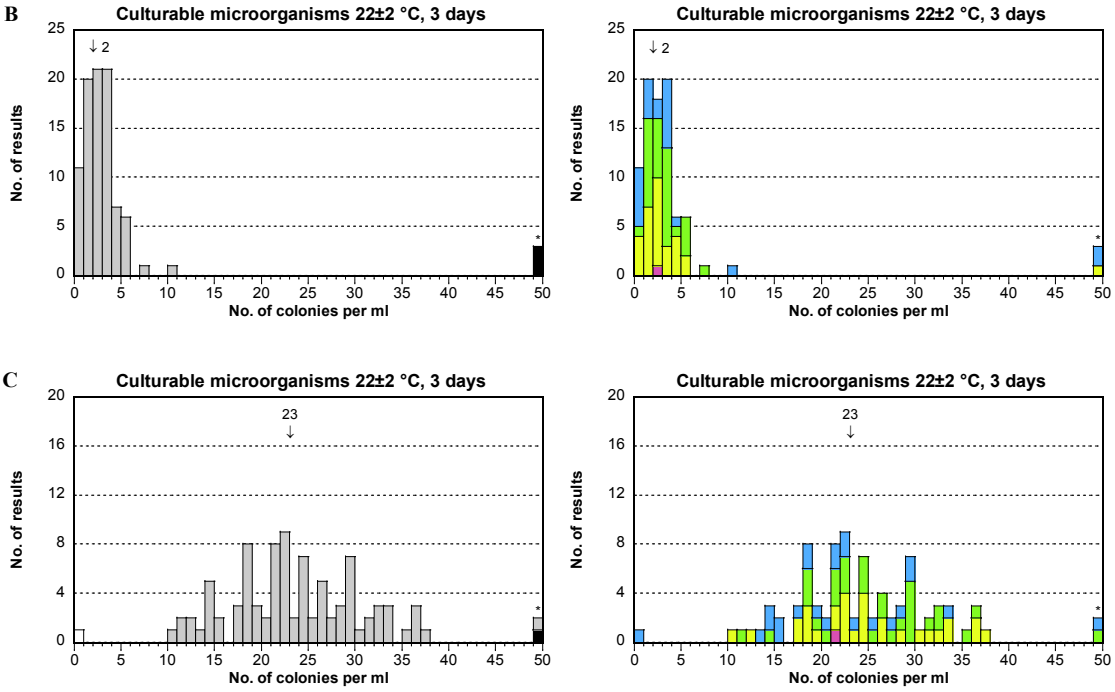
Only comparisons of method variants of the XX-EN ISO 6222:1999 are therefore relevant to discuss. Here, the results are presented in relation to culture media and magnification for reading.

No general pattern can be discerned in terms of medium or magnification. Only one out of 4 deviating results was obtained when the magnification was ≥ 5 times.

22±2 °C, 3 days

Group of results	Tot	A						B						C					
	n	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>
Total, all results	91	90	**14**	15	0	0	0	88	**2**	49	0	0	3	89	**23**	15	1	0	1
EN ISO 6222	*86*	*86*	***14***	*14*	*0*	*0*	*0*	*83*	***2***	*51*	*0*	*0*	*3*	*84*	***23***	*15*	*1*	*0*	*1*
Medium																			
Yeast extract Agar	80	80	**14**	14	0	0	0	77	**2**	51	0	0	3	78	**23**	15	1	0	1
Plate Count Agar	4	4	**10**	–	0	0	0	4	**4**	–	0	0	0	4	**22**	–	0	0	0
Other/Unknown	2	2	**18**	–	0	0	0	2	**4**	–	0	0	0	2	**25**	–	0	0	0
Magnification																			
None	23	23	**12**	17	0	0	0	21	**1**	76	0	0	2	22	**22**	17	1	0	0
1,1–4,9×	32	32	**14**	12	0	0	0	32	**2**	35	0	0	0	31	**24**	13	0	0	1
5–11,9×	30	30	**15**	14	0	0	0	29	**2**	50	0	0	1	30	**24**	15	0	0	0
> 12×	1	1	**13**	–	0	0	0	1	**2**	–	0	0	0	1	**21**	–	0	0	0
Unknown	0	0	**–**	–	–	–	–	0	**–**	–	–	–	–	0	**–**	–	–	–	–
Other method	5	4	**16**	–	0	0	0	5	**3**	17	0	0	0	5	**15**	18	0	0	0





Mixture A

- All strains that grow in any of the reported analyses also grow at 22 °C and contribute to the number of culturable microorganisms.
- No deviating results were present.

Mixture B

- All strains except *S. capitis* will grow as culturable microorganisms at 22 °C. However, all of them were present in low numbers.
- Except for 3 high outliers the distribution of the results was good. The relative dispersion (CV) was high due to the very low average of only 2 cfu/ml.
- Depending on the low average the acceptable zero results will get a z-score < –2. This should not be reckoned as a deviation in the follow-up process.

Mixture C

- All strains present in the mixture grow.
- Two deviating results were identified. The distribution of the results was a bit wide.

Culturable microorganisms 36 °C, 2 days

Only 4 out of 77 laboratories reported another method than XX-EN ISO 6222:1999. There was one high outlier reported from those 4 laboratories.

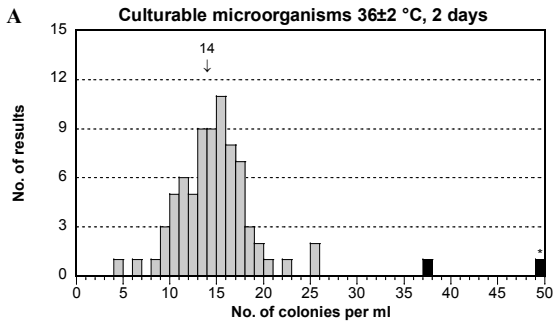
As for the analysis at 22 °C, comparisons of method variants are relevant to discuss only when XX-EN ISO 6222:1999 was used. Also here, the results are presented in relation to culture media and magnification for reading.

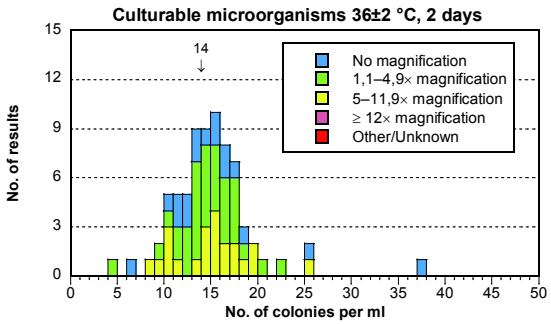
For mixtures A and C the results are very similar to those for the analyses at 22 °C. Even here no general pattern can be discerned in terms of medium or magnification. The results for mixture B at 36 °C are higher than at 22 °C, but even here there is no evident difference between the used method variants.

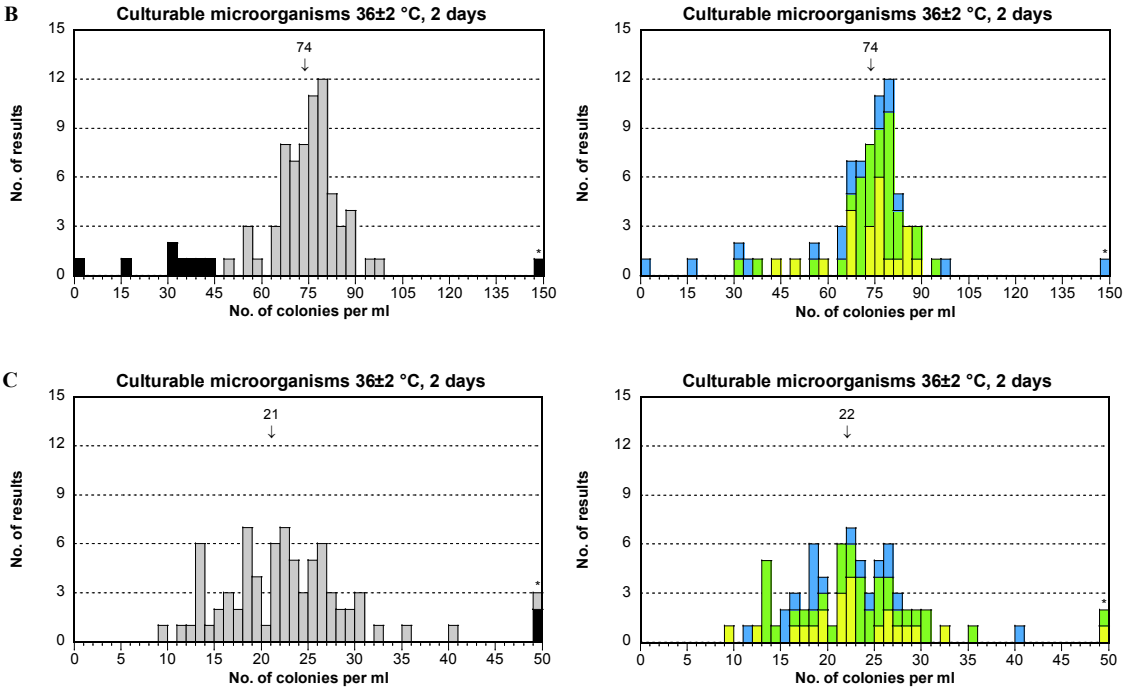
Deviating results were obtained only when low magnification (≤ 5 times) was used.

36±2 °C, 3 days

Group of results	**Tot**	**A**						**B**						**C**					
	n	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>	n	**Mv**	CV	F	<	>
Total, all results	77	75	**14**	13	0	0	2	68	**74**	6	0	8	1	75	**21**	15	0	0	2
EN ISO 6222	*73*	*72*	***14***	*13*	*0*	*0*	*1*	*65*	***74***	*6*	*0*	*7*	*1*	*72*	***22***	*15*	*0*	*0*	*1*
Medium																			
Yeast extract Agar	66	65	**14**	13	0	0	1	61	**75**	6	0	5	0	65	**21**	15	0	0	1
Plate Count Agar	5	5	**16**	17	0	0	0	3	**69**	–	0	1	1	5	**28**	12	0	0	0
Other/Unknown	2	2	**14**	–	0	0	0	1	**88**	–	0	1	0	2	**26**	–	0	0	0
Magnification																			
None	17	16	**14**	15	0	0	1	12	**72**	8	0	4	1	17	**21**	15	0	0	0
1,1–4,9×	34	34	**14**	13	0	0	0	32	**76**	5	0	2	0	33	**22**	13	0	0	1
5–11,9×	22	22	**14**	14	0	0	0	21	**74**	7	0	1	0	22	**22**	17	0	0	0
> 12×	0	0	–	–	0	0	0	0	–	–	0	0	0	0	–	–	0	0	0
Unknown	0	0	–	–	0	0	0	0	–	–	0	0	0	0	–	–	–	–	–
Other method	4	3	**12**	–	0	0	1	3	**69**	–	0	1	0	3	**20**	–	0	0	1







Mixture A

- All strains that grow in any of the reported analyses also grow at 36±2 °C and contribute to the number of culturable microorganisms.
- Except for 2 high outliers there was no problem. The distribution of the results was good.

Mixture B

- All strains grow as culturable microorganisms at 36±2 °C. *S. capitis* that didn't grow at 22 °C was here the most abundant.
- Seven low and one high outlier were present. Aside from these outliers the distribution of the results was good. The reason for the many low results is unclear.

Mixture C

- All strains in the mixture grow as culturable microorganisms at 22 °C.
- Two high outliers were present. The distribution of the results was good.
- The strain of *P. fluorescens* usually doesn't grow at 37 °C. However, this time the difference between the average results at 36 and at 22 °C was insignificant.

Outcome of the results and laboratory assessment

Assessment of the performance

The laboratories are not grouped or ranked in relation to their performances. The assessment is basically a clear description of the number of false results and outliers.

The laboratories that did not report their results in due time, have to compare their results themselves with all other laboratories' by looking in **annex A**.

General information about reported results

The distributions of results for the respective analysis are shown in histograms. A box plot (see below) gives a summarizing image of all the results of a laboratory, except false results. The number of false results and outliers are given below the plot for a particular laboratory to summarize its performance. These values are highlighted with bold text and colour background in **annex A**, where all laboratories' reported results are compiled. The limit values for lowest and highest accepted results are given for each analysis in the summarizing lines at the end of annex A, together with the measurement uncertainty of the mean.

Mixed up samples or results

When it is evident that a laboratory has mixed up results it is mentioned in the text. If whole samples seem to have been mixed up, the respective sample numbers are hatched in annex A. Perhaps have two laboratories this time mixed up the results for coliform bacteria for two sample mixtures.

Z-scores, box plots and deviating results for each laboratory

The square root transformed results of the laboratories are calculated to standard scores, z-scores, to be comparable between analyses. They are shown in **annex B** but are not evaluated more elaborately. They are given explicitly to facilitate the follow-up process for the laboratories using z-scores.

The z-scores are the base for the box plots. The range of the z-scores for each laboratory is shown by a rectangle (box) and lines and/or circles above and beneath the box. The smaller the range from lowest to highest value is in the plot and the more centred around zero the values are, the better is the agreement between the particular laboratory's results and the means obtained from all laboratories' results.

Box plots and numbers of deviating results for each participating laboratory

- *Z-scores are calculated from the formula z = (x – mv) / s*
- *Z-scores > +4 and < –4 have been set to +4 and –4, respectively.*
- *False results do not generate z-scores and are not included in 'No. of results'. False positive results cannot be illustrated in the box plots.*
- *The outliers are included in the plots after recalculation to standardised values with the same standard deviation (s) as the rest of the results.*
- *The numbers of false positives and false negatives are given in the table under the plots together with the numbers of outliers.*
- *The horizontal red line in each box indicates the median for the laboratory.*
- *The box includes 25% of the results above and below the median. The lines protruding from the box and/or the circles embrace the remaining 50% of the results, false results excluded.*
- *A circle is shown when a result is highly deviating* from the rest.*
- *The background is divided into coloured fields in order to simplify localization of the laboratory results.*

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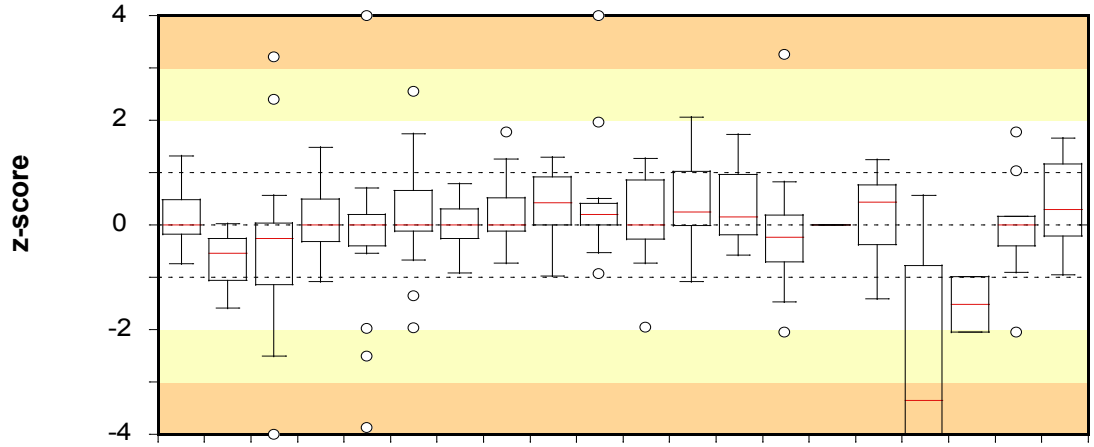
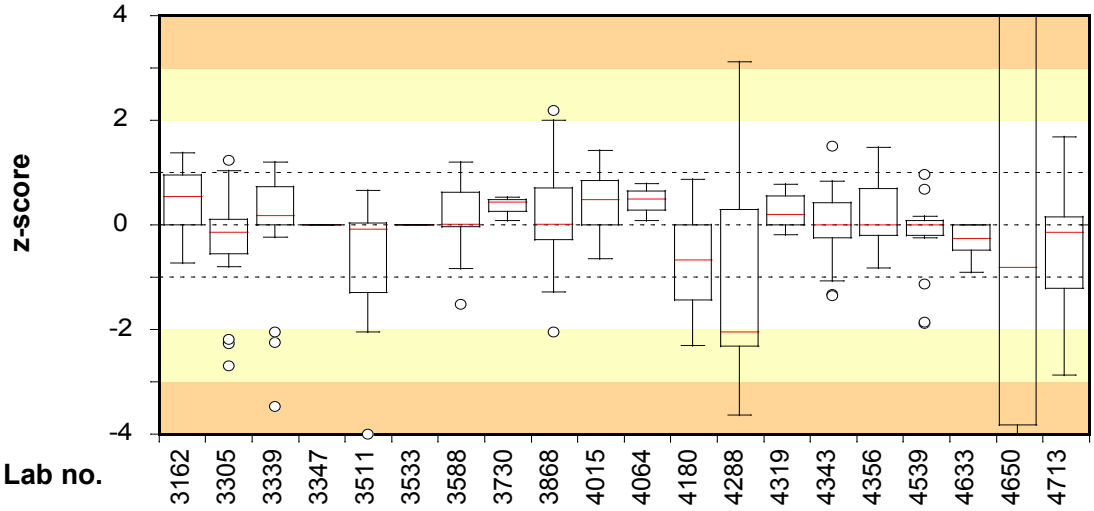
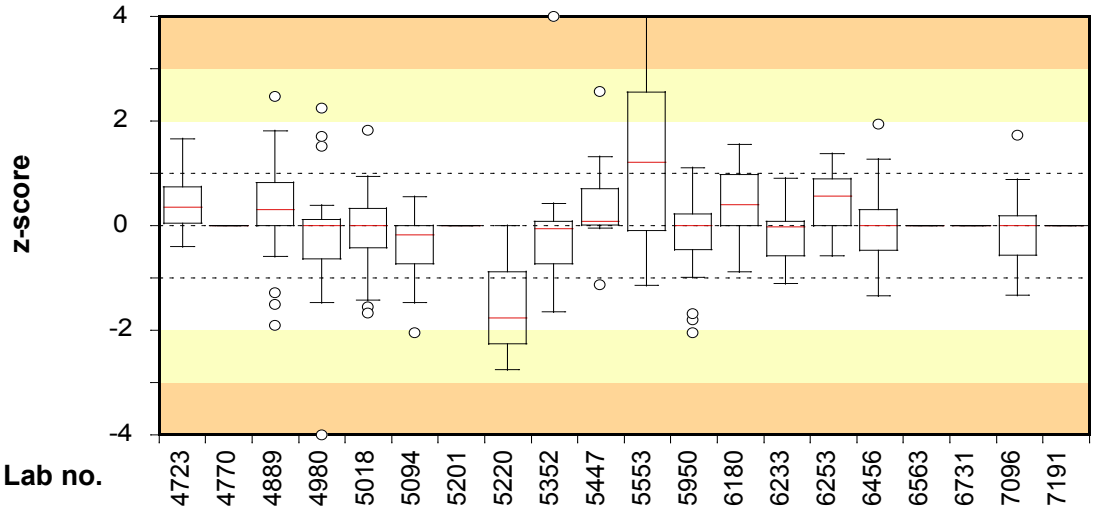
* < [smallest value of the box - 1.5 × (largest value of the box - smallest value of the box)] *or* > [largest value of the box + 1.5 × (largest value of the box - smallest value of the box)]



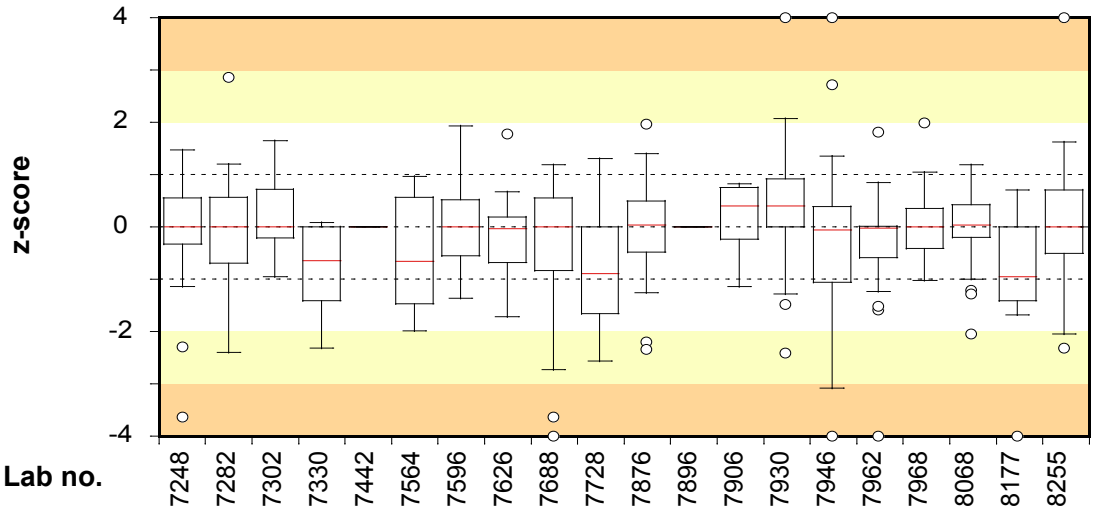
Lab no.	1131	1149	1237	1254	1290	1545	1594	1611	1753	1868	1970	2050	2386	2637	2670	2704	2745	3055	3076	3159
No. of results	15	3	24	24	15	18	24	24	24	15	18	24	18	15	-	20	8	2	9	15
False positive	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
False negative	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Low outliers	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
High outliers	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-



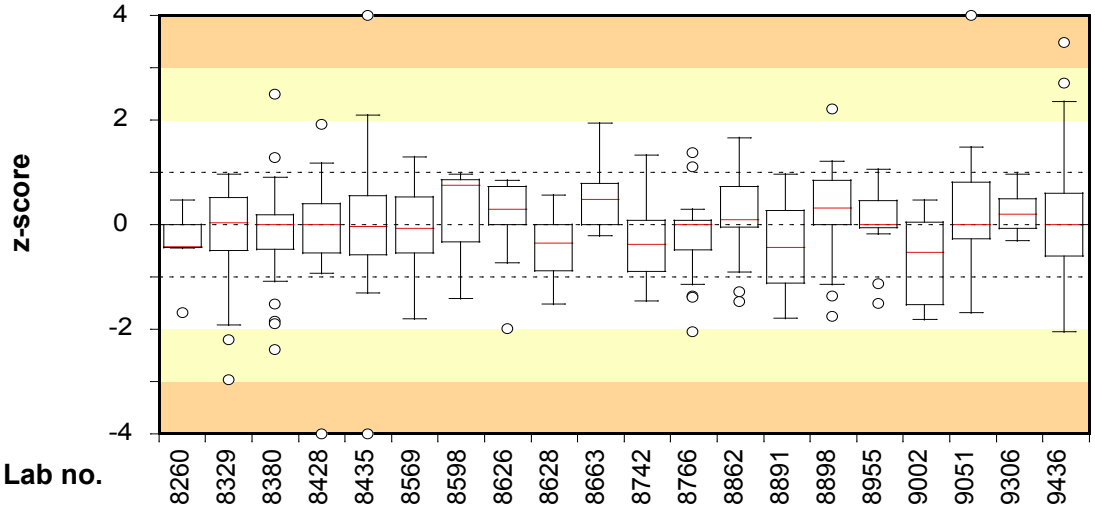
Lab no.	3162	3305	3339	3347	3511	3533	3588	3730	3868	4015	4064	4180	4288	4319	4343	4356	4539	4633	4650	4713
No. of results	24	24	18	-	15	-	18	3	24	18	3	15	5	21	24	24	18	9	6	24
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Low outliers	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	2	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-



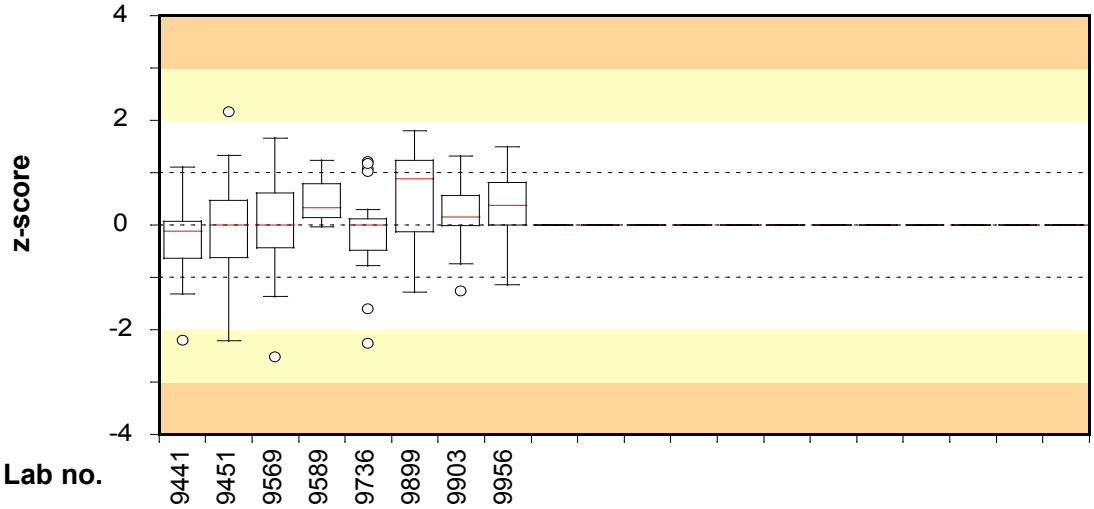
Lab no.	4723	4770	4889	4980	5018	5094	5201	5220	5352	5447	5553	5950	6180	6233	6253	6456	6563	6731	7096	7191
No. of results	12	-	21	24	24	9	-	3	18	15	6	23	24	18	9	21	-	-	18	-
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-



Lab no.	7248	7282	7302	7330	7442	7564	7596	7626	7688	7728	7876	7896	7906	7930	7946	7962	7968	8068	8177	8255
No. of results	24	15	24	14	-	6	24	24	24	18	24	-	6	23	24	24	24	24	21	24
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Low outliers	1	-	-	-	-	-	-	-	2	-	-	-	-	-	1	1	-	-	1	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-	1



Lab no.	8260	8329	8380	8428	8435	8569	8598	8626	8628	8663	8742	8766	8862	8891	8898	8955	9002	9051	9306	9436
No. of results	9	24	23	15	18	9	3	9	17	24	6	24	24	3	24	15	12	18	12	24
False positive	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-



Lab no.	9441	9451	9569	9589	9736	9899	9903	9956
No. of results	12	12	24	3	24	19	18	24
False positive	-	-	-	-	-	-	-	-
False negative	-	-	-	-	-	-	-	-
Low outliers	-	-	-	-	-	-	-	-
High outliers	-	-	-	-	-	-	-	-

Test material, quality controls and processing of data

Test material and its content

The test material was manufactured and freeze-dried in portions of 0.5 ml in small vials, according to the description by Peterz and Steneryd (2). This round comprised three test items with different microorganism mixtures. 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 and concentrations of each mixture is listed in **Table 2**. The participating laboratories were assigned to perform the analyses according to the methods routinely used on drinking water samples.

The test material is primarily adapted to the EN ISO methods for analyses of drinking water referred to in the European Drinking water directive (4). Alternative methods may usually also be used without any problem.

Table 2 *Microorganisms present in the mixtures*

Mixture [1]	**Microorganisms**	**Strain no.**	**cfu/100 ml** [2]
A	*Escherichia coli*	SLV-084	360
	Citrobacter freundii	SLV-091	320
	Enterococcus faecalis	SLV-051	700
	Pseudomonas aeruginosa	SLV-395	200
	Clostridium perfringens	SLV-442	330
B	*Cronobacter sakazakii*	SLV-419	21
	Escherichia coli	SLV-082	32
	Enterococcus hirae	SLV-536	57
	Staphylococcus saprophyticus	SLV-013	100
	Staphylococcus capitis	SLV-463	83 *
C	*Klebsiella oxytoca*	SLV-089	1300
	Enterobacter aerogenens	SLV-099	900
	Burkholderia cepacia	SLV-042	20
	Pseudomonas fluorescens	SLV-535	12 *

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

2 cfu = colony forming units; * indicates cfu per ml; at the times given in note 1 of table 3

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 13 to 41 vials of each mixture and the biggest differences between vials were 6, 5 and 3 mg for mixture A, B and C, respectively. The highest accepted volume variation is 15 mg (3%). **Table 3** presents the results from the

organizer in the form of concentration means (cfu) and coefficients of variation (CV) from duplicate analyses of 10 vials (in two mixtures about 5) from each mixture. The results relate to the volume at which the colonies were counted. According to the criteria for the CVs used they were acceptable for the mixtures to be considered homogenous. The highest accepted CV normally is 25%. For very low colony counts a higher CV is accepted.

Table 3 *Contents (cfu) and measures of homogeneity (CV; coefficient of variation in per cent) in relevant sample volumes for the various parameters in the mixtures* [1]

Analysis parameter ***Method standard for analysis***	**Mixture**					
	A		**B**		**C**	
	cfu	**CV**	**cfu**	**CV**	**cfu**	**CV**
Coliform bacteria (MF) *m-Endo Agar LES according to SS 028167*	90	3 [a]	52	3	21	7 [b]
Suspected thermo-tolerant colif. bact. (MF) *m-FC Agar, 44 °C according to SS 028167*	39	6 [a]	36	6 [c]	–	–
Escherichia coli (MF) *m-Endo Agar LES according to SS 028167*	48	5 [a]	32	4	–	–
Intestinal enterococci (MF) *m-Enterococcus Agar acc. to SS-EN ISO 7899-2:2000*	93	4 [a]	57	2	–	–
Pseudomonas aeruginosa (MF) *Pseudomonas Agar base med cetrimide and nalidixic acid according to SS-EN ISO 16288:2008*	27	9 [a]	–	–	–	–
Culturable microorg., 2d 37 °C (pour plate) *Yeast extract Agar according to SS-EN ISO 6222:1999*	41	7	85	3	26	6
Culturable microorg., 3d 22 °C (pour plate) *Yeast extract Agar according to SS-EN ISO 6222:1999*	43	5	[d]	[d]	36	5

1 n=10 vials (n=4-5 in mixture A and B according to a stability test of previously tested mixtures) analysed in duplicate, normally100 ml for MF and 1 ml for pour plate, 19, 10 and 13 weeks ahead of the testing round for the mixtures A, B and C, respectively (sample volume was 300 ml in A)

a Result for 5 ml

b Result for 1 ml

c Including both *E. coli* and *C. sakazakii*

d Analysis not performed as only individual colonies will grow, giving very large CV

– No target organism and thus no analysis

Processing of numerical results

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 that give better normal distributions by decreasing the significance of the high end “tails”. Very deviating values are still present in most

analyses and are identified as outliers (black bars). False negative results are presented with white bars in the histograms.

Outliers are identified by use of Grubbs' test according to a modification by Kelly (3). 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 at the 1% level. A zero result that is a low outlier is considered as a false negative result. In special situations, e.g. when many zero results are reported and in some borderline cases, a few subjective adjustments are made in order to set the right limits based on the knowledge of the mixture's contents. False results and outliers are not included in the calculations.

The coefficient of variation (CV) for square root transformed results is given as a measure of dispersion. When 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.

The calculation of uncertainty of measurement of the assigned value is described in the scheme protocol (1). The assigned value for an analysis is calculated from the square root transformed results and is the square root of "Mean" in Annex A, and there denoted as mv. Hence, also the measurement uncertainty will be expressed in the square root form. 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 after multiplication by 100.

More about result processing and recommendations on follow-up work are given in the scheme protocol (1). A PDF of that document is available on the website www.slv.se/absint.

References

1. Anonymous 2012. Scheme protocol, Microbiology, Drinking water & Food. The National Food Agency, Sweden.
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. Kelly, K. 1990. Outlier detection in collaborative studies. J. Assoc. Off. Chem. 73:58-64.
4. 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 *(national translations available)*.
5. Standard Methods for the Examination of Water and Wastewater, http://www.standardmethods.org/

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****. 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*

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	1 3 2	470	53	2070	470	53	2070	-	-	-	330	29	0	517	52	2419	387	24	0
1149	3 2 1	300	32	2300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1237	1 2 3	-	-	-	410	100	1300	-	-	-	322	**70**	0	429	41	1652	364	19	0
1254	3 1 2	500	47	1350	500	47	1200	-	-	-	300	22	0	600	62	1600	370	23	0
1290	1 2 3	-	-	-	180	**<1**	440	-	-	-	**72**	**<1**	**440**	-	-	-	-	-	-
1545	2 3 1	625	50	1700	305	50	1700	300	35	0	300	35	0	-	-	-	-	-	-
1594	1 3 2	480	41	1800	480	41	1800	152	25	0	305	27	0	429	56	2184	283	34	0
1611	1 2 3	480	64	2900	480	64	2900	190	27	0	340	26	0	517	58	1961	365	33	0
1753	1 2 3	696	69	2018	696	69	2018	-	-	-	391	41	0	681	60	2246	394	22	0
1868	1 2 3	524	55	1760	524	55	1760	-	-	-	352	33	0	563	57	1658	368	26	0
1970	1 2 3	660	73	2100	660	39	2100	380	51	0	380	26	0	-	-	-	-	-	-
2050	2 3 1	-	-	-	709	58	855	-	-	-	436	37	0	395	69	2376	270	49	0
2386	1 2 3	720	80	2600	720	80	2600	360	96	0	360	50	0	-	-	-	-	-	-
2637	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	580	56	3700	390	21	<1
2670	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2704	1 3 2	-	-	-	590	36	1400	-	-	-	430	34	**1120**	697	78	2380	406	38	<1
2745	3 1 2	52	3	210	**52**	**3**	210	29	2	110	**29**	**2**	**110**	-	-	-	-	-	-
3055	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3076	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3159	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	504	83.1	1652	453	45.3	<1
3162	3 2 1	580	64	2200	580	64	2200	-	-	-	390	35	<1	677	84	2410	399	32	<1
3305	1 3 2	-	-	-	460	15	2000	-	-	-	300	13	0	430	29	2000	360	13	0
3339	2 3 1	630	64	2100	630	64	2100	-	-	-	410	37	0	-	-	-	-	-	-
3347	3 2 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3511	3 2 1	-	-	-	-	-	-	-	-	-	-	-	-	288	34	2005	222	24	0
3533	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3588	3 2 1	615	50	1886	615	50	1886	370	34	0	370	18	0	-	-	-	-	-	-
3730	1 2 3	720	64	1200	-	-	-	240	64	0	-	-	-	-	-	-	-	-	-
3868	3 2 1	510	43	2400	510	43	2400	240	20	0	260	32	0	660	41	3100	480	24	0
4015	3 1 2	660	61	2000	660	61	2000	300	48	0	391	37	0	730	50	2400	360	28	0
4064	3 1 2	-	-	-	570	52	2050	-	-	-	-	-	-	-	-	-	-	-	-
4180	3 2 1	-	-	-	200	30	1150	-	-	-	200	24	0	-	-	-	-	-	-
4288	1 2 3	-	-	-	**90**	**<10**	325	-	-	-	-	-	-	-	-	-	-	-	-
4319	1 3 2	580	61	1850	580	61	1850	338	40	0	320	33	0	565	73	1986	376	31	0
4343	2 1 3	541	49	1586	541	49	1586	-	-	-	369	25	**<9**	436	44	2420	250	19	<1
4356	2 3 1	700	46	2200	700	46	2200	230	17	0	430	30	0	550	86	1700	410	34	<1
4539	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	530	56	2000	380	29	0
4633	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4650	3 2 1	-	-	-	**23**	12	**23**	12	12	9.2	-	-	-	-	-	-	-	-	-
4713	3 1 2	210	46	1800	210	46	1800	77	23	0	140	37	0	210	70	2000	210	50	0
4723	3 1 2	613	56	2000	613	56	2000	-	-	-	357	35	0	-	-	-	-	-	-
4770	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4889	3 1 2	-	-	-	560	64	1100	-	-	-	560	51	0	580	77	1300	240	37	0
4980	3 2 1	500	80	750	500	80	750	210	49	0	210	31	0	591	101.3	2005	344	50.4	<1
5018	2 3 1	310	60	560	280	60	560	-	-	-	280	30	<1	820	62	2420	330	37	<1
5094	1 3 2	560	49	1640	-	-	-	550	31	0	300	31	0	-	-	-	-	-	-
5201	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5220	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5352	2 1 3	583	39	1770	460	39	1770	228	28	0	228	28	0	-	-	-	-	-	-
5447	3 1 2	-	-	-	518	51	1500	-	-	-	311	21	0	-	-	-	-	-	-
5553	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5950	2 1 3	530	63	1000	530	63	1000	290	26	<1	405	29	<1	465	66	2204	310	43	<10
6180	3 1 2	625	69	935	625	69	935	385	57	0	345	35	0	620	80	2010	343	40	0
6233	2 3 1	-	-	-	-	-	-	330	49	0	-	-	-	495	45	1590	296	24	0
6253	2 3 1	-	-	-	-	-	-	-	-	-	-	-	-	727	75	1800	377	33	0
6456	1 3 2	-	-	-	543	43	1681	-	-	-	315	20	0	418	95	2011	344	45	0
6563	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6731	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7096	2 1 3	-	-	-	520	67	1520	-	-	-	290	50	0	-	-	-	-	-	-
7191	3 2 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7248	3 1 2	565	62	818	565	62	818	129	23	0	452	46	0	656	75	2110	382	33	0
7282	3 1 2	-	-	-	-	-	-	-	-	-	144	25	0	-	-	-	-	-	-
7302	2 1 3	518	73	900	518	73	900	-	-	-	345	49	<10	576	55	1733	327	26	<1
7330	1 2 3	-	-	-	-	-	-	-	-	-	250	21	0	-	-	-	-	-	-
7442	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7564	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7596	~~2 3~~ 1	570	64	1850	570	64	1850	210	43	0	210	23	0	411	46	1986	261	33	0
7626	1 3 2	262	62	859	262	62	859	267	53	0	267	27	0	432	66	1640	292	38	0
7688	2 3 1	-	-	-	160	65	1600	-	-	-	**82**	43	0	370	57	1700	280	44	0
7728	2 1 3	-	-	-	230	23	1800	-	-	-	190	23	0	-	-	-	-	-	-
7876	3 2 1	445	40	1790	445	40	1790	-	-	-	445	32	<1	662	64	1720	369	34	<1
Mean					**490**	**51**	**1467**				**315**	**31**	**0**	**535**	**60**	**2042**	**333**	**31**	**0**
CV (%)					16	17	23				13	16	-	13	13	11	10	16	-

are excluded, as well as other outliers, in the summarizing calculated results at the end of the table. The mean value (Mean) is the square of the mean value for the square root transformed results (mv). The coefficient of variation (CV) is the standard deviation (s) in percentage of the mean value for the square root transformed results. As means to calculate the z-values of your own, the appropriate values of mv and s are given at the end of the table. The x-values are obtained as the square roots of the 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 (1); also briefly described in the text.*

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				
-	-	-	-	-	-	-	-	-	-	-	-	14	1	33	-	-	-	**1131**
-	-	-	-	-	-	-	-	-	-	-	-	8	1	23	-	-	-	**1149**
-	-	-	370	33	0	-	-	-	210	0	0	10	3	21	9	**40**	18	**1237**
550	76	0	550	76	0	270	0	160	270	0	0	14	3	31	17	70	21	**1254**
-	-	-	600	**670**	<1	-	-	-	190	<1	<1	15	1	21	13	81	25	**1290**
770	81	0	770	37	0	240	0	0	240	0	0	15	5	22	25	68	26	**1545**
625	59	0	625	59	0	141	0	108	141	0	0	13	3	21	17	80	21	**1594**
520	73	0	520	73	0	200	0	0	200	0	0	22	3	22	13	82	23	**1611**
691	51	0	691	51	0	284	0	0	284	0	0	14	1	29	14	78	25	**1753**
1054	55	0	-	-	-	-	-	-	-	-	-	23	**87**	24	-	-	-	**1868**
610	50	0	610	50	0	280	0	0	280	0	0	13	2	21	19	57	28	**1970**
-	-	-	664	53	0	-	-	-	345	0	0	12	2	37	16	74	32	**2050**
560	61	0	560	61	0	160	0	0	160	0	0	13	4	25	17	70	18	**2386**
-	-	-	460	54	<1	-	-	-	-	-	-	14	<1	28	13	72	13	**2637**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2670**
-	-	-	540	67	0	-	-	-	-	-	-	10	3	14	13	80	18	**2704**
-	-	-	-	-	-	-	-	-	-	-	-	9	3	21	-	-	-	**2745**
-	-	-	-	-	-	-	-	-	-	-	-	10	0	**0**	-	-	-	**3055**
-	-	-	-	-	-	190	0	0	190	0	0	22	0	24	18	66	19	**3076**
-	-	-	680	70	0	-	-	-	-	-	-	13	5	29	12	77	17	**3159**
691	121	<1	691	69	<1	200	<1	<1	200	<1	<1	18	1	18	15	80	25	**3162**
540	60	0	540	60	0	280	0	0	280	0	0	13	1	19	18	78	20	**3305**
390	61	0	390	61	0	180	0	0	180	0	0	14	0	28	4	80	30	**3339**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3347**
-	-	-	**58**	56	0	-	-	-	-	-	-	14	1	24	15	74	26	**3511**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**3533**
510	101	0	510	61	0	275	0	0	275	0	0	17	1	32	14	70	25	**3588**
-	-	-	-	-	-	-	-	-	-	-	-	16	2	26	-	-	-	**3730**
580	50	0	580	50	0	230	0	0	230	0	0	14	0	23	18	80	27	**3868**
736	85	0	736	62	0	-	-	-	-	-	-	14	2	31	-	-	-	**4015**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4064**
-	-	-	610	68	0	-	-	-	-	-	-	6	2	13	10	68	18	**4180**
-	-	-	-	-	-	-	-	-	-	-	-	15	<10	50	-	-	-	**4288**
630	58	0	630	58	0	-	-	-	-	-	-	13	3	26	14	80	22	**4319**
658	108	0	658	61	0	189	0	0	189	0	0	16	2	28	15	89	19	**4343**
550	55	0	550	55	0	220	0	0	220	0	0	13	1	22	11	87	23	**4356**
420	79	1	420	38	0	130	15	81	130	0	0	18	2	24	14	75	22	**4539**
-	-	-	564	52	0	-	-	-	177	0	0	-	-	-	11	74	16	**4633**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**140**	88	**65**	**4650**
620	64	0	620	64	0	110	0	42	110	0	0	13	1	18	13	64	14	**4713**
600	55	0	600	53	0	-	-	-	-	-	-	19	2	36	-	-	-	**4723**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4770**
-	-	-	700	69	0	-	-	-	200	0	0	9	3	29	-	-	-	**4889**
560	48	0	560	48	0	170	0	0	170	0	0	15	1	18	13	**30**	13	**4980**
570	66	<1	570	66	<1	115	<1	<1	115	<1	<1	11	2	20	13	70	28	**5018**
550	46	0	-	-	-	-	-	-	-	-	-	12	0	18	16	76	13	**5094**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**5201**
430	87	0	430	30	0	-	-	-	-	-	-	-	-	-	-	-	-	**5220**
478	40	0	478	40	0	200	0	146	200	0	0	13	**76**	22	11	75	22	**5352**
-	-	-	691	91	0	-	-	-	-	-	-	17	2	33	15	75	26	**5447**
-	-	-	580	45	**<1,0**	-	-	-	-	-	-	-	-	-	25	**161**	40	**5553**
>100	53	<1	**>100**	53	<100	180	<1	<1	180	<1	<1	10	<1	21	8	76	12	**5950**
620	50	0	620	50	0	220	0	0	220	0	0	18	5	35	16	88	29	**6180**
564	57	0	564	57	0	205	0	0	205	0	0	11	2	29	12	83	23	**6233**
545	66	0	-	-	-	-	-	-	-	-	-	20	1	27	-	-	-	**6253**
-	-	-	560	43	0	-	-	-	-	-	-	10	3	29	13	63	22	**6456**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**6563**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**6731**
-	-	-	600	50	0	-	-	-	120	0	0	12	3	18	16	65	18	**7096**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**7191**
608	34	0	608	34	0	140	0	0	140	0	0	15	1	22	10	**44**	21	**7248**
-	-	-	520	72	0	-	-	-	250	0	0	28	2	12	15	67	30	**7282**
636	65	<1	636	65	<1	300	<1	<1	300	<1	<1	13	4	32	17	72	16	**7302**
-	-	-	430	52	0	-	-	-	192	0	0	-	2	14	11	54	13	**7330**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**7442**
-	-	-	-	-	-	-	-	-	-	-	-	18	3	11	12	67	13	**7564**
580	49	0	580	49	0	280	0	0	280	0	0	14	5	24	22	71	30	**7596**
775	52	0	775	52	0	141	0	15	141	0	0	13	3	18	15	75	21	**7626**
-	-	-	**200**	67	0	-	-	-	73	0	0	11	3	26	16	79	27	**7688**
-	-	-	723	58	0	-	-	-	123	0	0	8	1	14	6	66	11	**7728**
473	66	<1	473	66	<1	155	<1	<1	155	<1	<1	23	2	10	19	75	9	**7876**
			589	**57**	**0**				**194**	**0**	**0**	**14**	**2**	**23**	**14**	**74**	**21**	**Mean**
			8	10	-				16	-	-	15	49	15	13	6	15	**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
7896	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7906	1 2 3	610	2155	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7930	2 3 1	620	54	2200	620	54	2200	-	-	-	350	41	<1	624	50	2400	192	18	**2400**
7946	3 1 2	490	290	900	470	**280**	900	480	60	980	180	**85**	0	350	46	1800	350	46	0
7962	1 3 2	460	51	1470	460	51	1470	178	28	0	310	51	0	517	66	1414	308	40	0
7968	2 3 1	430	50	1700	430	50	1700	200	22	0	280	35	0	477	46	2992	275	28	0
8068	2 3 1	570	58	1800	570	58	1800	300	23	0	340	40	0	380	67	2000	270	35	0
8177	2 1 3	380	39	690	380	39	690	-	-	-	340	20	0	410	36	1650	290	22	0
8255	1 3 2	-	-	-	390	53	2300	-	-	-	390	40	0	620	53	2000	450	24	0
8260	2 3 1	428	126	555	428	59	555	278	44	<1	278	27	<1	-	-	-	-	-	-
8329	3 1 2	518	35	1950	518	35	1950	-	-	-	332	35	0	411	69	1203	276	36	0
8380	1 3 2	-	-	-	450	18	**>100**	-	-	-	360	18	<1	730	34	1600	520	15	<1
8428	2 3 1	-	-	-	-	-	-	-	-	-	270	33	0	-	-	-	-	-	-
8435	1 3 2	310	64	2300	310	64	2300	231	29	0	310	25	0	-	-	-	-	-	-
8569	2 1 3	710	42	1420	710	42	1420	380	24	0	380	16	0	-	-	-	-	-	-
8598	1 2 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8626	3 1 2	630	39	1700	630	39	1500	380	39	0	380	39	0	-	-	-	-	-	-
8628	2 1 3	-	-	-	364	54	627	-	-	-	240	32	**627**	-	-	-	-	-	-
8663	2 1 3	610	49	2000	550	49	2000	280	14	0	370	29	0	770	63	2400	370	39	0
8742	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8766	1 3 2	330	30	1110	330	30	1110	190	25	<1	165	19	<1	548	64	1986	307	33	<1
8862	3 1 2	708	83	736	708	83	736	-	-	-	390	45	0	480	71	2000	361	34	0
8891	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8898	1 3 2	565	59	2270	565	59	2270	-	-	-	332	26	0	707	40	2437	390	16	0
8955	2 3 1	-	-	-	-	-	-	300	38	0	300	30	0	390	78	2400	240	31	<1
9002	2 1 3	-	-	-	290	30	1800	-	-	-	180	30	0	-	-	-	-	-	-
9051	2 3 1	745	209	554	745	**209**	554	727	55	0	436	33	0	-	-	-	-	-	-
9306	1 3 2	-	-	-	-	-	-	-	-	-	-	-	-	539	55	2091	324	29	0
9436	1 3 2	573	58	745	573	58	745	573	58	745	273	58	<1	980	71	1986	344	37	<1
9441	3 1 2	-	-	-	-	-	-	-	-	-	-	-	-	515	61	1510	301	43	<1
9451	2 1 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9569	1 3 2	350	45	2000	350	45	2000	180	7	<1	210	25	<1	517	40	2000	365	11	<1
9589	1 2 3	-	-	-	700	50	1700	-	-	-	-	-	-	-	-	-	-	-	-
9736	2 1 3	514	27	2273	514	27	2273	-	-	-	279	13	0	547	48	2599	326	26	0
9899	1 3 2	622	67	730	622	67	730	282	28	-	486	45	-	477	84	2627	314	42	-
9903	2 3 1	488	44	2267	488	44	2267	255	37	0	255	20	0	-	-	-	-	-	-
9956	3 2 1	600	65	2100	600	65	2100	-	-	-	300	33	0	687	64	2420	261	38	0
n		56	56	56	72	72	71	39	39	38	73	73	72	56	56	56	56	56	55
Min		52	3	42	23	0	23	12	2	0	29	0	0	210	29	1203	192	11	0
Max		745	2155	2900	745	280	2900	727	96	980	560	85	1120	980	101.3	3700	520	50.4	2400
Median		562.5	57	1780	518	53	1700	278	31	0	321	31	0	534.5	61.5	2000	344	33	0
Mean					**490**	**51**	**1467**				**315**	**31**	**0**	**535**	**60**	**2042**	**333**	**31**	**0**
CV (%)					16	17	23				13	16	-	13	13	11	10	16	-
False positive		-	-	-	0	0	0	-	-	-	0	0	4	0	0	0	0	0	1
False negative		-	-	-	0	2	0	-	-	-	0	1	0	0	0	0	0	0	0
Outliers, low		-	-	-	3	1	1	-	-	-	3	1	0	0	0	0	0	0	0
Outliers, high		-	-	-	0	2	0	-	-	-	0	2	0	0	0	0	0	0	0
Low limit OK		52	3	42	160	12	210	12	2	0	140	13	0	210	29	1203	192	11	0
High limit OK		745	2155	2900	745	100	2900	727	96	980	560	58	0	980	102	3700	520	51	0
mv *(√Mean)*					22.140	7.117	38.307				17.749	5.566	0.000	23.140	7.735	45.184	18.246	5.566	0.000
s *(CV*mv/100)*					3.476	1.202	8.773				2.393	0.870	0.000	3.016	1.035	4.790	1.825	0.895	0.000
$u_{rel,mv}$ (%) *(100*s/ √n_{mv})*					1.9	2.1	2.7				1.6	1.9		1.7	1.8	1.4	1.3	2.1	
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				
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7896
-	-	-	-	-	-	-	-	-	-	-	-	17	3	29	10	72	23	7906
570	68	<1	570	68	<1	280	<1	<1	280	<1	<1	9	2	**2700**	16	95	**1800**	7930
500	75	0	480	70	0	190	0	0	75	0	0	4	10	22	11	**30**	25	7946
450	57	0	450	57	0	156	0	0	156	0	0	16	1	15	17	**15**	16	7962
695	68	0	695	68	0	135	0	145	135	0	0	12	2	22	14	78	24	7968
710	54	0	710	54	0	220	0	0	220	0	0	9	0	18	15	75	26	8068
670	100	0	660	60	0	-	-	-	-	-	-	8	2	14	9	**36**	13	8177
-	-	-	720	56	0	-	-	-	130	0	0	12	0	20	**37**	54	18	8255
-	-	-	-	-	-	-	-	-	-	-	-	12	2	22	-	-	-	8260
677	110	0	677	64	0	188	0	0	188	0	0	7	4	24	17	49	22	8329
-	-	-	660	50	<1	-	-	-	180	<1	<1	15	2	21	13	83	22	8380
-	-	-	790	65	0	-	-	-	140	0	0	19	3	17	12	**34**	23	8428
810	54	0	810	54	0	180	0	0	180	0	0	12	**94**	19	16	**1**	15	8435
-	-	-	-	-	-	-	-	-	-	-	-	16	1	19	-	-	-	8569
-	-	-	-	-	-	-	-	-	-	-	-	17	4	14	-	-	-	8598
-	-	-	-	-	-	-	-	-	-	-	-	15	3	11	-	-	-	8626
-	-	-	555	57	0	-	-	-	160	0	0	16	3	15	11	70	15	8628
630	77	0	630	75	0	230	0	0	230	0	0	15	7	32	17	73	35	8663
-	-	-	-	-	-	-	-	-	-	-	-	13	5	17	9	75	18	8742
590	54	<1	590	54	<1	190	<1	<1	190	<1	<1	20	2	17	15	85	21	8766
454	67	0	454	67	0	300	0	273	300	0	0	15	1	24	14	66	26	8862
-	-	-	-	-	-	-	-	-	-	-	-	12	4	12	-	-	-	8891
573	134	0	573	86	0	264	0	0	264	0	0	14	3	26	10	86	27	8898
610	66	0	610	66	0	-	-	-	260	0	0	-	-	-	-	-	-	8955
-	-	-	500	40	0	-	-	-	-	-	-	8	2	26	-	-	-	9002
673	59	0	673	54	0	185	0	0	185	0	0	14	1	21	14	82	19	9051
-	-	-	-	-	-	-	-	-	-	-	-	18	4	25	15	80	24	9306
509	58	<1	509	58	<1	236	<1	200	236	<1	<1	11	<1	36	10	68	50	9436
-	-	-	-	-	-	-	-	-	-	-	-	14	1	18	15	55	21	9441
490	55	0	490	55	0	80	0	0	80	0	0	11	5	27	12	96	24	9451
550	69	<1	540	69	<1	270	<1	<1	270	<1	<1	20	3	36	15	71	26	9569
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9589
572	70	0	572	70	0	154	0	129	154	0	0	19	1	22	14	77	22	9736
622	85	-	622	51	-	245	-	-	245	-	-	21	4	30	14	86	17	9899
625	64	0	625	64	0	264	0	0	264	0	0	15	3	33	16	72	29	9903
670	55	0	670	55	0	260	0	0	260	0	0	10	3	29	20	79	19	9956
54	55	54	74	75	74	47	46	46	62	61	61	90	91	91	77	77	77	n
390	34	0	58	30	0	80	0	0	73	0	0	4	0	0	4	1	9	Min
1054	134	1	810	670	0	300	15	273	345	0	0	28	94	2700	140	161	1800	Max
585	61	0	595	57.5	0	200	0	0	191	0	0	14	2	22	14	75	22	Median
			589	**57**	**0**				**194**	**0**	**0**	**14**	**2**	**23**	**14**	**74**	**21**	Mean
			8	10	-				16	-	-	15	49	15	13	6	15	CV (%)
-	-	-	0	0	0	-	-	-	0	0	0	0	0	0	0	0	0	False pos.
-	-	-	0	0	0	-	-	-	0	0	0	0	0	1	0	0	0	False neg.
-	-	-	2	0	0	-	-	-	0	0	0	0	0	0	0	8	0	Outliers <
-	-	-	0	1	0	-	-	-	0	0	0	0	3	1	2	1	2	Outliers >
390	34	0	370	30	0	80	0	0	73	0	0	4	0	10	4	49	9	Low limit
1054	134	1	810	91	0	300	15	273	345	0	0	28	10	50	25	96	50	High limit
			24.263	7.581	0.000				13.934	0.000	0.000	3.707	1.356	4.778	3.727	8.614	4.636	mv
			2.005	0.764	0.000				2.254	0.000	0.000	0.554	0.663	0.734	0.498	0.545	0.699	s
			1.0	1.2					2.1			1.6	5.2	1.6	1.5	0.8	1.7	$u_{rel,mv}$ (%)
																		x
																		z

Annex B *Z-scores calculated from the laboratory results. Susp. = Suspected on the membrane filters before confirmation. z = (x - mv) / s. Z-scores are calculated also for outliers (excluding false negative results) in the same way as ordinary z-scores. 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	1 3 2				-0,133	0,136	0,820				0,174	-0,208	0,000	-0,134	-0,506	0,835	0,782	-0,745	0,000
1149	3 2 1																		
1237	1 2 3				-0,544	**2,398**	-0,257				0,082	**3,219**	0,000	-0,805	-1,287	-0,948	0,456	-1,348	0,000
1254	3 1 2				0,064	-0,217	-0,418				-0,179	-1,006	0,000	0,449	0,134	-1,082	0,542	-0,860	0,000
1290	1 2 3				**-2,509**		-1,976				**-3,871**								
1545	2 3 1				-1,345	-0,038	0,333				-0,179	0,403	0,000						
1594	1 3 2				-0,067	-0,594	0,470				-0,119	-0,425	0,000	-0,805	-0,243	0,323	-0,780	0,297	0,000
1611	1 2 3				-0,067	0,734	1,772				0,289	-0,537	0,000	-0,134	-0,115	-0,188	0,471	0,200	0,000
1753	1 2 3				1,220	0,989	0,754				0,846	0,962	0,000	0,980	0,011	0,461	0,879	-0,978	0,000
1868	1 2 3				0,216	0,249	0,416				0,423	0,205	0,000	0,195	-0,179	-0,932	0,514	-0,521	0,000
1970	1 2 3				1,021	-0,725	0,857				0,729	-0,537	0,000						
2050	2 3 1				1,291	0,415	-1,034				1,309	0,594	0,000	-1,083	0,552	0,743	-0,994	1,602	0,000
2386	1 2 3				1,350	1,520	1,446				0,512	1,730	0,000						
2637	1 2 3													0,313	-0,243	**3,266**	0,823	-1,098	0,000
2670	2 1 3																		
2704	1 3 2				0,619	-0,929	-0,102				1,249	0,305		1,081	1,060	0,752	1,043	0,669	0,000
2745	3 1 2				**-4,000**	**-4,000**	**-2,715**				**-4,000**	**-4,000**							
3055	2 3 1																		
3076	2 3 1																		
3159	3 1 2													-0,229	1,334	-0,948	1,664	1,301	0,000
3162	3 2 1				0,559	0,734	0,980				0,836	0,403	0,000	0,954	1,382	0,816	0,947	0,102	0,000
3305	1 3 2				-0,199	**-2,698**	0,731				-0,179	**-2,253**	0,000	-0,797	**-2,271**	-0,097	0,399	**-2,189**	0,000
3339	2 3 1				0,851	0,734	0,857				1,045	0,594	0,000						
3347	3 2 1																		
3511	3 2 1													**-2,046**	-1,840	-0,085	-1,833	-0,745	0,000
3533	3 1 2																		
3588	3 2 1				0,765	-0,038	0,584				0,621	-1,521	0,000						
3730	1 2 3																		
3868	3 2 1				0,128	-0,465	1,218				-0,679	0,105	0,000	0,845	-1,287	**2,191**	**2,007**	-0,745	0,000
4015	3 1 2				1,021	0,577	0,731				0,846	0,594	0,000	1,286	-0,642	0,795	0,399	-0,306	0,000
4064	3 1 2				0,499	0,078	0,795												
4180	3 2 1				**-2,301**	-1,364	-0,501				-1,507	-0,767	0,000						
4288	1 2 3				**-3,640**		**-2,312**												
4319	1 3 2				0,559	0,577	0,536				0,059	0,205	0,000	0,209	0,782	-0,129	0,627	0,003	0,000
4343	2 1 3				0,322	-0,097	0,173				0,610	-0,650	0,000	-0,749	-1,065	0,837	-1,334	-1,348	0,000
4356	2 3 1				1,242	-0,278	0,980				1,249	-0,102	0,000	0,103	1,487	-0,825	1,097	0,297	0,000
4539	1 2 3													-0,039	-0,243	-0,097	0,684	-0,202	0,000
4633	1 3 2																		
4650	3 2 1				**-4,000**	**-3,038**	**-3,820**												
4713	3 1 2				**-2,200**	-0,278	0,470				**-2,472**	0,594	0,000	**-2,867**	0,610	-0,097	**-2,057**	1,682	0,000
4723	3 1 2				0,753	0,305	0,731				0,479	0,403	0,000						
4770	2 1 3																		
4889	3 1 2				0,439	0,734	-0,586				**2,472**	1,811	0,000	0,313	1,005	-1,906	-1,509	0,578	0,000
4980	3 2 1				0,064	1,520	-1,245				-1,361	0,002	0,000	0,388	**2,251**	-0,085	0,165	1,713	0,000
5018	2 3 1				-1,555	0,523	-1,669				-0,424	-0,102	0,000	1,822	0,134	0,837	-0,044	0,578	0,000
5094	1 3 2										-0,179	0,002	0,000						
5201	2 1 3																		
5220	1 2 3																		
5352	2 1 3				-0,199	-0,725	0,429				-1,107	-0,315	0,000						
5447	3 1 2				0,178	0,020	0,048				-0,047	-1,130	0,000						
5553	3 1 2																		
5950	2 1 3				0,254	0,682	-0,762				0,993	-0,208	0,000	-0,523	0,376	0,368	-0,350	1,108	0,000
6180	3 1 2				0,823	0,989	-0,881				0,345	0,403	0,000	0,583	1,169	-0,073	0,150	0,848	0,000
6233	2 3 1													-0,296	-0,992	-1,109	-0,570	-0,745	0,000
6253	2 3 1													1,267	0,894	-0,576	0,641	0,200	0,000
6456	1 3 2				0,334	-0,465	0,307				0,000	-1,257	0,000	-0,894	1,944	-0,071	0,165	1,276	0,000
6563	1 3 2																		
6731	3 1 2																		
7096	2 1 3				0,191	0,889	0,078				-0,301	1,730	0,000						
7191	3 2 1																		
7248	3 1 2				0,469	0,630	-1,106				1,468	1,398	0,000	0,820	0,894	0,157	0,712	0,200	0,000
7282	3 1 2										**-2,402**	-0,650	0,000						
7302	2 1 3				0,178	1,187	-0,947				0,345	1,649	0,000	0,285	-0,308	-0,742	-0,089	-0,521	0,000
7330	1 2 3										-0,810	-1,130	0,000						
7442	1 3 2																		
7564	3 1 2																		
7596	2 3 1				0,499	0,734	0,536				-1,361	-0,885	0,000	-0,951	-0,921	-0,129	-1,145	0,200	0,000
7626	1 3 2				-1,713	0,630	-1,026				-0,589	-0,425	0,000	-0,781	0,376	-0,979	-0,634	0,669	0,000
7688	2 3 1				**-2,730**	0,786	0,193				**-3,633**	1,140	0,000	-1,295	-0,179	-0,825	-0,829	1,193	0,000
7728	2 1 3				**-2,006**	-1,930	0,470				-1,657	-0,885	0,000						
7876	3 2 1				-0,301	-0,659	0,456				1,398	0,105	0,000	0,858	0,256	-0,775	0,528	0,297	0,000
7896	3 1 2																		
7906	1 2 3																		
7930	2 3 1				0,794	0,193	0,980				0,401	0,962	0,000	0,610	-0,642	0,795	**-2,405**	-1,478	
7946	3 1 2				-0,133	**4,000**	-0,947				-1,810	**4,000**	0,000	-1,469	-0,921	-0,576	0,253	1,359	0,000
7962	1 3 2				-0,199	0,020	0,004				-0,059	1,811	0,000	-0,134	0,376	-1,583	-0,381	0,848	0,000
7968	2 3 1				-0,404	-0,038	0,333				-0,424	0,403	0,000	-0,431	-0,921	1,987	-0,911	-0,306	0,000
8068	2 3 1				0,499	0,415	0,470				0,289	0,872	0,000	-1,209	0,435	-0,097	-0,994	0,392	0,000
8177	2 1 3				-0,761	-0,725	-1,372				0,289	-1,257	0,000	-0,959	-1,677	-0,953	-0,666	-0,978	0,000
8255	1 3 2				-0,688	0,136	1,100				0,836	0,872	0,000	0,583	-0,440	-0,097	1,626	-0,745	0,000
8260	2 3 1				-0,418	0,469	-1,681				-0,449	-0,425	0,000						
8329	3 1 2				0,178	-0,999	0,667				0,197	0,403	0,000	-0,951	0,552	**-2,192**	-0,894	0,485	0,000
8380	1 3 2				-0,267	**-2,390**					0,512	-1,521	0,000	1,286	-1,840	-1,082	**2,497**	-1,891	0,000
8428	2 3 1										-0,550	0,205	0,000						

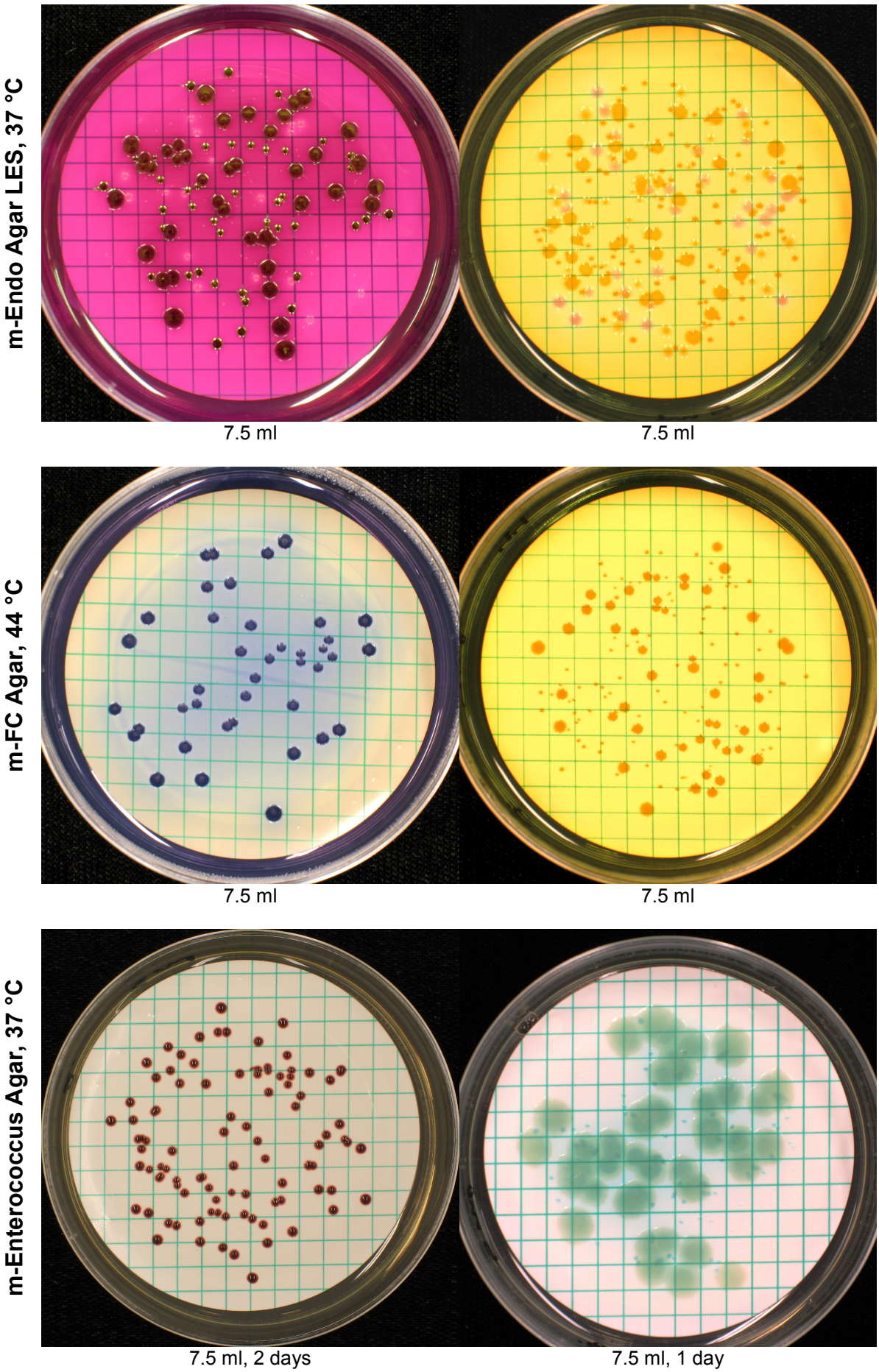
positive results can no z-scores be calculated. Z-scores from outliers are not real z-scores but a practical means to express also the results from the outliers. Very low and high values are here limited to –4 and +4, respectively.

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	
												0,063	-0,536	1,317				1131
												-1,586	-0,536	0,025				1149
			-2,507	-2,405	0,000				0,247	0,000	0,000	-0,983	0,568	-0,266	-1,460	-4,000	-0,563	1237
			-0,405	1,488	0,000				1,108	0,000	0,000	0,063	0,568	1,076	0,796	-0,455	-0,076	1254
			0,116	4,000	0,000				-0,066	0,000	0,000	0,300	-0,536	-0,266	-0,244	0,707	0,521	1290
			1,738	-1,962	0,000				0,691	0,000	0,000	0,300	1,327	-0,119	2,557	-0,675	0,663	1545
			0,367	0,131	0,000				-0,913	0,000	0,000	-0,183	0,568	-0,266	0,796	0,605	-0,076	1594
			-0,728	1,260	0,000				0,093	0,000	0,000	1,776	0,568	-0,119	-0,244	0,809	0,229	1611
			1,009	-0,576	0,000				1,295	0,000	0,000	0,063	-0,536	0,828	0,030	0,399	0,521	1753
												1,966	4,000	0,165				1868
			0,217	-0,668	0,000				1,242	0,000	0,000	-0,183	0,088	-0,266	1,270	-1,953	0,939	1970
			0,751	-0,395	0,000				2,059	0,000	0,000	-0,438	0,088	1,778	0,549	-0,022	1,461	2050
			-0,299	0,300	0,000				-0,570	0,000	0,000	-0,183	0,971	0,303	0,796	-0,455	-0,563	2386
			-1,404	-0,305	0,000							0,063	-2,044	0,700	-0,244	-0,237	-1,475	2637
																		2670
			-0,511	0,791	0,000							-0,983	0,568	-1,412	-0,244	0,605	-0,563	2704
												-1,276	0,568	-0,266				2745
												-0,983	-2,044					3055
									-0,066	0,000	0,000	1,776	-2,044	0,165	1,036	-0,899	-0,397	3076
			0,904	1,028	0,000							-0,183	1,327	0,828	-0,528	0,295	-0,734	3159
			1,009	0,950	0,000				0,093	0,000	0,000	0,967	-0,536	-0,729	0,294	0,605	0,521	3162
			-0,511	0,215	0,000				1,242	0,000	0,000	-0,183	-0,536	-0,571	1,036	0,399	-0,235	3305
			-2,251	0,300	0,000				-0,229	0,000	0,000	0,063	-2,044	0,700	-3,468	0,605	1,204	3339
																		3347
			-4,000	-0,129	0,000							0,063	-0,536	0,165	0,294	-0,022	0,663	3511
																		3533
			-0,838	0,300	0,000				1,175	0,000	0,000	0,751	-0,536	1,198	0,030	-0,455	0,521	3588
												0,529	0,088	0,438				3730
			-0,090	-0,668	0,000				0,547	0,000	0,000	0,063	-2,044	0,025	1,036	0,605	0,802	3868
			1,429	0,383	0,000							0,063	0,088	1,076				4015
																		4064
			0,217	0,870	0,000							-2,270	0,088	-1,597	-1,134	-0,675	-0,563	4180
												0,300	-2,044	3,124				4288
			0,417	0,045	0,000							-0,183	0,568	0,438	0,030	0,605	0,078	4319
			0,692	0,300	0,000				-0,082	0,000	0,000	0,529	0,088	0,700	0,294	1,504	-0,397	4343
			-0,405	-0,216	0,000				0,399	0,000	0,000	-0,183	-0,536	-0,119	-0,824	1,308	0,229	4356
			-1,880	-1,855	0,000				-1,123	0,000	0,000	0,967	0,088	0,165	0,030	0,084	0,078	4539
			-0,257	-0,485	0,000				-0,279	0,000	0,000				-0,824	-0,022	-0,910	4633
															4,000	1,406	4,000	4650
			0,318	0,548	0,000				-1,528	0,000	0,000	-0,183	-0,536	-0,729	-0,244	-1,127	-1,280	4713
			0,116	-0,395	0,000							1,177	0,088	1,665				4723
																		4770
			1,094	0,950	0,000				0,093	0,000	0,000	-1,276	0,568	0,828				4889
			-0,299	-0,855	0,000				-0,397	0,000	0,000	0,300	-0,536	-0,729	-0,244	-4,000	-1,475	4980
			-0,194	0,710	0,000				-1,424	0,000	0,000	-0,705	0,088	-0,416	-0,244	-0,455	0,939	5018
												-0,438	-2,044	-0,729	0,549	0,190	-1,475	5094
																		5201
			-1,759	-2,755	0,000													5220
			-1,197	-1,646	0,000				0,093	0,000	0,000	-0,183	4,000	-0,119	-0,824	0,084	0,078	5352
			1,009	2,564	0,000							0,751	0,088	1,317	0,294	0,084	0,663	5447
			-0,090	-1,143	0,000										2,557	4,000	2,417	5553
				-0,395	0,000				-0,229	0,000	0,000	-0,983	-2,044	-0,266	-1,804	0,190	-1,678	5950
			0,318	-0,668	0,000				0,399	0,000	0,000	0,967	1,327	1,551	0,549	1,406	1,073	6180
			-0,257	-0,041	0,000				0,170	0,000	0,000	-0,705	0,088	0,828	-0,528	0,910	0,229	6233
												1,382	-0,536	0,570				6253
			-0,299	-1,341	0,000							-0,983	0,568	0,828	-0,244	-1,242	0,078	6456
																		6563
																		6731
			0,116	-0,668	0,000				-1,322	0,000	0,000	-0,438	0,568	-0,729	0,549	-1,013	-0,563	7096
																		7191
			0,197	-2,292	0,000				-0,932	0,000	0,000	0,300	-0,536	-0,119	-1,134	-3,634	-0,076	7248
			-0,728	1,183	0,000				0,833	0,000	0,000	2,861	0,088	-1,790	0,294	-0,787	1,204	7282
			0,477	0,630	0,000				1,502	0,000	0,000	-0,183	0,971	1,198	0,796	-0,237	-0,910	7302
			-1,759	-0,485	0,000				-0,034	0,000	0,000		0,088	-1,412	-0,824	-2,322	-1,475	7330
																		7442
												0,967	0,568	-1,991	-0,528	-0,787	-1,475	7564
			-0,090	-0,761	0,000				1,242	0,000	0,000	0,063	1,327	0,165	1,936	-0,345	1,204	7596
			1,783	-0,485	0,000				-0,913	0,000	0,000	-0,183	0,568	-0,729	0,294	0,084	-0,076	7626
			-4,000	0,791	0,000				-2,391	0,000	0,000	-0,705	0,568	0,438	0,549	0,502	0,802	7688
			1,309	0,045	0,000				-1,261	0,000	0,000	-1,586	-0,536	-1,412	-2,566	-0,899	-1,889	7728
			-1,254	0,710	0,000				-0,658	0,000	0,000	1,966	0,088	-2,201	1,270	0,084	-2,342	7876
																		7896
												0,751	0,568	0,828	-1,134	-0,237	0,229	7906
			-0,194	0,870	0,000				1,242	0,000	0,000	-1,276	0,088	4,000	0,549	2,077	4,000	7930
			-1,174	1,028	0,000				-2,339	0,000	0,000	-3,082	2,724	-0,119	-0,824	-4,000	0,521	7946
			-1,521	-0,041	0,000				-0,640	0,000	0,000	0,529	-0,536	-1,233	0,796	-4,000	-0,910	7962
			1,047	0,870	0,000				-1,027	0,000	0,000	-0,438	0,088	-0,119	0,030	0,399	0,377	7968
			1,188	-0,305	0,000				0,399	0,000	0,000	-1,276	-2,044	-0,729	0,294	0,084	0,663	8068
			0,712	0,215	0,000							-1,586	0,088	-1,412	-1,460	-4,000	-1,475	8177
			1,281	-0,129	0,000				-1,123	0,000	0,000	-0,438	-2,044	-0,416	4,000	-2,322	-0,563	8255
												-0,438	0,088	-0,119				8260
			0,876	0,548	0,000				-0,099	0,000	0,000	-1,916	0,971	0,165	0,796	-2,961	0,078	8329
			0,712	-0,668	0,000				-0,229	0,000	0,000	0,300	0,088	-0,266	-0,244	0,910	0,078	8380
			1,917	0,630	0,000				-0,932	0,000	0,000	1,177	0,568	-0,892	-0,528	-4,000	0,229	8428

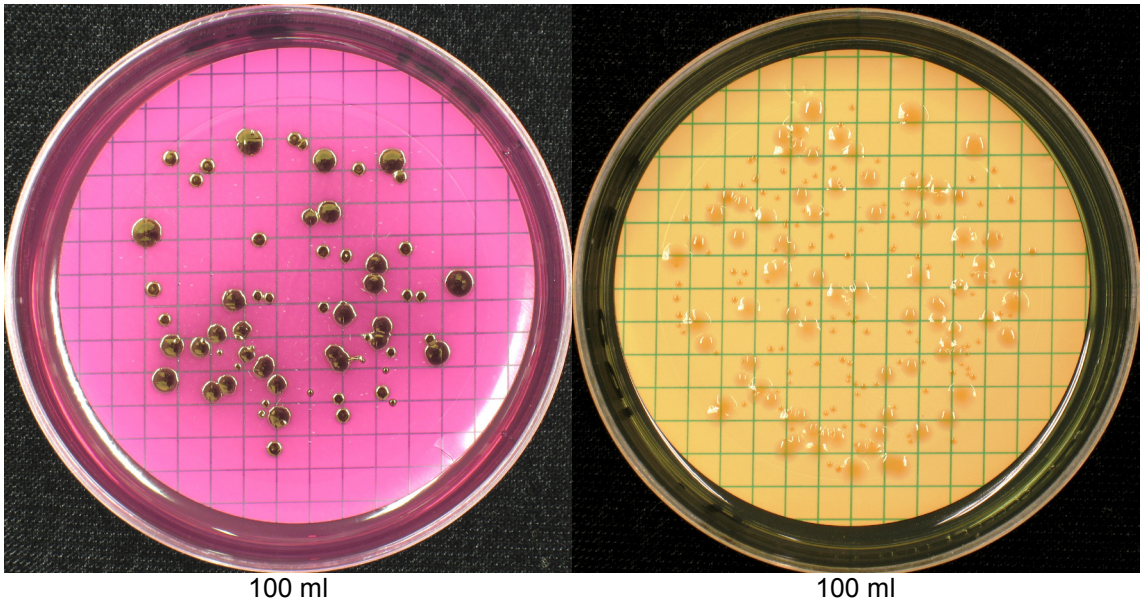
Lab no.	Sample			Suspected coliform bacteria (MF)			Coliform bacteria (MF)			Susp. thermotolerant coliform bact. (MF)			*E. coli* (MF)			Coliform bacteria ("rapid" MPN)			*E. coli* ("rapid" MPN)		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
8435	1	3	2				-1,304	0,734	1,100				-0,059	-0,650	0,000						
8569	2	1	3				1,296	-0,529	-0,071				0,729	-1,800	0,000						
8598	1	2	3																		
8626	3	1	2				0,851	-0,725	0,048				0,729	0,781	0,000						
8628	2	1	3				-0,881	0,193	-1,512				-0,943	0,105							
8663	2	1	3				0,377	-0,097	0,731				0,621	-0,208	0,000	1,528	0,195	0,795	0,542	0,759	0,000
8742	1	3	2																		
8766	1	3	2				-1,143	-1,364	-0,569				**-2,049**	-1,387	0,000	0,089	0,256	-0,129	-0,397	0,200	0,000
8862	3	1	2				1,285	1,658	-1,274				0,836	1,313	0,000	-0,408	0,668	-0,097	0,413	0,297	0,000
8891	3	1	2																		
8898	1	3	2				0,469	0,469	1,064				0,197	-0,537	0,000	1,144	-1,363	0,873	0,823	-1,749	0,000
8955	2	3	1										-0,179	-0,102	0,000	-1,125	1,060	0,795	-1,509	0,003	0,000
9002	2	1	3				-1,470	-1,364	0,470				-1,810	-0,102	0,000						
9051	2	3	1				1,483	**4,000**	-1,684				1,309	0,205	0,000						
9306	1	3	2													0,025	-0,308	0,113	-0,135	-0,202	0,000
9436	1	3	2				0,517	0,415	-1,255				-0,512	**2,356**	0,000	**2,707**	0,668	-0,129	0,165	0,578	0,000
9441	3	1	2													-0,148	0,073	-1,321	-0,491	1,108	0,000
9451	2	1	3																		
9569	1	3	2				-0,987	-0,340	0,731				-1,361	-0,650	0,000	-0,134	-1,363	-0,097	0,471	**-2,512**	0,000
9589	1	2	3				1,242	-0,038	0,333												
9736	2	1	3				0,153	-1,597	1,068				-0,437	**-2,253**	0,000	0,082	-0,780	1,210	-0,104	-0,521	0,000
9899	1	3	2				0,805	0,889	-1,287				1,796	1,313		-0,431	1,382	1,267	-0,288	1,022	
9903	2	3	1				-0,014	-0,402	1,061				-0,744	-1,257	0,000						
9956	3	2	1				0,677	0,786	0,857				-0,179	0,205	0,000	1,018	0,256	0,837	-1,145	0,669	0,000
n				0	0	0	72	70	71	0	0	0	73	72	68	56	56	56	56	56	54
Min							-4,000	-4,000	-3,820				-4,000	-4,000	0,000	-2,867	-2,271	-2,192	-2,405	-2,512	0,000
Max							1,483	4,000	1,772				2,472	4,000	0,000	2,707	2,251	3,266	2,497	1,713	0,000
Median							0,178	0,136	0,333				0,000	0,053	0,000	-0,007	0,104	-0,097	0,165	0,200	0,000
Mean							-0,162	0,057	-0,054				-0,158	0,045	0,000	0,000	0,000	0,000	0,000	0,000	0,000
SD							1,252	1,284	1,091				1,244	1,246	0,000	1,000	1,000	1,000	1,000	1,000	0,000
z<-3							3	2	1				3	1	0	0	0	0	0	0	0
-3≤z<-2							5	2	2				3	2	0	2	1	1	2	2	0
2<z≤3							0	1	0				1	1	0	1	1	1	2	0	0
z>3							0	2	0				0	2	0	0	0	1	0	0	0

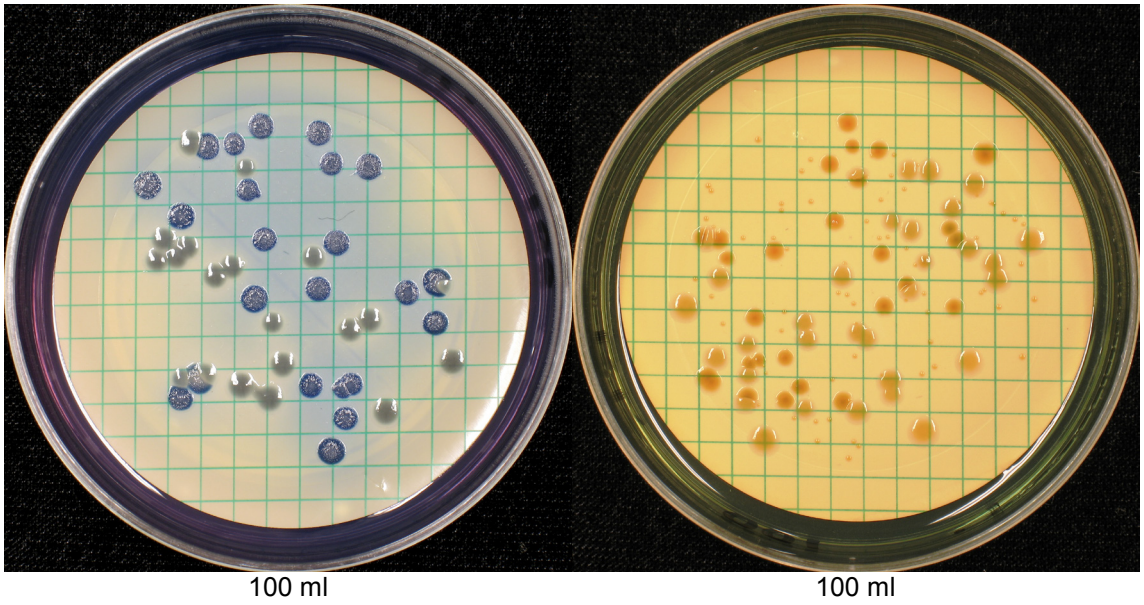
Susp. intestinal enterococci (MF)			Intestinal enterococci (MF)			Susp. *Pseudomonas aeruginosa* (MF)			*Pseudomonas aeruginosa* (MF)			Total plate count 22 °C, 3 days			Total plate count 36±2 °C, 2 days			Lab no.
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
			2,093	-0,305	0,000				-0,229	0,000	0,000	-0,438	**4,000**	-0,571	0,549	**-4,000**	-1,092	**8435**
												0,529	-0,536	-0,571				**8569**
												0,751	0,971	-1,412				**8598**
												0,300	0,568	-1,991				**8626**
			-0,351	-0,041	0,000				-0,570	0,000	0,000	0,529	0,568	-1,233	-0,824	-0,455	-1,092	**8628**
			0,417	1,413	0,000				0,547	0,000	0,000	0,300	1,945	1,198	0,796	-0,129	1,833	**8663**
												-0,183	1,327	-0,892	-1,460	0,084	-0,563	**8742**
			0,013	-0,305	0,000				-0,066	0,000	0,000	1,382	0,088	-0,892	0,294	1,110	-0,076	**8766**
			-1,474	0,791	0,000				1,502	0,000	0,000	0,300	-0,536	0,165	0,030	-0,899	0,663	**8862**
												-0,438	0,971	-1,790				**8891**
			-0,162	**2,216**	0,000				1,027	0,000	0,000	0,063	0,568	0,438	-1,134	1,209	0,802	**8898**
			0,217	0,710	0,000				0,972	0,000	0,000							**8955**
			-0,949	-1,646	0,000							-1,586	0,088	0,438				**9002**
			0,837	-0,305	0,000				-0,147	0,000	0,000	0,063	-0,536	-0,266	0,030	0,809	-0,397	**9051**
												0,967	0,971	0,303	0,294	0,605	0,377	**9306**
			-0,849	0,045	0,000				0,634	0,000	0,000	-0,705	**-2,044**	1,665	-1,134	-0,675	**3,486**	**9436**
												0,063	-0,536	-0,729	0,294	**-2,198**	-0,076	**9441**
			-1,061	-0,216	0,000				**-2,213**	0,000	0,000	-0,705	1,327	0,570	-0,528	**2,171**	0,377	**9451**
			-0,511	0,950	0,000				1,108	0,000	0,000	1,382	0,568	1,665	0,294	-0,345	0,663	**9569**
																		9589
			-0,173	1,028	0,000				-0,676	0,000	0,000	1,177	-0,536	-0,119	0,030	0,295	0,078	**9736**
			0,338	-0,576					0,763			1,581	0,971	0,953	0,030	1,209	-0,734	**9899**
			0,367	0,548	0,000				1,027	0,000	0,000	0,300	0,568	1,317	0,549	-0,237	1,073	**9903**
			0,808	-0,216	0,000				0,972	0,000	0,000	-0,983	0,568	0,828	1,497	0,502	-0,397	**9956**
0	0	0	74	75	74	0	0	0	62	61	61	90	91	90	77	77	77	**n**
			-4,000	-2,755	0,000				-2,391	0,000	0,000	-3,082	-2,044	-2,201	-3,468	-4,000	-2,342	**Min**
			2,093	4,000	0,000				2,059	0,000	0,000	2,861	4,000	4,000	4,000	4,000	4,000	**Max**
			-0,038	0,045	0,000				-0,050	0,000	0,000	0,063	0,088	-0,119	0,030	-0,022	0,078	**Median**
			-0,108	0,053	0,000				0,000	0,000	0,000	0,000	0,132	0,044	0,104	-0,359	0,104	**Mean**
			1,183	1,095	0,000				1,000	0,000	0,000	1,000	1,218	1,080	1,176	1,615	1,176	**SD**
																		Summa
			2	0	0				0	0	0	1	0	0	1	8	0	22
			2	3	0				3	0	0	1	11	1	1	4	1	49
			1	2	0				1	0	0	1	1	0	2	2	1	19
			0	1	0				0	0	0	0	3	2	2	1	3	17

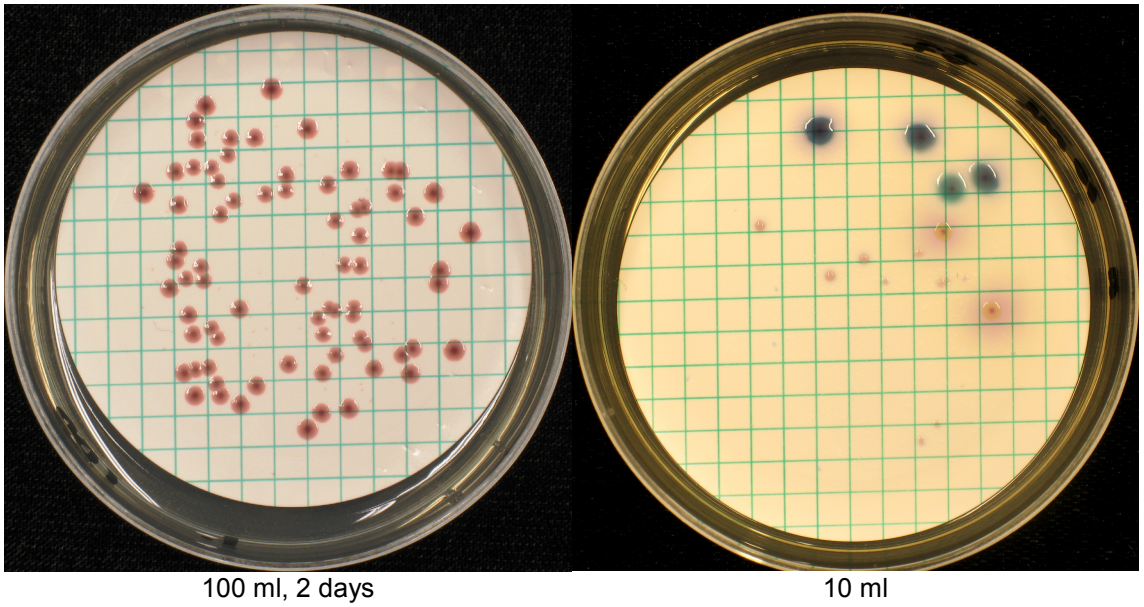
Mixture A


m-Endo Agar LES, 37 °C
m-Lactose TTC Agar, 37 °C
7.5 ml
7.5 ml
m-FC Agar, 44 °C
m-Lactose TTC Agar, 44 °C
7.5 ml
7.5 ml
m-Enterococcus Agar, 37 °C
m-Pseudomonas CN Agar, 37 °C
7.5 ml, 2 days
7.5 ml, 1 day

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
Chromocult Coliform Agar, 37 °C
100 ml, 2 days
10 ml

Mixture C

m-Endo Agar LES, 37 °C	Missing	m-Lactose TTC Agar, 37 °C
1 ml		1 ml
m-FC Agar, 44 °C	Missing	Missing
1 ml		1 ml
Chromocult Coliform Agar, 37 °C	Missing	m-Pseudomonas CN Agar, 37 °C
1 ml		10 ml, 2 days

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.
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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.
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16. Sammanställning av resultat från en projektinriktad kontrollkurs om skyddade beteckningar 2012 av P Elvingsson.
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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. Not publiced.
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.

Rapporter som utgivits 2013

1. Contaminants and minerals in foods for infants and young children – analytical results, Part 1, by V Öhrvik, J Engman, B Kollander and B Sundström.

   Contaminants and minerals in foods for infants and young children – risk and benefit assessment, Part 2 by G Concha, H Eneroth, H Hallström and S Sand.

   Tungmetaller och mineraler i livsmedel för spädbarn och småbarn. Del 3 Risk- och nytto-hantering av R Bjerselius, E Halldin Ankarberg, A Jansson, I Lindeberg, J Sanner Färnstrand och C Wanhainen.

   Contaminants and minerals in foods for infants and young children – risk and benefit manage-ment, Part 3 by R Bjerselius, E Halldin Ankarberg, A Jansson, I Lindeberg, J Sanner Färnstrand and C Wanhainen.
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26. Proficiency Testing – Food Microbiology, October 2013 av L Nachin, C Normark and I Boriak.
27. Proficiency Testing – Drinking Water Microbiology, September 2013 by T Šlapokas and K Mykkänen.

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