OXA-23 K-SeT

MOLDOVA EUROPEANĂ

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Produced in BELGIUM

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IFU-58R7/EN/02

***In vitro* rapid diagnostic test for the detection of OXA-23 carbapenemase in bacterial culture**

FOR IN VITRO DIAGNOSTIC USE **EN**
FOR PROFESSIONAL USE ONLY
References: K-15R7, 20 cassettes, buffer, 20 tubes and droppers

I. INTRODUCTION

Acinetobacter baumannii is an important opportunistic and multidrug-resistant Gram-negative bacterium responsible for nosocomial infections in health facilities. If left untreated, this infection can lead to septicemia and death. The carbapenem-hydrolysing oxacillinases (OXAs) are the most commonly reported carbapenem-resistance determinants in *Acinetobacter* spp., particularly in *A. baumannii*. Among the OXAs, OXA-23 is the most prevalent carbapenem-resistance determinant in *A. baumannii* isolates.
OXA-23 has been detected in other bacterial species as chromosomal (*P. mirabilis,* Bonnet et al 2002 and Osterblad et al 2016; *A. radioresistans*) or plasmidic gene (*E. coli*, La et al, 2014), which can constitute reservoirs for horizontal transmission of this resistance factor (Poirel et al 2016). The detection of this resistance factor OXA-23, not only in resistant species but also in carrier species, is therefore of paramount importance in the control of antibiotic resistance in the hospital.
Nowadays, definitive confirmation of OXA-23 relies on molecular amplification analysis and DNA sequencing. These tests are expensive and can only be performed in dedicated environment and by skilled staff, hence limiting their more generalized usage.
The development of new rapid diagnostic tests to track antimicrobial resistance patterns is considered as one of the priority core action by international experts and health authorities.
The OXA-23 K-SeT test aimed at a rapid identification of the OXA-23 carbapenemase (and variants of the OXA-23 group) ensures effective treatment of patients and prevention of spread of OXA-23 *Acinetobacter* spp. carrier, especially in hospitals.

II. PRINCIPLE OF THE TEST

This test is ready to use and is based on a membrane technology with colloidal gold nanoparticles. A nitrocellulose membrane is sensitized with a monoclonal antibody directed against one epitope of the OXA-23 carbapenemase. Another monoclonal antibody directed against a second epitope of the OXA-23 carbapenemase is conjugated to colloidal gold particles. This conjugate is dried on a membrane.
This test is aimed at the detection of OXA-23 like carbapenemases in a single bacterial colony growing on agar plate. The sample must be diluted in the dilution buffer supplied with the test. When the provided buffer containing the resuspended bacteria comes into contact with the strip, the solubilized conjugate migrates with the sample by passive diffusion and both the conjugate and sample material come into contact with the anti-OXA-23 antibody that it is adsorbed onto the nitrocellulose strip. If the sample contains the OXA-23 carbapenemase, the conjugate–OXA-23 complex will remain bound to the anti-OXA-23 antibody adsorbed onto the nitrocellulose and a red line will develop. Solution continues to migrate to reach a second reagent (control reagent) that binds the migration control conjugate, thereby producing a red control line that confirms that the test is valid. Result is visible within 15 minutes.

III. REAGENTS AND MATERIALS

1. **OXA-23 *K*-SeT (20)**

20 sealed pouches containing one device and one desiccant. Each device contains one sensitized strip.

2. **LY-A buffer vial (15 mL)**

Saline solution buffered to pH 7.5 containing TRIS, NaN_3 (<0,1%) and a detergent.

3. **Instruction for use (1)**
4. **Semi-rigid disposable collection tubes with droppers (20)**
5.

IV. SPECIAL PRECAUTIONS

- All operations linked to the use of the test must be performed in accordance with Good Laboratory Practices (GLP).
- All reagents are for *in vitro* diagnostic use only.
- Pouch must be opened with care.
- Avoid touching nitrocellulose with your fingers.
- Wear gloves when handling samples.
- Never use reagents from another kit.
- Green lines indicate immunoreagents adsorption sites. Green colour disappears during the test.
- Reagents' quality cannot be guaranteed beyond their shelf-life dates or if reagents are not stored under required conditions as indicated in the insert.

V. WASTE DISPOSAL

- Dispose of gloves, swabs, test tubes and used devices in accordance with GLP.
- Each user is responsible for the management of any waste produced, and must ensure that it is disposed of in accordance with the applicable legislation.

VI. STORAGE

- An unopened pouch may be kept at between 4 and 30°C and used until the shelf-life date indicated on the packaging. Once the pouch is opened, run the test immediately.
- Avoid freezing devices and buffer.

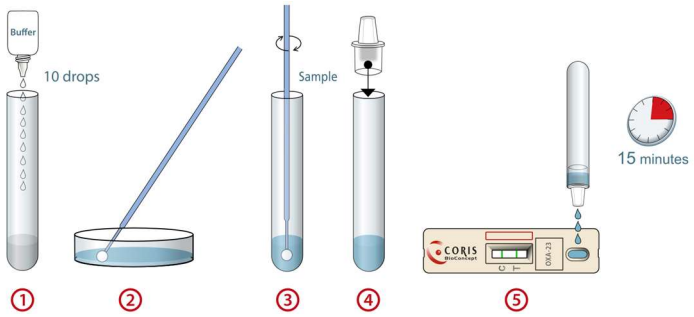
VII. SPECIMEN HANDLING AND COLLECTION

Specimens to be tested should be obtained and handled by standard microbiological methods.
Make sure that the specimens are not treated with solutions containing formaldehyde or its derivatives.
Culture media tested and validated with Coris BioConcept RESIT kits are listed on the website: https://www.corisbio.com/Products/Human-Field/OXA-23/FAQ.php

VIII. PROCEDURE

PREPARATIONS OF THE TEST:
Allow kit components, in unopened packaging, and specimens (in case the plate containing colony to be tested was kept at 4°C) to reach room temperature (15-30°C) before performing a test.
Open the pouch and remove the device. Once opened, run the test immediately. Indicate the patient's name or specimen number on the device (one device per sample).
SPECIMEN PREPARATION PROCEDURE:
We recommend the use of fresh bacterial colonies for optimal test performance.

1. Prepare one semi-rigid tube provided in the kit and add **10** drops of LY-A buffer in the tube.
2. Harvest bacteria by taking one colony with a disposable bacteriological loop and dip the loop in the bottom of the semi-rigid tube containing the buffer.
3. Stir thoroughly before removing the loop
4. Insert tightly the dropper on the semi-rigid tube.
5. Vortex the preparation to homogenize. The entire bacterial colony must be suspended into the buffer.
6. Invert the test tube and add slowly **3** drops of diluted sample into the sample well of the cassette. Alternatively, add 100µl with a micropipette into the sample well of the cassette.
7. Allow to react for 15 min max and read the result.



Positive results may be reported as soon as the test and control lines become visible.
Do not take the appearance of new lines into account after the reaction time is passed.
The result must be read on still wet strip.

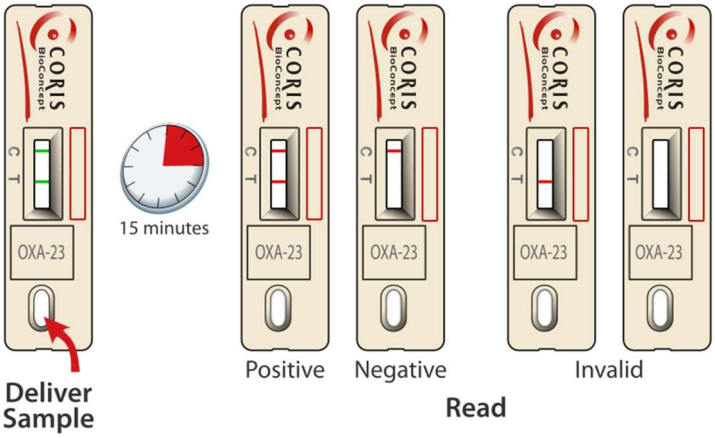
IX. INTERPRETING RESULTS

The results are to be interpreted as follows:

Negative test result: a reddish-purple line appears across the central reading window at the Control line (C) position. No other band is present.

Positive test result: in addition to a reddish-purple band at the Control line (C), a visible reddish-purple band appears at the Test line position (T). Intensity of the test line may vary according to the quantity of antigens present in the sample. Any reddish-purple line (T), even weak, should be considered as a positive result.

Invalid test result: The absence of a Control line indicates a failure in the test procedure. Repeat invalid tests with a new test device.
Note: during the drying process, a very faint shadow may appear at the Test line position. It should not be regarded as a positive result.



X. PERFORMANCE

A. Detection Limit

The detection limit was determined with a purified recombinant OXA-23 protein and has been evaluated at 0,156 ng/mL.

B. Validation on collection of reference strains

The OXA-23 *K*-SeT was evaluated on a collection of 108 clinical isolates of carbapenem-resistant *Acinetobacter* spp. fully characterized resistance mechanisms to beta-lactams by phenotypic and molecular tests (Germany).

108 strains	**35 strains** tested positive with the OXA-23 *K*-SeT	**35 strains** carrying OXA-23 carbapenemase	*Acinetobacter baumannii, Acinetobacter pittii, Acinetobacter nosocomialis, Acinetobacter radioresistens*
	73 strains tested negative with the OXA-23 *K*-SeT	**68 strains** carrying a non-OXA-23 carbapenemase	OXA-40, OXA-51, OXA-58, OXA-143, OXA-235
		5 strains carrying class B carbapenemases	Including VIM-2, NDM-1, NDM-2

A second evaluation was retrospectively performed on 448 clinical strains of *Acinetobacter spp*. and 14 oxacillinase-producing Gram-negative bacteria collected in Belgium and in Italy between 2008 and 2018 with an agreement of 100 % versus real-time PCR and molecular sequencing. see Riccobono, 2019

	Italy	Belgium	Total	Test OXA-23 K-SeT
$bla_{OXA\text{-}23\text{-}like}$	170	137	307	307 +
$bla_{OXA\text{-}24\text{-}like}$	5	25	30	negative
$bla_{OXA\text{-}58\text{-}like}$	1	30	31	negative
IS*Aba1* $bla_{OXA\text{-}51\text{-}like}$	11	0	11	negative
$bla_{OXA\text{-}23\text{-}like}$ + $bla_{OXA\text{-}58\text{-}like}$	5	2	7	7 +
$bla_{OXA\text{-}23\text{-}like}$ + IS*Aba1* $bla_{OXA\text{-}51\text{-}like}$	4	0	4	4 +
$bla_{OXA\text{-}23\text{-}like}$ + bla_{NDM}	0	3	3	3 +
$bla_{OXA\text{-}58\text{-}like}$ + bla_{VIM}	0	1	1	negative
bla_{NDM}	0	13	13	negative
$bla_{OXA\text{-}143\text{-}like}$	0	1	1	negative
bla_{IMP}	0	3	3	negative
bla_{VIM}	0	1	1	negative
bla_{GES}	0	1	1	negative
$bla_{OXA\text{-}48\text{-}like}$	0	2	2	negative
$bla_{OXA\text{-}198\text{-}like}$	0	1	1	negative
non-carbapenemase producer	0	46	46	negative
Total	196	266	462	321 +

C. Repeatability and reproducibility

To check intra-batch accuracy (repeatability), the same positive samples and a buffer solution were processed 15 times on kits of the same production batch in the same experimental conditions. All observed results were confirmed as expected.
To check inter-batch accuracy (reproducibility), some samples (positive and buffer) were processed on kits from three different production batches. All results were confirmed as expected.

XI. LIMITS OF THE KIT

The test is qualitative and cannot predict the quantity of antigens present in the sample. Clinical presentation and other test results must be taken into consideration to establish diagnosis.
A positive test does not rule out the possibility that other antibiotic resistance mechanisms may be present.

XII. TECHNICAL PROBLEMS/COMPLAINTS

If you encounter a technical problem or if performances do not correspond with those indicated in this package insert:

1. Record the kit batch number
2. If possible, keep the sample in the appropriate storage condition during the complaint management
3. Contact Coris BioConcept (client.care@corisbio.com) or your local distributor

XIII. BIBLIOGRAPHIC REFERENCES

A. **E. Riccobono, P. Bogaerts, A. Antonelli, S. Evrard, T. Giani, G. M. Rossolini and Y. Glupczynski.** Evaluation of the OXA-23 K-SeT immunochromatographic assay for the rapid detection of OXA-23-like carbapenemase-producing Acinetobacter spp. **J Antimicrob Chemother. 2019 Jan 25. doi: 10.1093**

B. **DW. Wareham, LM. Phee, MHF. Abdul Momin.** Direct detection of carbapenem resistance determinants in clinical specimens using immunochromatographic lateral flow devices. J Antimicrob Chemother. 2018 Mar 22. doi: 10.1093

C. **A. Saleh, S. Göttig and A. Hamprecht.** Multiplex immunochromatographic detection of OXA-48, KPC and NDM carbapenemases: impact of the inoculum, antibiotics and agar. J Clin Microbiol. 2018 Feb 14. pii: JCM.00050-18.

D. **G. L. Vanstone, S. Woodhead, K. Roulston, H. Sharma, E. Wey, E. R. Smith, D. Mack and I. Balakrishna.** Improving the detection of carbapenemase-producing organisms (CPO) in a low-prevalence setting: evaluation of four commercial methods and implementation of an algorithm of testing. Journal of Medical Microbiology 2018;67: 208–214

E. **P. Bogaerts, S. Evrard, L. Denorme, Q. Gilleman, P. Mertens, T.-D. Huang, and Y. Glupczynski**. Evaluation of a new lateral flow assay for the detection of VIM-producing bacteria. 37th RICAI, Paris, December, 18-19, 2017, Abstract # P066.

F. **Y. Glupczynski, A. Jousset, S. Evrard, R. Bonnin, T. Huang, L. Dortet, P. Bogaerts and T. Naas.** Prospective evaluation of the OKN K-SeT assay, a new multiplex immunochromatographic test for the rapid detection of OXA-48-like, KPC and NDM carbapenemases. J Antimicrob Chemother. 2017 Jul 1 ;72(7):1955-1960

G. **CS. Nodari, AC. Gales, AL. Barth, CM. Magagnin, AP. Zavascki, CG. Carvalhaes.** Detection of OXA-370 Directly from Rectal Swabs and Blood Culture Vials Using an Immunochromatographic Assay. J Microbiol Methods. 2017 May 5. pii: S0167-7012 : 30113-6

H. **Y. Glupczynski, A. Jousset, S. Evrard, R. Bonnin, TD Huang, L. Dortet, P. Bogaerts and T. Naas.** Evaluation of a new multiplex immunochromatographic assay OKN K-SeT for the rapid detection of OXA-48, KPC and NDM carbapenemases from cultured bacteria. 27th European Congress of Clinical Microbiology and Infectious Diseases, Infectious Diseases April 22 – 25, 2017

I. **C. Trouvé, R. De Smedt and E. De Laer.** Evaluation of five commercial confirmation tests for Carbapenemase-Producing Enterobacteriaceaein an OXA-48 endemic geographic region. 27th European Congress of Clinical Microbiology and Infectious Diseases, Infectious Diseases April 22 – 25, 2017

J. **E. Riccobono, A. Antonelli, P. Pecile, P. Bogaerts, MM. D'Andrea, GM. Rossolini.** Evaluation of the KPC K-SeTVR immunochromatographic assay for the rapid detection of KPC carbapenemase producers from positive blood cultures. J Antimicrob Chemother. 2017 Nov 8. doi: 10.109

K. **AC. Ramos, AC. Gales, J. Monteiro, S. Silbert, T. Chagas-Neto, AMO. Machado, CG. Carvalhaes.** Evaluation of a rapid immunochromatographic test for detection of distinct variants of Klebsiella pneumoniae carbapenemase (KPC) in Enterobacteriaceae. J Microbiol Methods. 2017 Nov;142:1-3

L. **F. Erdem, A. Abulaila, Z. Aktas, O. Oncul.** Comparison of the Novel Oxa-48 and Kpc K-SeT Assay, and Blue-Carba Test for the Detection of Carbapenemase-Producing Enterobacteriaceae Using PCR as a Reference Method. Clin Lab. 2017 Mar 1;63(3):515-522.

M. **DW Wareham and MH Abdul Momin.** Rapid Detection of Carbapenemases in Enterobacteriaceae: Evaluation of the RESIST-3 O.K.N (OXA-48, KPC, NDM) Multiplexed Lateral Flow Assay. J Clin Microbiol. 2017 Feb 1. pii: JCM.02471-16

N. **E Rubio, Y Zboromyrska, C Pitart, I Campo, I Alejo-Cancho, A Fasanella, A Vergara, F Marco, J Vila.** Evaluation of a rapid immunochromatographic test for the detection of OXA-48 carbapenemase. Diagn Microbiol Infect Dis. 2017 Mar;87(3):266-267

O. **F Koroska, S Göttig, M Kaase, J Steinmann, S Gatermann, J Sommer, T Wille, G Plum, A Hamprecht.** Comparison of phenotypic tests and an immunochromatographic assay and development of a new algorithm for OXA-48-like detection. J Clin Microbiol. 2016 Dec 28. Pii: JCM.01929-16

P. **F Pasteran, L Denorme, I Ote, S Gomez, D De Belder, Y Glupczynski, P Bogaerts, B Ghiglione, P Power, P Mertens, A Corso.** Rapid identification of OXA-48 and OXA-163 subfamily in carbapenem resistant gram-negative bacilli with a novel immunochromatographic lateral flow assay. J Clin Microbiol. 2016 Aug; 54(11):2832-2836

Q. **D. Meunier, A. Vickers, R. Pike, R.L. Hill, N. Woodford and K.L. Hopkins**. Evaluation of the K-SeT R.E.S.I.S.T. immunochromatographic assay for the rapid detection of KPC and OXA-48-like carbapenemases. J Antimicrob Chemother. 2016 Aug; 71 (8):2357-9

R. **Wareham DW, Shah R, Betts JW, Phee LM, Abdul Momin MH.** Evaluation of an Immunochromatographic Lateral Flow Assay (OXA-48 K-SeT) for the Rapid Detection of OXA-48-like Carbapenemases in Enterobacteriaceae. . J Clin Microbiol. 2016 Feb;54 (2):471-3

S. **Fernández J, Fleites A, Rodcio MR, Vazquez F.** Evaluation of OXA-48 K-Se T: an immunochromatographic assay for rapid detection of OXA-48-producing Enterobacteriaceae. Diagn Microbiol Infect Dis. 2016 May;85 (1):12-5

T. **Dortet L, Jousset A, Sainte-Rose V, Cuzon G, Naas T.** Prospective evaluation of the OXA-48 K-SeT assay, an immunochromatographic test for the rapid detection of OXA-48-type carbapenemases. J Antimicrob Chemother. 2016 Jul;71 (7):1834-40

U. **Glupczynski Y, Evrard S, Ote I, Mertens P, Huang TD, Leclipteux T, Bogaerts P.** Evaluation of two new commercial immunochromatographic assays for the rapid detection of OXA-48 and KPC carbapenemases from cultured bacteria. J Antimicrob Chemother. 2016 May;71(5):1217-22

V. **B.M. Willey, X. Trimi, R. Ioboni, D.A. Boyd, G. Ricci, D.N. Grohn, D. Terenzi, A. Mazzulli, L. Mataseje, M. Mulvey, P. Lo, T. Mazzulli, S.M. Poutanen**. The Coris BioConcept OXA48 K-SeT Immuno-Chromatographic Assay Detects OXA48-type Carbapenemases with High Sensitivity and Specificity. 26th European Congress of Clinical Microbiology and Infectious Diseases, Amsterdam April 9-12, 2016

W. **P. Bogaerts, S. Evrard, G. Cuzon, TD. Huang, T. Naas and Y. Glupczynski** Specificity of the OXA-48 immunochromatographic K-SeT for the detection of OXA-48 like in Shewanella spp. 26th European Congress of Clinical Microbiology and Infectious Diseases, Infectious Amsterdam April 09 – 12, 2016

Last update: 27 NOVEMBER 2019

REF	Catalogue number		Manufacturer
IVD	*In vitro* diagnostic medical device		Temperature limits
Σ	Contains sufficient for <n> tests	LOT	Lot number
	Consult instructions for use		Do not reuse
	Keep dry		Use by
DIL SPE	Diluent specimen	CONT NaN_3	Contains Sodium azide

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I. INTRODUCTION

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OXA-23 has been detected in other bacterial species as chromosomal (*P. mirabilis,* Bonnet et al 2002 and Osterblad et al 2016; *A. radioresistans*) or plasmidic gene (*E. coli*, La et al, 2014), which can constitute reservoirs for horizontal transmission of this resistance factor (Poirel et al 2016). The detection of this resistance factor OXA-23, not only in resistant species but also in carrier species, is therefore of paramount importance in the control of antibiotic resistance in the hospital.
Nowadays, definitive confirmation of OXA-23 relies on molecular amplification analysis and DNA sequencing. These tests are expensive and can only be performed in dedicated environment and by skilled staff, hence limiting their more generalized usage.
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II. PRINCIPLE OF THE TEST

This test is ready to use and is based on a membrane technology with colloidal gold nanoparticles. A nitrocellulose membrane is sensitized with a monoclonal antibody directed against one epitope of the OXA-23 carbapenemase. Another monoclonal antibody directed against a second epitope of the OXA-23 carbapenemase is conjugated to colloidal gold particles. This conjugate is dried on a membrane.
This test is aimed at the detection of OXA-23 like carbapenemases in a single bacterial colony growing on agar plate. The sample must be diluted in the dilution buffer supplied with the test. When the provided buffer containing the resuspended bacteria comes into contact with the strip, the solubilized conjugate migrates with the sample by passive diffusion and both the conjugate and sample material come into contact with the anti-OXA-23 antibody that it is adsorbed onto the nitrocellulose strip. If the sample contains the OXA-23 carbapenemase, the conjugate–OXA-23 complex will remain bound to the anti-OXA-23 antibody adsorbed onto the nitrocellulose and a red line will develop. Solution continues to migrate to reach a second reagent (control reagent) that binds the migration control conjugate, thereby producing a red control line that confirms that the test is valid. Result is visible within 15 minutes.

III. REAGENTS AND MATERIALS

1. OXA-23 *K*-SeT (20)
20 sealed pouches containing one device and one desiccant. Each device contains one sensitized strip.
2. LY-A buffer vial (15 mL)
Saline solution buffered to pH 7.5 containing TRIS, NaN_3 (<0,1%) and a detergent.
3. Instruction for use (1)
4. Semi-rigid disposable collection tubes with droppers (20)
5.

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- All operations linked to the use of the test must be performed in accordance with Good Laboratory Practices (GLP).
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We recommend the use of fresh bacterial colonies for optimal test performance.

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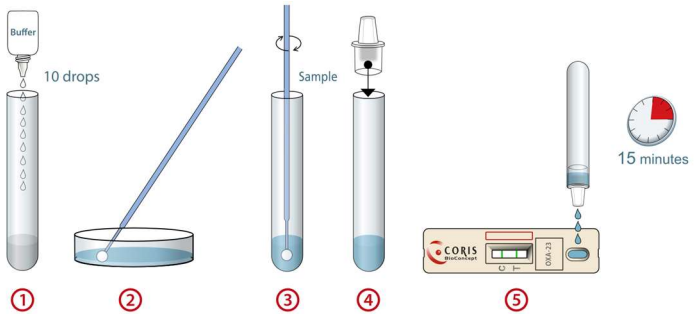

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The results are to be interpreted as follows:

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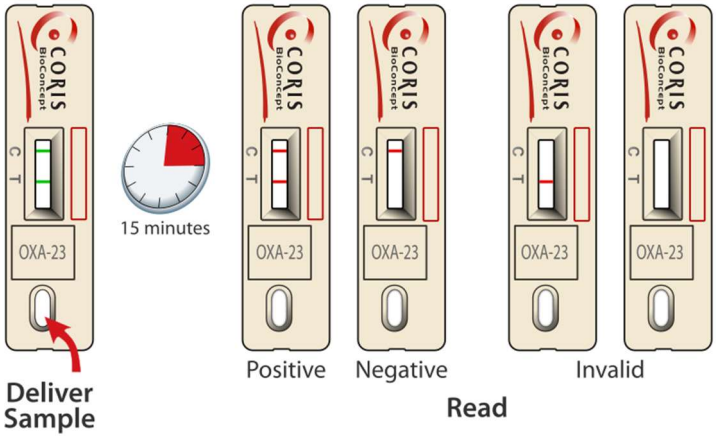

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$bla_{OXA\text{-}23\text{-}like}$ + IS*Aba1* $bla_{OXA\text{-}51\text{-}like}$	4	0	4	4 +
$bla_{OXA\text{-}23\text{-}like}$ + bla_{NDM}	0	3	3	3 +
$bla_{OXA\text{-}58\text{-}like}$ + bla_{VIM}	0	1	1	negative
bla_{NDM}	0	13	13	negative
$bla_{OXA\text{-}143\text{-}like}$	0	1	1	negative
bla_{IMP}	0	3	3	negative
bla_{VIM}	0	1	1	negative
bla_{GES}	0	1	1	negative
$bla_{OXA\text{-}48\text{-}like}$	0	2	2	negative
$bla_{OXA\text{-}198\text{-}like}$	0	1	1	negative
non-carbapenemase producer	0	46	46	negative
Total	196	266	462	321 +

C. Repeatability and reproducibility

To check intra-batch accuracy (repeatability), the same positive samples and a buffer solution were processed 15 times on kits of the same production batch in the same experimental conditions. All observed results were confirmed as expected.
To check inter-batch accuracy (reproducibility), some samples (positive and buffer) were processed on kits from three different production batches. All results were confirmed as expected.

XI. LIMITS OF THE KIT

The test is qualitative and cannot predict the quantity of antigens present in the sample. Clinical presentation and other test results must be taken into consideration to establish diagnosis.
A positive test does not rule out the possibility that other antibiotic resistance mechanisms may be present.

XII. TECHNICAL PROBLEMS/COMPLAINTS

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Last update: 27 NOVEMBER 2019

REF	Catalogue number		Manufacturer
IVD	*In vitro* diagnostic medical device		Temperature limits
Σ	Contains sufficient for <n> tests	LOT	Lot number
	Consult instructions for use		Do not reuse
	Keep dry		Use by
DIL SPE	Diluent specimen	CONT NaN_3	Contains Sodium azide

OXA-23 *K*-SeT

Manufacturer:

Coris BioConcept
Science Park CREALYS
Rue Jean Sonet 4A
B – 5032 GEMBLOUX
BELGIUM
Tel.: +32(0)81.719.917
Fax: +32(0)81.719.919
info@corisbio.com

Produced in BELGIUM

www.corisbio.com
IFU-58R7/EN/02

***In vitro* rapid diagnostic test for the detection of OXA-23 carbapenemase in bacterial culture**

FOR IN VITRO DIAGNOSTIC USE **EN**
FOR PROFESSIONAL USE ONLY
References: K-15R7, 20 cassettes, buffer, 20 tubes and droppers

I. INTRODUCTION

Acinetobacter baumannii is an important opportunistic and multidrug-resistant Gram-negative bacterium responsible for nosocomial infections in health facilities. If left untreated, this infection can lead to septicemia and death. The carbapenem-hydrolysing oxacillinases (OXAs) are the most commonly reported carbapenem-resistance determinants in *Acinetobacter* spp., particularly in *A. baumannii*. Among the OXAs, OXA-23 is the most prevalent carbapenem-resistance determinant in *A. baumannii* isolates.
OXA-23 has been detected in other bacterial species as chromosomal (*P. mirabilis,* Bonnet et al 2002 and Osterblad et al 2016; *A. radioresistans*) or plasmidic gene (*E. coli*, La et al, 2014), which can constitute reservoirs for horizontal transmission of this resistance factor (Poirel et al 2016). The detection of this resistance factor OXA-23, not only in resistant species but also in carrier species, is therefore of paramount importance in the control of antibiotic resistance in the hospital.
Nowadays, definitive confirmation of OXA-23 relies on molecular amplification analysis and DNA sequencing. These tests are expensive and can only be performed in dedicated environment and by skilled staff, hence limiting their more generalized usage.
The development of new rapid diagnostic tests to track antimicrobial resistance patterns is considered as one of the priority core action by international experts and health authorities.
The OXA-23 K-SeT test aimed at a rapid identification of the OXA-23 carbapenemase (and variants of the OXA-23 group) ensures effective treatment of patients and prevention of spread of OXA-23 *Acinetobacter* spp. carrier, especially in hospitals.

II. PRINCIPLE OF THE TEST

This test is ready to use and is based on a membrane technology with colloidal gold nanoparticles. A nitrocellulose membrane is sensitized with a monoclonal antibody directed against one epitope of the OXA-23 carbapenemase. Another monoclonal antibody directed against a second epitope of the OXA-23 carbapenemase is conjugated to colloidal gold particles. This conjugate is dried on a membrane.
This test is aimed at the detection of OXA-23 like carbapenemases in a single bacterial colony growing on agar plate. The sample must be diluted in the dilution buffer supplied with the test. When the provided buffer containing the resuspended bacteria comes into contact with the strip, the solubilized conjugate migrates with the sample by passive diffusion and both the conjugate and sample material come into contact with the anti-OXA-23 antibody that it is adsorbed onto the nitrocellulose strip. If the sample contains the OXA-23 carbapenemase, the conjugate–OXA-23 complex will remain bound to the anti-OXA-23 antibody adsorbed onto the nitrocellulose and a red line will develop. Solution continues to migrate to reach a second reagent (control reagent) that binds the migration control conjugate, thereby producing a red control line that confirms that the test is valid. Result is visible within 15 minutes.

III. REAGENTS AND MATERIALS

1. OXA-23 *K*-SeT (20)
20 sealed pouches containing one device and one desiccant. Each device contains one sensitized strip.
2. LY-A buffer vial (15 mL)
Saline solution buffered to pH 7.5 containing TRIS, NaN_3 (<0,1%) and a detergent.
3. Instruction for use (1)
4. Semi-rigid disposable collection tubes with droppers (20)
5.

IV. SPECIAL PRECAUTIONS

- All operations linked to the use of the test must be performed in accordance with Good Laboratory Practices (GLP).
- All reagents are for *in vitro* diagnostic use only.
- Pouch must be opened with care.
- Avoid touching nitrocellulose with your fingers.
- Wear gloves when handling samples.
- Never use reagents from another kit.
- Green lines indicate immunoreagents adsorption sites. Green colour disappears during the test.
- Reagents' quality cannot be guaranteed beyond their shelf-life dates or if reagents are not stored under required conditions as indicated in the insert.

V. WASTE DISPOSAL

- Dispose of gloves, swabs, test tubes and used devices in accordance with GLP.
- Each user is responsible for the management of any waste produced, and must ensure that it is disposed of in accordance with the applicable legislation.

VI. STORAGE

- An unopened pouch may be kept at between 4 and 30°C and used until the shelf-life date indicated on the packaging. Once the pouch is opened, run the test immediately.
- Avoid freezing devices and buffer.

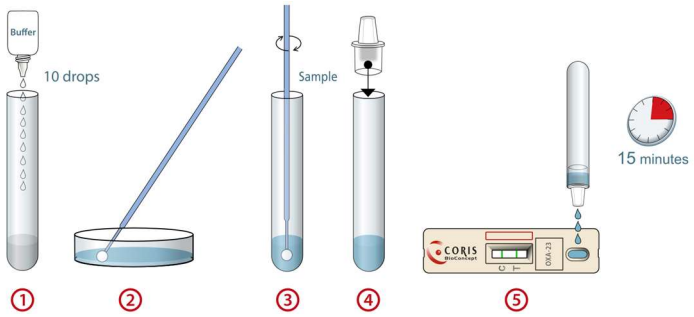
VII. SPECIMEN HANDLING AND COLLECTION

Specimens to be tested should be obtained and handled by standard microbiological methods.
Make sure that the specimens are not treated with solutions containing formaldehyde or its derivatives.
Culture media tested and validated with Coris BioConcept RESIT kits are listed on the website: https://www.corisbio.com/Products/Human-Field/OXA-23/FAQ.php

VIII. PROCEDURE

PREPARATIONS OF THE TEST:
Allow kit components, in unopened packaging, and specimens (in case the plate containing colony to be tested was kept at 4°C) to reach room temperature (15-30°C) before performing a test.
Open the pouch and remove the device. Once opened, run the test immediately. Indicate the patient's name or specimen number on the device (one device per sample).
SPECIMEN PREPARATION PROCEDURE:
We recommend the use of fresh bacterial colonies for optimal test performance.

1. Prepare one semi-rigid tube provided in the kit and add **10** drops of LY-A buffer in the tube.
2. Harvest bacteria by taking one colony with a disposable bacteriological loop and dip the loop in the bottom of the semi-rigid tube containing the buffer.
3. Stir thoroughly before removing the loop
4. Insert tightly the dropper on the semi-rigid tube.
5. Vortex the preparation to homogenize. The entire bacterial colony must be suspended into the buffer.
6. Invert the test tube and add slowly **3** drops of diluted sample into the sample well of the cassette. Alternatively, add 100µl with a micropipette into the sample well of the cassette.
7. Allow to react for 15 min max and read the result.



Positive results may be reported as soon as the test and control lines become visible.
Do not take the appearance of new lines into account after the reaction time is passed.
The result must be read on still wet strip.

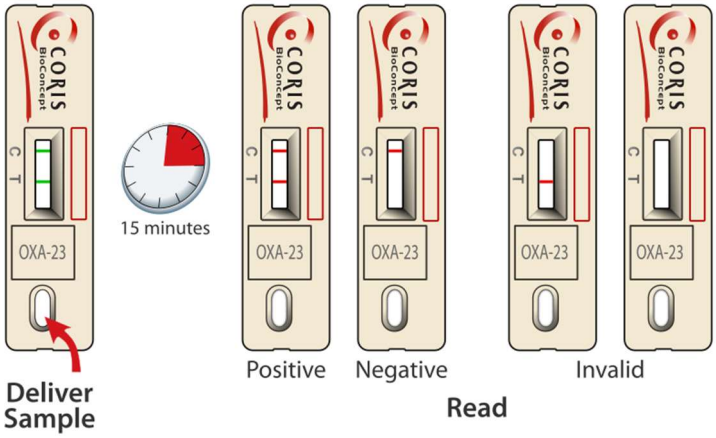
IX. INTERPRETING RESULTS

The results are to be interpreted as follows:

Negative test result: a reddish-purple line appears across the central reading window at the Control line (C) position. No other band is present.

Positive test result: in addition to a reddish-purple band at the Control line (C), a visible reddish-purple band appears at the Test line position (T). Intensity of the test line may vary according to the quantity of antigens present in the sample. Any reddish-purple line (T), even weak, should be considered as a positive result.

Invalid test result: The absence of a Control line indicates a failure in the test procedure. Repeat invalid tests with a new test device.
Note: during the drying process, a very faint shadow may appear at the Test line position. It should not be regarded as a positive result.



X. PERFORMANCE

A. Detection Limit

The detection limit was determined with a purified recombinant OXA-23 protein and has been evaluated at 0,156 ng/mL.

B. Validation on collection of reference strains

The OXA-23 *K*-SeT was evaluated on a collection of 108 clinical isolates of carbapenem-resistant *Acinetobacter* spp. fully characterized resistance mechanisms to beta-lactams by phenotypic and molecular tests (Germany).

108 strains	**35 strains** tested positive with the OXA-23 *K*-SeT	**35 strains** carrying OXA-23 carbapenemase	*Acinetobacter baumannii, Acinetobacter pittii, Acinetobacter nosocomialis, Acinetobacter radioresistens*
	73 strains tested negative with the OXA-23 *K*-SeT	**68 strains** carrying a non-OXA-23 carbapenemase	OXA-40, OXA-51, OXA-58, OXA-143, OXA-235
		5 strains carrying class B carbapenemases	Including VIM-2, NDM-1, NDM-2

A second evaluation was retrospectively performed on 448 clinical strains of *Acinetobacter spp*. and 14 oxacillinase-producing Gram-negative bacteria collected in Belgium and in Italy between 2008 and 2018 with an agreement of 100 % versus real-time PCR and molecular sequencing. see Riccobono, 2019

	Italy	Belgium	Total	Test OXA-23 K-SeT
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W. **P. Bogaerts, S. Evrard, G. Cuzon, TD. Huang, T. Naas and Y. Glupczynski** Specificity of the OXA-48 immunochromatographic K-SeT for the detection of OXA-48 like in Shewanella spp. 26th European Congress of Clinical Microbiology and Infectious Diseases, Infectious Amsterdam April 09 – 12, 2016

Last update: 27 NOVEMBER 2019

REF	Catalogue number		Manufacturer
IVD	*In vitro* diagnostic medical device		Temperature limits
Σ	Contains sufficient for <n> tests	LOT	Lot number
	Consult instructions for use		Do not reuse
	Keep dry		Use by
DIL SPE	Diluent specimen	CONT NaN_3	Contains Sodium azide

O.K.N.V.I. RESIST-5

Manufacturer:

Coris BioConcept
CREALYS Science Park
Rue Guillaume Fouquet, 11
5032 GEMBLOUX
BELGIUM
Tel.: +32(0)81.719.917
Fax: +32(0)81.719.919
info@corisbio.com
Produced in BELGIUM

www.corisbio.com
IFU-58R11/EN/06

***In vitro* rapid diagnostic test for the detection of OXA-48, KPC, NDM, VIM and IMP carbapenemases in bacterial culture**

FOR IN VITRO DIAGNOSTIC USE **EN**
FOR PROFESSIONAL USE ONLY
References: K-15R11, 2x20 cassettes, buffer, 20 tubes and transfer pipets

I. INTRODUCTION

Carbapenemase-producing Organisms (CPO), and more specifically, Carbapenem-resistant Enterobacteriaceae (CRE) represent a major public health concern worldwide due to their broad spectrum of resistance to antibiotics including, besides carbapenems, most classes of antimicrobial agents, and thus leaving very few options for the management of infected patients. Besides CREs, CPOs also include nonfermenting Gram-negative bacilli (NFGNB), such as *Pseudomonas aeruginosa* and *Acinetobacter baumannii* that exhibit resistance not only to beta lactam and other groups of antibiotics, but also to carbapenems. The rapid spread of CPOs and genes encoding these resistances has led to nosocomial outbreaks and endemic situations worldwide.
Development of new rapid diagnostic tests to track antimicrobial resistance patterns is considered as one of the priority core actions by international experts and health authorities. NDM and KPC represent two of the most increasing and prevalent carbapenemases in many countries. On the other hand, class D OXA-48 type carbapenemases are the most challenging resistance mechanisms to be detected by clinical laboratories. VIM is not only present in Enterobacteriaceae but is also highly prevalent in non-fermenting bacteria. IMP should be regarded as a potential problem since they degrade not only C3G but also carbapenem antimicrobial drug like Imipenem. IMP prevalence is the lowest, apart from Japan where it is more prevalent.
Inhibitor-based phenotypic confirmatory tests exist for the confirmation of class A (KPC) and class B (VIM, IMP, NDM) carbapenemases, Nowadays, definitive confirmation of CPO resistance mechanism relies on molecular assays. These tests are expensive and can only be performed in dedicated environment and by skilled personnel, hence limiting their more generalized usage.
O.K.N.V.I. RESIST-5 test is part of Coris BioConcept RESIST range of antimicrobial resistance diagnostic tests.

II. PRINCIPLE OF THE TESTS

These tests are ready to use and are based on a membrane technology with colloidal gold nanoparticles. Our kit is aimed to detect and identify the carbapenemases from a bacterial colony isolate of Enterobacteriaceae or NFGNB growing on agar plate. Each pouch contains: 2 lateral-flow cassettes for the identification of (i) OXA-48, KPC, NDM and (ii) VIM and IMP.
Identification of OXA-48, KPC and NDM. A nitrocellulose membrane is sensitised with:
(1) a monoclonal antibody directed against OXA-48 carbapenemase and variants (except OXA-163-like enzymes) (“O” line)
(2) a monoclonal antibody directed against KPC carbapenemase (“K” line)
(3) a monoclonal antibody directed against NDM carbapenemase (“N” line)
(4) a control capture reagent (upper “C” line).
Four different colloidal gold nanoparticles conjugates are dried on a membrane: a conjugate directed against a second epitope of the OXA-48 carbapenemase, a conjugate directed against a second epitope of the KPC carbapenemase, a third conjugate specific to NDM carbapenemase and a control conjugate to validate the test conditions.
Identification of VIM and IMP. A nitrocellulose membrane is sensitised with:
(1) a monoclonal antibody directed against VIM carbapenemase (“V” line),
(2) a monoclonal antibody directed against IMP carbapenemase (“I” line)
(3) a control capture reagent (upper “C” line).
Three different colloidal gold nanoparticles conjugates are dried on a membrane: a conjugate directed against VIM carbapenemase, a conjugate directed against IMP carbapenemase and a control conjugate.
When the provided buffer containing the resuspended bacteria comes into contact with the membrane, the solubilised conjugates migrate with the sample by passive diffusion, while conjugates and sample material come into contact with the immobilised respective antibodies that are adsorbed onto the nitrocellulose strip. If the sample contains an OXA-48, KPC, NDM, VIM or IMP carbapenemase, the respective complexes made of the conjugates and either OXA-48, or KPC, or NDM or VIM or IMP will remain bound to their respective specific lines (OXA-48 : “O” line; KPC : “K” line; NDM : “N” line, VIM : “V” line, IMP : “I” line). The migration continues by passive diffusion and both conjugates and sample material come into contact with the (upper) line control reagent that binds a control conjugate (“C” line), thereby producing a red line.
The result is visible within 15 minutes in the form of red lines on the strip.

III. REAGENTS AND MATERIALS

1. O.K.N.V.I. RESIST-5 (2x20 cassettes)
20 sealed pouches containing two lateral-flow cassettes and one desiccant.
Each cassette contains one sensitised strip.
2. LY-D buffer vial (7 mL)
Tris-EDTA solution containing NaN_3 (<0.1%) and a detergent.
3. Instruction for use (1)
4. Disposable collection tubes (20)
5. Disposable transfer pipettes (20)

Materials to be ordered separately:
- RESIST-BC (S-1001): reagents kit for use with blood culture
- ReSCape (S-1002): reagents kits for use with rectal swab

IV. SPECIAL PRECAUTIONS

- All operations linked to the use of the test must be performed in accordance with good laboratory practices.
- All reagents are for *in vitro* diagnostic use only.
- Pouch must be opened with care.
- Avoid touching nitrocellulose with your fingers.
- Wear gloves when handling samples.
- Never use reagents from another kit.
- Green lines indicate immunoreagents adsorption sites. Green colour disappears during the test.
- The quality of the reagents cannot be guaranteed beyond their shelf-life dates or if reagents are not stored under required conditions as indicated in the insert.

V. WASTE DISPOSAL

- Dispose of gloves, swabs, test tubes and used devices in accordance with GLP.
- Each user is responsible for the management of any waste produced, and must ensure that it is disposed of in accordance with the applicable legislation.

VI. STORAGE

- An unopened pouch may be kept at between 4 and 30°C and used until the shelf-life date indicated on the packaging. Once the pouch is opened, run the test immediately.
- Avoid freezing devices and buffer.

VII. SPECIMEN HANDLING AND COLLECTION

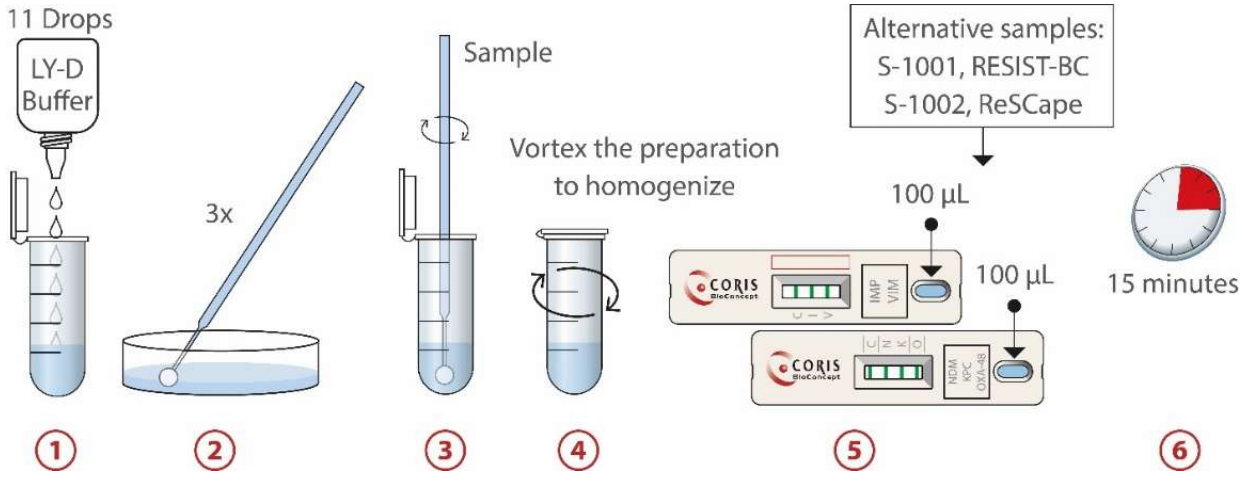
Specimens to be tested should be obtained and handled by standard microbiological methods.
Make sure that the specimens are not treated with solutions containing formaldehyde or its derivatives.
Culture media tested and validated with Coris BioConcept RESIST kits are listed on the website: https://www.corisbio.com/products/oknvi-resist-5/faq

VIII. PROCEDURE

PREPARATIONS OF THE TEST:
Allow kit components, in unopened packaging, and specimens (in the event that the plate containing colony to be tested was kept at 4°C) to equilibrate at room temperature (15-30°C) before performing a test.
Open the pouch and remove the device. Once opened, run the test immediately. Indicate the patient’s name or specimen number on the device (one device per sample).

SPECIMEN PREPARATION PROCEDURE:
Performance claims with regard to sample types other than bacterial colonies have been established for rectal swabs and blood cultures.
With rectal swabs and blood cultures, the preparation procedure has to be followed as described in the respective kits (S-1002, ReSCape and S-1001, RESIST-BC)
With bacterial colonies, we recommend the use of fresh agar cultures for optimal test performance and as followed:

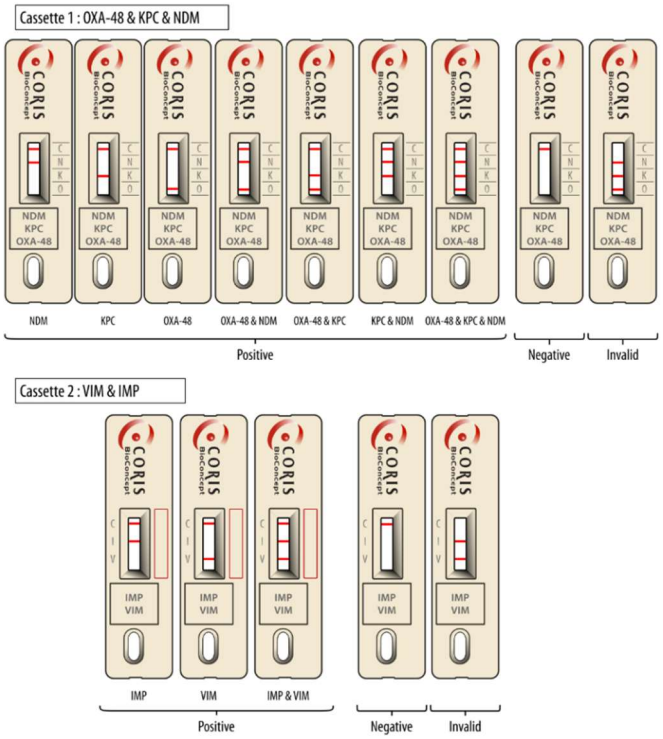
1. Prepare one collection tube and add **11 drops** of LY-D buffer in the tube
2. Harvest bacteria by taking **3 colonies** with a disposable bacteriological loop and dip the loop in the bottom of the tube containing the buffer. The same bacteriological loop can be used to collect the 3 colonies.
3. Stir thoroughly before removing the loop.
4. Close de tube and vortex the preparation to homogenize.
5. Use the transfer pipette provided in the kit and add 100 µL of diluted sample into the sample well of each of the two cassettes labelled (i) NDM, KPC and OXA-48 and (ii) IMP and VIM (**diluted sample must reach the black line indicated on the transfer pipette to accurately aspirate 100 µL**).
6. Allow to react for 15 minutes and read the result.



Positive results may be reported as soon as the test and control lines become visible.
Do not take the appearance of new lines into account after the reaction time has passed.
The result must be read on still wet strip.

IX. INTERPRETING RESULTS

The results are to be interpreted as follows for each of the two cassettes:
Negative test result: a reddish-purple line appears across the central reading window at the Control line (C) position. No other line is present.
Positive test result: in addition to a reddish-purple line at the Control line (C), a visible reddish-purple line appears at one of the Test lines position ("N" or "K" or "O") on cassette labelled (i) NDM, KPC, OXA-48 or at one of the Test lines position ("I" or "V") on cassette labelled (ii) IMP and VIM. Intensity of the test line may vary according to the quantity of antigens as well as of the variant type present in the sample. Any reddish-purple test line (OXA-48, KPC, NDM, VIM and IMP), even weak, should be considered as a positive result.
If a positive test line appears beside of the "O" mark, the sample contains OXA-48 or OXA-48-like variants. If it appears beside the "K" mark, the sample contains KPC variants; beside the "N" mark, the sample contains NDM; the "V" mark, the sample contains VIM; and beside of the "I" mark, IMP is present in the sample. Combinations of positive test lines can occur.
In this case the sample contains several carbapenemases.
Invalid test result: The absence of a Control line indicates a failure in the test procedure. Repeat invalid tests with a new test device.
Note: during the drying process, a very faint shadow may appear at the Test line positions. It should not be regarded as a positive result.



X. PERFORMANCE

A. Detection Limit

The detection limit determined with purified recombinant proteins of OXA-48, KPC, NDM, VIM and IMP have been evaluated at 0.25 ng/mL, 0.5 ng/mL, 0.0625 ng/mL, 0.23 ng/mL and 0.781 ng/mL, respectively.

B. Retrospective study

The test cassettes were validated by comparison with reference molecular method (validated in house multiplex PCR including sequencing) in a retrospective study performed on 180 non duplicated, consecutive suspected CPE clinical isolates collected between 2012 and 2021 from Belgian hospitals.

Molecular method / OXA-48 test	Positive	Negative	Total
Positive	41	0	41
Negative	0	139	139
Total	41	139	180

95 % Confidence Interval [1]

Sensitivity:	100 %	(89.3 to 100 %)
Specificity:	100 %	(96.6 to 100 %)
Positive Predictive value:	100 %	(89.3 to 100 %)
Negative predictive value:	100 %	(96.7 to 100 %)
Agreement:	100 %	(180/180)

Molecular method / KPC test	Positive	Negative	Total
Positive	24	0	24
Negative	0	156	156
Total	24	156	180

95 % Confidence Interval [1]

Sensitivity:	100 %	(82.8 to 100 %)
Specificity:	100 %	(97.0 to 100 %)
Positive Predictive value:	100 %	(82.8 to 100 %)
Negative predictive value:	100 %	(97.0 to 100 %)
Agreement:	100 %	(180/180)

Molecular method / NDM test	Positive	Negative	Total
Positive	40	0	40
Negative	0	140	140
Total	40	140	180

95 % Confidence Interval [1]

Sensitivity:	100 %	(89.1 to 100 %)
Specificity:	100 %	(96.7 to 100 %)
Positive Predictive value:	100 %	(89.1 to 100 %)
Negative predictive value:	100 %	(96.7 to 100 %)
Agreement:	100 %	(180/180)

Molecular method / VIM test	Positive	Negative	Total
Positive	43	0	43
Negative	3	134	137
Total	46	134	180

95 % Confidence Interval [1]

Sensitivity:	93.5 %	(81.1 to 98.3 %)
Specificity:	100 %	(96.5 to 100 %)
Positive Predictive value:	100 %	(89.8 to 100 %)
Negative predictive value:	97.8 %	(93.2 to 99.4 %)
Agreement:	98.3 %	(177/180)

Molecular method / IMP test	Positive	Negative	Total
Positive	19	0	19
Negative	0	161	161
Total	19	161	180

95 % Confidence Interval [1]

Sensitivity:	100 %	(79.1 to 100 %)
Specificity:	100 %	(97.1 to 100 %)
Positive Predictive value:	100 %	(79.1 to 100 %)
Negative predictive value:	100 %	(97.1 to 100 %)
Agreement:	100 %	(180/180)

The O.K.N.V.I. RESIST-5 kit was also validated with rectal swabs and blood cultures.

C. Repeatability and reproducibility

To check intra-batch accuracy (repeatability), the same positive samples and a buffer solution were processed 15 times on kits of the same production batch in the same experimental conditions. All observed results were confirmed as expected.
To check inter-batch accuracy (reproducibility), some samples (positive and buffer) were processed on kits from three different production batches. All results were confirmed as expected.

XI. LIMITS OF THE KIT

The test is qualitative and cannot predict the quantity of antigens present in the sample. Clinical presentation and other test results must be taken into consideration to establish diagnosis. A positive test does not rule out the possibility that other antibiotic resistance mechanisms may be present.

XII. TECHNICAL PROBLEMS / COMPLAINTS

If you face a technical problem or if performances do not correspond with those indicated in this package insert:

1. Record the lot number of the kit concerned.
2. If possible, keep the sample in the appropriate storage condition during the complaint management.
3. Contact Coris BioConcept (client.care@corisbio.com) or your local distributor.

Any serious incident that has occurred in relation to the device shall be reported to the manufacturer and the competent authority of the Member State in which the user and/or the patient is established.

XIII. BIBLIOGRAPHIC REFERENCES

A. **J. Wesley MacDonald and V. Chibabhai Evaluation of the RESIST-4 O.K.N.V immunochromatographic lateral flow assay for the rapid detection of OXA-48, KPC, NDM and VIM carbapenemases from cultured isolates** Access Microbiology 2019;1
B. T. Pilate, S. Desmet Detection of carbapenemase production in pseudomonas aeruginosa in a tertiary care centre Annual Meeting of the Royal Belgian Society of Laboratory Medicine November 15th, 2019 Belgium
C. **Oueslati S, Iorga BI, Tlili L, Exilie C, Zavala A, Dortet L, Jousset AB, Bernabeu S, Bonnin RA, Naas T.** Unravelling ceftazidime/avibactam resistance of KPC-28, a KPC-2 variant lacking carbapenemase activity. **J Antimicrob Chemother. 2019 Aug 1;74(8):2239-2246**
D. **Brolund A, Lagerqvist N, Byfors S, Struelens MJ, Monnet DL, Albiger B, Kohlenberg A.** Worsening epidemiological situation of carbapenemase-producing Enterobacteriaceae in Europe, **assessment by national experts from 37 countries, July 2018. Euro Surveill. 2019 Feb; 24 (9) 1560-7917**
E. **Oliveira J, Reygaert WC.** Gram Negative Bacteria. **StatPearls Publishing; 2019 Jan-2019**
F. **Baeza LL, Pfennigwerth N, Greissl C, Göttig S, Saleh A, Stelzer Y, Gatermann SG, Hamprecht A.** Comparison of five methods for detection of carbapenemases in Enterobacterales with proposal of a new algorithm. **Clin Microbiol Infect. 2019 Mar 18. pii: S1198-743X(19)30104-1**
G. **Rösner S, Kamalanabhaiah S, Küsters U, Kolbert M, Pfennigwerth N, Mack D.** Evaluation of a novel immunochromatographic lateral flow assay for rapid detection of OXA-48, NDM, KPC and VIM carbapenemases in multidrug-resistant Enterobacteriaceae. **J Med Microbiol. 2019 Mar;68(3):379-381.**
H. **Glupczynski Y, Evrard S, Huang TD, Bogaerts P.** Evaluation of the RESIST-4 K-SeT assay, a multiplex immunochromatographic assay for the rapid detection of OXA-48-like, KPC, VIM and NDM carbapenemases. **J Antimicrob Chemother. 2019 Feb 6. doi: 10.1093**

Last update : 20 FEBRUARY 2023

REF	Catalogue number		Manufacturer
IVD	In vitro diagnostic medical device		Temperature limits
Σ	Contains sufficient for <n> tests	LOT	Batch code
	Consult instructions for use		Do not reuse
	Keep dry		Use by
DIL SPE	Diluent specimen	CONT NaN_3	Contains Sodium azide
UDI	Unique device identifier		

[1] Newcombe, Robert G. "Two-Sided Confidence Intervals for the Single Proportion: Comparison of Seven Methods," *Statistics in Medicine*, **17**, 857-872 (1998).

accuracy and quality as a science

tcs biosciences

Selectrol® Technical Guide

Selectrol® : Manufactured under licence from Public Health England Culture Collections

SELECTROL® - FREEZE-DRIED ORGANISMS IN A DISC

Quality control of microbial characterisation tests, culture media and antimicrobial susceptibility determinations is best accomplished by the use of microorganisms with well-documented and stable phenotypic and genotypic characteristics.

Bacterial and fungal strains have been selected and recommended by expert bodies, such as EUCAST, CLSI and the European Pharmacopoeia, on the basis of their suitability for monitoring test performance and ensuring the validity of results for testing used in clinical, food, pharmaceutical, water and veterinary laboratories.

Products derived from the cultures in the collections should be manufactured using the minimum number of sub-cultures, to minimise the possibility of alterations to the phenotype due to mutations. See also page 14.

Selectrol strains are manufactured exclusively from Public Health England Culture Collections (NCTC® and NCPF®) and are first generation subcultures, unlike many products on the market which are 2nd, 3rd or 4th generation subcultures. They are preserved by long-term storage as freeze-dried cells in order to minimise any alterations to the phenotype caused by mutations.

Passages

A Selectrol® disc is a first generation subculture from a **master culture** sourced from Public Health England Culture Collections, and is designed to be used to obtain **working stock** cultures for use in testing. It is generally accepted that no more than a total of five passages should be made from the **master culture**, in order to avoid genetic drift and mutant selection. Therefore, no more than four passages (fresh cultures) from the **working stock** should be made.

Shelf life

For most strains, Selectrol® discs are guaranteed to contain at least 10^6 organisms at the time of purchase; this number is sufficient to ensure that when the discs are used and stored as directed there will be viable organisms cultivable up to the stated end of the shelf life, which is usually 9 months from the time the vial is first opened.

Quality Control

Selectrol® batches are tested in our UKAS accredited testing laboratory number 2496. A test report for each batch of Selectrol® can be accessed via our website. The reporting of Selectrol® test results via the website comes under our UKAS accreditation.

Selectrol® cultures are rigorously tested to confirm identity, to confirm the possession of essential phenotypic characteristics and to exclude contamination with other organisms. Photographic evidence of the test results is retained for each batch, along with retained appropriately stored samples.

Glossary

AMRHAI: Antimicrobial Resistance and Healthcare Associated Infections reference unit

ATCC®: American Type Culture Collection. ATCC® strains are listed for reference only. ATCC® is a registered trademark of the American Type Culture Collection.

BSAC: British Society for Antimicrobial Chemotherapy - Now superseded by EUCAST

CLSI: Clinical Laboratory Standards Institute. (USA)

CPE: Carbapenemase Producing Enterobacteriaceae

CRE: Carbapenem Resistant Enterobacteriaceae

Culture collection: Cultures of fully characterised organisms maintained in such a way as to minimise sub-culturing. See page 14.

ESBL: Extended Spectrum Beta-Lactamase-producing organism.

EUCAST: European Committee on Antimicrobial Susceptibility Testing.

First generation derivative: A single passage from a master culture, for example a Selectrol® disc.

Master culture: Culture derived from a reference culture vial.

NCPF®: National Collection of Pathogenic Fungi. NCPF® is a registered trademark of Public Health England.

NCTC®: National Collection of Type Cultures. NCTC® is a registered trademark of Public Health England.

Passage: An equivalent term for a subculture.

PHE: Public Health England.

Reference cultures: Quality control strains selected on the basis of their phenotypic biochemical and antimicrobial susceptibility characteristics to be used as controls in microbiological testing. These are obtained as freeze-dried vials from culture collections.

Stock culture: Cultures derived from a Selectrol® disc, which can be stored for up to a week, usually on agar slants.

Working cultures: Stock cultures further sub-cultured to provide 18-24 hour growth for use in testing.

WDCM: World Data Centre for Microorganisms

WFCC: World Federation for Culture Collections

SIGNIFICANT PROPERTIES AND USES OF SELECTROL® ORGANISMS

Aspergillus brasiliensis (formerly *Aspergillus niger*)**:**

MM94 – NCPF® 2275 / ATCC® 16404 / WDCM 00053 – used in pharmaceutical industry for testing media and preservatives. Colonies are initially white or yellowish and on the reverse greyish or greenish-yellow. Sporing heads on the colony surface are initially pale, becoming dark brown to black. Sporulation may be inhibited in sealed plates.

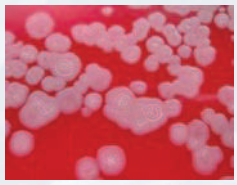
***Bacillus cereus*:**

MM21 – NCTC® 10320 / ATCC® 9634 / WDCM 00001 (recently renamed *Bacillus toyonensis*) – ISO 11133 recommended media and ID test control organism.

MM86 – NCTC® 7464 / ATCC® 10876 – PHE recommended media and ID test control organism.

Bacillus subtilis *(Bacillus subtilis* subsp. *spizizenii)***:**

MM29 – NCTC® 10400 / ATCC® 6633 / WDCM 00003 – used in antibiotic assays (fully sensitive), PHE recommended media and ID test control organism.



***Bacteroides fragilis*:**

MM44 – NCTC® 9343 / ATCC® 25285 – type strain, PHE recommended strain for media and sensitivity test control.

Campylobacter jejuni *(Campylobacter jejuni* subsp. *jejuni)***:**

MM82 – NCTC® 11322 / ATCC® 29428 / WDCM 00156 – PHE recommended strain for media control.

MM36 – NCTC® 11351 / ATCC® 33560 – EUCAST recommended strain for susceptibility testing.

***Candida albicans*:**

MM28 – NCPF® 3255 / ATCC® 2091 / WDCM 00055 – sensitivity control / industrial use.

MM42 – NCPF® 3179 / ATCC® 10231 / WDCM 00054 – pharmaceutical / media testing / PHE recommended strain for media control.

CRE ≡ 'Carbapenem Resistant Enterobacteriaceae' / CPE ≡ 'Carbapenemase Producing Enterobacteriaceae'

There are 5 carbapenemases which are currently a significant problem in the UK – KPC, OXA-48, IMP, NDM and VIM – and PHE recommend that all clinically-significant Gram-negative bacteria should be routinely screened for carbapenemase production, using a recommended carbapenem[2] such as ertapenem or meropenem. Resistant isolates may be investigated further to determine which resistance mechanism is involved using the Modified Hodge Test, MALDI-TOF, PCR or a reference laboratory.

MM55 *Klebsiella pneumoniae* – NCTC® 13440 – produces a Class B VIM-1 Carbapenemase.

MM56 *Klebsiella pneumoniae* – NCTC® 13443 – produces a Class B NDM-1 Carbapenemase.

MM58 *Klebsiella pneumoniae* – NCTC® 13438 – produces a Class A KPC-3 Carbapenemase.

MM59 *Klebsiella pneumoniae* – NCTC® 13442 – produces a Class D OXA-48 Carbapenemase.

MM57 *Escherichia coli* – NCTC® 13476 – produces a Class B IMP Carbapenemase.

MM33 *Escherichia coli* – NCTC® 10418 / ATCC® 10536 – recommended by PHE as a negative control for CRE testing.

***Citrobacter freundii*:**

MM27 – NCTC® 9750 / ATCC® 8090 – type strain.

***Clostridium perfringens*:**

MM45 – NCTC® 8237 / ATCC® 13124 / WDCM 00007 – type strain. PHE recommended strain for food testing (Tryptose Sulphite Cycloserine agar – lactose and gelatin positive) and sensitivity test control. *Clostridium perfringens* is listed in Schedule 5 of the Anti-terrorism, Crime and Security Act 2001, and should be securely stored in accordance with the guidelines of the Act. However, MM45 is a type A strain, which does not produce the lethal epsilon toxin of potential interest to bioterrorists.

***Clostridium sporogenes*:**

MM31 – NCTC® 532 / ATCC® 19404 / WDCM 00008 – used for media control. PHE recommended strain for media QC (lactose gelatin medium for ID of *C. perfringens* lactose negative and gelatin positive).

***Enterobacter aerogenes*:**

MM26 – NCTC® 10006 / ATCC® 13048 / WDCM 00175 – type strain; used in water, paint and adhesive testing.

***Enterobacter cloacae*:**

MM01 – NCTC® 13380 / ATCC® 23355 / WDCM 00082 – disinfectant control, media testing.

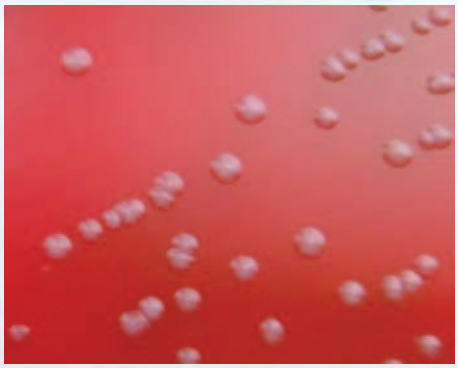
MM51– NCTC® 13406 – PHE recommended strain for QC of AmpC (de-repressed) detection.

***Enterococcus faecalis*:**

MM52 – NCTC® 13379 / ATCC® 51299 / WDCM 00085 – is vancomycin resistant (low-level VanB mediated) and also shows high-level resistance to aminoglycosides. It is used to confirm methodologies used to detect these resistances are working correctly. Lancefield group D.

MM17 – NCTC® 775 / ATCC® 19433 / WDCM 00009 – used in water industry and QC. PHE recommended strain for media control. Fully sensitive. Lancefield group D.

MM18 – NCTC® 12697 / ATCC® 29212 / WDCM 00087 – is fully sensitive to vancomycin and gentamicin. PHE recommended positive control strain for aesculin test. CLSI, EUCAST recommended media control for sulpha / trimethoprim testing and general susceptibility testing control. Lancefield group D.

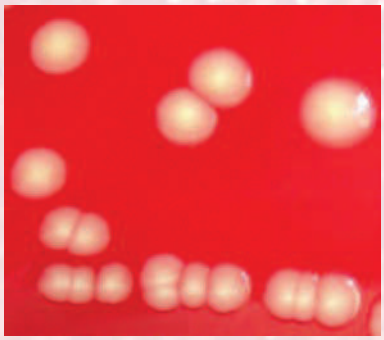


***Enterococcus hirae*:**

MM35 – NCTC® 13383 / ATCC® 10541 / WDCM 00011 – disinfectant control. Used in microbiological assays. Colonies are alpha-haemolytic on sheep blood agar.

***Escherichia coli* strains:**

MM02 – NCTC® 12241 / ATCC® 25922 / WDCM 00013 – EUCAST, CLSI, PHE recommended control strain for susceptibility testing (fully sensitive). Exhibits 2 colony types – the most prevalent type is slightly irregular, smooth and translucent. The secondary type appears more opaque. It is preferable to maintain cultures on agar as passage in broth can result in a change in MIC levels.



MM57 – NCTC® 13476 – CRE testing control; produces a Class B IMP Carbapenemase.

MM33 – NCTC® 10418 / ATCC® 10536 – (PHE recommended alternative to NCTC 12241) fully sensitive control strain. PHE recommended positive control for indole test, ONPG test, negative control for oxidase test, PHE recommended negative control for CRE and ESBL testing.

MM24 – NCTC® 11954 / ATCC® 35218 – beta-lactamase positive strain. CLSI recommended strain for susceptibility testing ONLY for penicillin / beta-lactamase inhibitor combinations. Sensitive to amoxicillin / clavulanic acid.

MM75 – NCTC® 9001 / ATCC® 11775 / WDCM 00090 – used in water / chemical industry. PHE recommended strain for media QC.

MM93 – NCTC® 12900 / ATCC® 700728 / WDCM 00014 – O157 strain (non-toxigenic). PHE recommended strain for media QC.

MM63 – NCTC® 11560 – beta-lactamase positive strain.

MM38 – NCTC® 12923 / ATCC® 8739 / WDCM 00012 – used in pharmaceutical / water industry. Three colony types: A) Entire, glistening, smooth and translucent. B) Entire, glistening smooth and opaque. C) Irregular, rough and translucent. The rough colonies appear after 48 hours incubation.

MM34 – NCTC® 13846 – Possesses the plasmid-mediated mcr-1 colistin resistance mechanism gene and is recommended by PHE and EUCAST as a control for tests to detect this increasingly prevalent resistance, in conjunction with NCTC® 12241 / ATCC® 25922 (Selectrol strain MM02) as a negative control.

***Haemophilus influenzae* strains:**

MM81 - NCTC® 12699 / ATCC® 49247 – is a 'BLNAR' strain – (beta-lactamase non-producing ampicillin / amoxycillin resistant). These strains are important clinically because the susceptibility results obtained using conventional testing procedures maybe misleading in the case cephalosporins. PHE, CLSI recommended QC strain for susceptibility testing media.

MM98 – NCTC® 11931 – a fully sensitive strain. PHE recommended strain for porphyrin synthesis test, chocolate agar control.

MM100 – NCTC® 8468 / ATCC® 9334 / CCUG 23946 – another fully sensitive strain, which reportedly gives results which are easier to interpret when Mueller-Hinton medium is used in preference to Iso-Sensitest medium. MIC for amoxycillin is 0.5 mg/l.

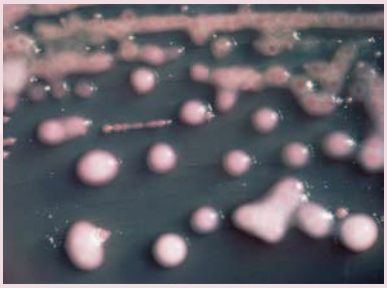
MM37 – NCTC® 12975 / ATCC® 49766 – recommended by EUCAST.

***Klebsiella* strains:**

MM04 *Klebsiella pneumoniae* – NCTC® 9633 / ATCC® 13883 / WDCM 00097 – type strain. Two colony types may be seen. The predominant type is entire and opaque. The secondary type is slightly smaller and translucent.

MM83 *Klebsiella pneumoniae* – NCTC® 13368 / ATCC® 700603 – ESBL-producing strain used as control for ESBL testing. There are two colony types.

MM55 *Klebsiella pneumoniae* – NCTC® 13440 – CRE testing control; produces a Class B VIM-1 Carbapenemase.



MM56 *Klebsiella pneumoniae* – NCTC® 13443 – CRE testing control; produces a Class B NDM-1 Carbapenemase.

MM58 *Klebsiella pneumoniae* – NCTC® 13438 – CRE testing control; produces a Class A KPC-3 Carbapenemase.

MM59 *Klebsiella pneumoniae* – NCTC® 13442 – CRE testing control; produces a Class D OXA-48 Carbapenemase.

MM88 *Klebsiella aerogenes (Raoultella planticola)* – NCTC® 9528 – used in water / pharmaceutical industry. PHE recommended negative control for Tryptone Bile X-Glucuronide agar and Yeast Extract agar.

***Lactobacillus brevis*:**

MM76 – NCTC® 13386 / ATCC® 8287 – used in food industry.

***Legionella pneumophila* serogroup 1:**

MM08 – NCTC® 11192 / ATCC® 33152 / WDCM 00107 – derived from strain isolated from first recognised outbreak of legionellosis in Philadelphia at the Legionnaires' Convention 1976

***Listeria innocua*:**

MM92 – NCTC® 11288 / ATCC® 33090 / WDCM 00017 – type strain. Non-pathogenic.

***Listeria monocytogenes*:**

MM87 – NCTC® 11994 / WDCM 00019 – type strain, PHE recommended positive control strain for Listeria detection in food. Serotype 4b, most common serovar isolated from human infections.

MM48 – NCTC® 7973 / ATCC® 35152 / WDCM 00109 – produces 2 phenotypes, one is beta-haemolytic and virulent, the other non-haemolytic and non-virulent. Serovar 1/2a.

MM77 – NCTC® 13372 / ATCC® 7644 – used in food microbiology Q.C. Colonies exhibit beta-haemolysis on sheep blood agar.

***Neisseria gonorrhoeae*:**

MM96 – NCTC® 12700 / ATCC® 49226 – has low-level, but clinically relevant, resistance to penicillin – MIC of penicillin is 0.5 mg/l. PHE recommended control for susceptibility testing – methodology assesses the ability of testing to detect resistance rather than sensitivity; this strain has low-level, but clinically relevant, resistance to penicillin – MIC of penicillin is 0.5 mg/l. Some variation in size and texture of colonies may be observed. Increased CO_2 is helpful in growth.

MM05 – NCTC® 8375 / ATCC® 19424 – is fully sensitive – MIC of penicillin is 0.06 mg/l. PHE recommended strain for media QC.

***Proteus mirabilis*:**

MM43 – NCTC® 13376 / ATCC® 14153 – pharmaceutical / disinfectant / media control.

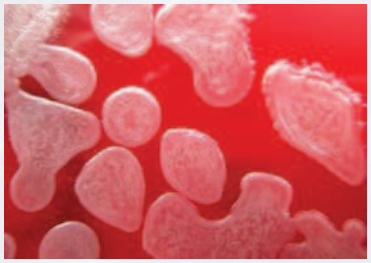
MM68 – NCTC® 10975 – media control. PHE recommended control for motility test.

***Proteus vulgaris*:**

MM09 – NCTC® 4175 / ATCC® 13315 – was the type strain, but is atypical and has been recognised as a separate species – *Proteus hauseri* – it is used for media control. Colonies are glistening with spreading edges.

***Pseudomonas aeruginosa* strains:**

MM10 – NCTC® 12903 / ATCC® 27853 / WDCM 00025 – is fully sensitive to anti-pseudomonal antibiotics (EUCAST susceptibility test control). 2 colony types may be observed: A) predominantly flat, spreading edges and rough surface; B) small and compact. Produces both fluorescein and pyocyanin pigments.



MM65 – NCTC® 10662 / ATCC® 25668 / WDCM 00114 – is fully sensitive. PHE recommended control strain for media control

MM40 – NCTC® 12924 / ATCC® 9027 / WDCM 00026 – used in water industry / disinfectant testing. Colonies on agar plates are entire, glistening and mucoid with a grainy surface. This strain also produces both fluorescein and pyocyanin pigments.

MM41 – NCTC® 13359 / ATCC® 15442 – used in water industry / disinfectant testing. May produce up to 3 different colony types. Pyocyanin is not produced.

***Rhodococcus equi*:**

MM97 – NCTC® 1621 / ATCC® 6939 / WDCM 00028 – type strain.

***Saccharomyces cerevisiae*:**

MM73 – NCPF® 3178 – PHE recommended strain for food testing and enumeration of yeasts and moulds.

MM50 — NCTC® 10716 / WDCM 00058 – used for QC of culture media and for antifungal susceptibility testing.

***Salmonella serotypes*:**

MM11 *Salmonella* Typhimurium – NCTC® 12023 / ATCC® 14028 / WDCM 00031 – (1,4,5,12: i: 1,2) Used for media/test QC. This is a common serotype from animals and from human infections.

The strains listed below are unusual serotypes, used to avoid any chance of confusion with strains commonly found in animals, food, etc, and are used to control media and detection methods in the food industry:

MM89 *Salmonella* Poona – NCTC® 4840 – (13,22: z: 1,6) PHE recommended control strain for food testing.

MM84 *Salmonella* Nottingham – NCTC® 7832 – (16: d: e,n,z15) PHE recommended control for water testing.

***Serratia marcescens*:**

MM12 – NCTC® 13382 / ATCC® 8100 – used for disinfectant testing. PHE recommended negative control for indole test. Colonies are entire, glistening, smooth and translucent. Non-pigmented.

***Staphylococcus aureus*:**

(A) Fully sensitive:

MM85 – NCTC® 6571 / ATCC® 9144 / WDCM 00035 – historically used for susceptibility testing ('Oxford staph'), but largely superseded by MM13 as it has unusually low MIC's and so is unrepresentative of normal range of Staph aureus strains. Sensitive to penicillin and cefoxitin / methicillin / oxacillin. PHE recommended coagulase, DNAse and catalase positive control.

MM13 – NCTC® 12981 / ATCC® 25923 / WDCM 00034 – used in susceptibility and media testing/QC. Fully sensitive to all anti-staphylococcal antibiotics (including penicillin and methicillin / oxacillin). It is preferable to maintain cultures on agar as passage in broth can result in a change in MIC levels. Colonies are circular white to cream, convex to flat in elevation. After 48 hours incubation a few grey/translucent variants may be noted. Beta-haemolytic on sheep blood agar.

B) Penicillin resistant:

MM14 – NCTC® 12973 / ATCC® 29213 / WDCM 00131 – used for susceptibility testing, especially for automated methodology. EUCAST, CLSI strain. Sensitive to cefoxitin / methicillin / oxacillin. Penicillin resistant – weak beta-lactamase producer. Colonies are beta-haemolytic, and a golden-orange colour.

MM30 – NCTC® 7447 / ATCC® 6538P / WDCM 00033 – used for susceptibility testing/antibiotic assay, disinfectant testing. Cefoxitin / methicillin / oxacillin sensitive. Penicillin resistant. Colonies are weakly beta-haemolytic, coagulase positive and beta-lactamase negative.

(C) MRSA (cefoxitin / methicillin / oxacillin resistant):

MM91 – NCTC® 13373 / ATCC® 43300 / WDCM 00211 (MRSA) – Possesses mecA gene but is hetero-resistant, (so as few as one per thousand cells demonstrate the resistance) and consequently has low-level cefoxitin /oxacillin/methicillin resistance (4.0 mg/l MIC of oxacillin, 8.0 mg/l MIC of cefoxitin – methicillin sensitive strains have MIC of 0.12-0.5 for oxacillin and 1-4 for cefoxitin.); it is used to confirm testing procedures for methicillin resistance are working and provides a more stringent test than testing with an MRSA which shows homogeneous resistance and has a much higher MIC. This organism will have a zone of inhibition reduced in size compared to a fully cefoxitin / oxacillin / methicillin sensitive strain (such as MM13). CLSI recommended strain for MRSA testing. There are two colony types: 1) Beta-haemolytic with a slight yellow tint. 2) Non-haemolytic and white.

MM64 – NCTC® 12493 / WDCM 00212 (MRSA) – possesses mecA gene and shows homogeneous resistance with MIC of >64 for methicillin, which produces high-level cefoxitin / methicillin / oxacillin resistance. EUCAST recommended strain. Instances have been reported where loss of the mecA gene has occurred during storage.

D) Other:

MM46 – NCTC® 10788 / ATCC® 6538 / WDCM 00032 – used in pharmaceutical industry for testing disinfectants etc. Usually yellow pigmented colonies, or can produce a white colonial variant. Beta-haemolytic.

***Staphylococcus epidermidis*:**

MM15 – NCTC® 13360 / ATCC® 12228 / WDCM 00036 – used for media control / antibiotic assay. Colonies are small and beta-haemolytic.

***Streptococcus agalactiae*:** (Beta-haemolytic Streptococcus group B)

MM16 – NCTC® 8181 / ATCC® 13813 – type strain, used for QC. PHE recommended negative control for aesculin test.

Streptococcus pneumoniae strains:

MM95 – NCTC® 12977 / ATCC® 49619 – has low-level, but clinically relevant, resistance to penicillin – this organism is used to assess detection of resistance rather than sensitivity. PHE recommended positive control for bile solubility test. CLSI, EUCAST recommended control strain for susceptibility testing. Serotype 19F.

MM19 – NCTC® 12695 / ATCC® 6303 – is fully sensitive. Colonies are mucoid and alpha-haemolytic. A few colonies may have an irregular edge. Serotype 3.

***Streptococcus pyogenes*:**

MM20 – NCTC® 12696 / ATCC® 19615 – used for QC and media testing. Lancefield group A, beta-haemolytic.
PHE recommended blood agar control.

***Vibrio parahaemolyticus*:**

MM06 – NCTC® 10885 / WDCM 00185 – used for QC of media and ID testing. PHE recommended strain used mainly in the food industry.

***Yersinia enterocolitica*:**

MM80 – NCTC® 12982 / ATCC® 9610 / WDCM 00038 – type strain, used for media control. Serotype O:8, which is a pathogenic serotype, commonest in USA.

References:

1 European Committee on Antimicrobial Susceptibility Testing (EUCAST). Routine and Extended Internal Quality Control for MIC Determination and Disc Diffusion. Version 7.0 - 01.01.2017.

2 UK Standards for Microbiology Investigations. Example Reference Strains for Microbiology Investigations Test Procedures: Bacteriology—Test Procedures | TP 1 | Issue No. 2 | 05.01.2015. Public Health England (PHE).

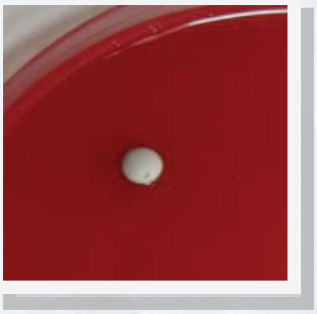
3 Performance Standards for Antimicrobial Disc Susceptibility Tests: Approved Standard—11th Edition. Clinical and Laboratory Standards Institute (CLSI).

How to use Selectrol®

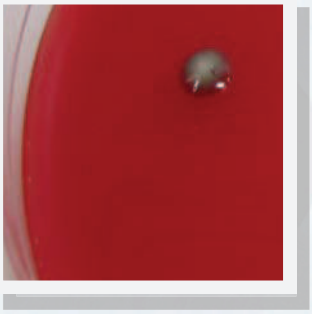
Always warm the vial to ambient temperature before opening.

Be sure to use non-selective culture media to revive the organisms.

For the more fastidious organisms, such as anaerobes, it is generally better to use agar rather than broth for revival.

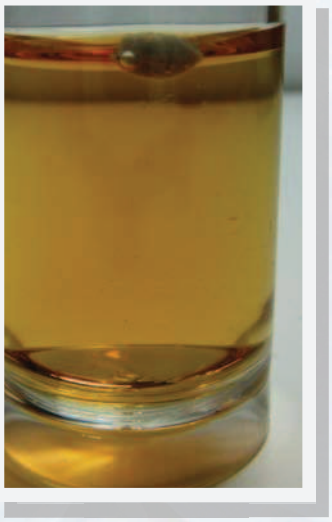


Place disc on suitable growth medium such as blood agar



Leave disc for a few minutes to liquefy, then spread plate and incubate to produce isolated colonies

Obtain a stock culture which can be used to prepare an inoculum for biochemical and antibiotic susceptibility tests



Place disc in a small volume of a suitable broth medium such as brain-heart infusion

Allow disc a few minutes to dissolve, then spread aliquot onto a plate of suitable growth medium

Out-of-specification results

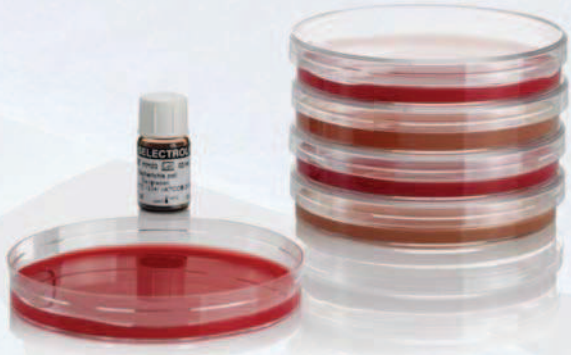
Laboratories use Selectrol® for Quality Control of culture media, biochemical identification tests and antimicrobial susceptibility testing. When a laboratory test result, an MIC or biochemical reaction, is unexpected or out-of-specification, the test should first be repeated to confirm it; an out-of-specification result is an indication that the testing procedure should be reviewed; it is not, in the first instance, a sign of a problem with the control organism.

If incorrect results are obtained on retesting, the explanation could be:

- The test procedure was not followed correctly – check standard operating procedures
- There is an instrumentation error – check calibration, mechanical functioning, etc
- There is a problem with the consumables – out of date, incorrect storage, etc
- The culture of the control organism has become contaminated

Technical Support

If no explanation for out-of-spec results can be found, but repeated tests still give unacceptable results, please contact TCS and / or your relevant reference laboratory or instrument manufacturer for advice. For example, contact AMRHAI at Colindale, London if MIC results are consistently outside the acceptable range. Please retain any remaining discs of organisms about which you have concerns so they can be returned to TCS and investigated alongside retained samples.



Preparing QC and Validation Spikes from Selectrol®

Preparing the spike

- Place a Selectrol® disc in Brain Heart Infusion (BHI) broth* or equivalent, and culture (typically for 18 hours) at the appropriate temperature for the organism (typically 37°C)
- Assume the count in the broth to be 10^8 organisms per ml ---------- (A)
- Mix and transfer 100 µl of (A) to 100 ml of saline or ¼ strength Ringer's solution -- (B)
- Mix and transfer 100 µl of (B) to 10 ml of saline or ¼ strength Ringer's solution --- (C)
- Mix and transfer 100 µl of (C) to your homogenised food sample.

Verifying the inoculum

- Pipette 5 x 10 µl drops from (C) onto each of two agar plates for Miles and Misra counts.

Using the assumptions and dilutions above:

- (A) contains 10^8 organisms per ml
- (B) contains 10^5 organisms per ml
- (C) contains 10^3 organisms per ml

If the Miles and Misra counts indicate that the required count was not achieved:

- If the count was too high by a factor of 10, reduce the volume transferred from (A) to (B) from 100 µl to 10 µl
- If the count was too low by a factor of 10, increase the volume transferred from (A) to (B) from 100 µl to 1 ml.

Keep a record of the correct dilutions for each organism type for future use. You will find that this method is very repeatable.

*Note: BHI broth will work for most of the Selectrol® organisms; however, for fastidious organisms an appropriate culture broth must be selected, e.g. Fastidious Anaerobe Broth for strictly anaerobic organisms.

Culture Collections

Cultures of microorganisms have been deposited and subsequently maintained in 589 collections in 68 countries, and many of the cultures are derived from the same original isolate; the history of each organism, its properties and names of the culture collections which hold it are detailed in the relevant catalogues and websites.

Some of the organisms have been selected and recommended by expert organisations to be supplied as controls for microbiological tests, and when the identical cultures are present in more than one collection they will have a specific designation for each, incorporating the abbreviation for the collection and a reference number.

For example:- *Staphylococcus aureus* NCTC 7447, widely recommended as a control for antimicrobial susceptibility testing, is held in 30 collections, and consequently the phenotypically and genotypically identical organism has 30 different references, such as ATCC 6538P, CIP 53.156, DSM 346 and so on.

In an effort to minimise potential confusion and help users find local sources of reference strains, the WFCC and the WDCM initiated a system that ascribes each recommended QC strain a reference number (WDCM 00001 onwards), cites all collections that contain it and provides contact details and each collection's unique reference. For example, the strain of *Staphylococcus aureus* NCTC 7447 (Selectrol® strain MM33) mentioned above is designated WDCM 00033.

Staphylococcus aureus WDCM 00033

AHU 1142; ATCC™ 6538P; BCRC 10451 ; BTCC 209P; BU 395; CCM 2022; CCTM 596; CCUG 1828; CECT 240; CIP 53.156; CN 3784; CNCTC Mau 28/58; DSM 346; FIRDI 451; IAM 1011; IAM 12082; IEM Mau 28/58; IFO 12732; IFO 3061; IID 671; IMET 10904; JCM 2151; LMG 8195; NCIMB 8625; NCTC 7447; NRRL B-313; OUT 8232; PCI 1209; PZH 8/54; RIMD 3109007; VNIIA 209P;

Products derived from the cultures in the collections should be manufactured using the minimum number of sub-cultures, to minimise the possibility of alterations to the phenotype due to mutations. Ideally, as in the case of **Selectrol®**, a single sub-culture only is used, so the **Selectrol®** product is a 'first generation derivative' of a culture supplied by NCTC, and will be identical with regard to its properties and suitability for use in QC applications to a culture of the particular organism obtained from any of the other WDCM listed culture collections.

Selectrol Strain Index

Strain Name	Designation	Code	WDCM
Aspergillus brasiliensis	NCPF® 2275 / ATCC® 16404	MM94	00053
Bacillus cereus	NCTC® 10320 / ATCC® 9634	MM21	00001
Bacillus cereus	NCTC® 7464 / ATCC® 10876	MM86	
Bacillus subtilis	NCTC® 10400 / ATCC® 6633	MM29	00003
Bacteroides fragilis	NCTC® 9343 / ATCC® 25285	MM44	
Campylobacter jejuni	NCTC® 11351 / ATCC® 33560	MM36	
Campylobacter jejuni	NCTC® 11322 / ATCC® 29428	MM82	00156
Candida albicans	NCPF® 3255 / ATCC® 2091	MM28	00055
Candida albicans	NCPF® 3179 / ATCC® 10231	MM42	00054
Citrobacter freundii	NCTC® 9750 / ATCC® 8090	MM27	
Clostridium perfringens	NCTC® 8237 / ATCC® 13124	MM45	00007
Clostridium sporogenes	NCTC® 532 / ATCC® 19404	MM31	00008
Enterobacter aerogenes	NCTC® 10006 / ATCC® 13048	MM26	00175
Enterobacter cloacae	NCTC® 13380 / ATCC® 23355	MM01	00082
Enterobacter cloacae	NCTC® 13406	MM51	
Enterococcus faecalis	NCTC® 775 / ATCC® 19433	MM17	00009
Enterococcus faecalis	NCTC® 12697 / ATCC® 29212	MM18	00087
Enterococcus faecalis	NCTC® 13379 / ATCC® 51299	MM52	00085
Enterococcus hirae	NCTC® 13383 /ATCC® 10541	MM35	00011
Escherichia coli	NCTC® 12241 / ATCC® 25922	MM02	00013
Escherichia coli	NCTC® 11954 / ATCC® 35218	MM24	
Escherichia coli	NCTC® 10418 / ATCC® 10536	MM33	
Escherichia coli	NCTC® 12923 / ATCC® 8739	MM38	00012
Escherichia coli	NCTC® 11560	MM63	
Escherichia coli	NCTC® 9001 / ATCC® 11775	MM75	00090
Escherichia coli CRE	NCTC® 13476	MM57	
Escherichia coli (mcr-1)	NCTC® 13846	MM34	
Escherichia coli O157 (non-toxigenic)	NCTC® 12900 / ATCC® 700728	MM93	00014
Haemophilus influenzae	NCTC® 8468 / ATCC® 9334	MM100	
Haemophilus influenzae	NCTC® 12975 / ATCC® 49766	MM37	
Haemophilus influenzae	NCTC® 12699 / ATCC® 49247	MM81	
Haemophilus influenzae	NCTC® 11931	MM98	
Klebsiella aerogenes	NCTC® 9528	MM88	
Klebsiella pneumoniae	NCTC® 9633 / ATCC® 13883	MM04	00097
Klebsiella pneumoniae	NCTC® 13368 / ATCC® 700603	MM83	
Klebsiella pneumoniae CRE	NCTC® 13440	MM55	
Klebsiella pneumoniae CRE	NCTC® 13443	MM56	
Klebsiella pneumoniae CRE	NCTC® 13438	MM58	

Selectrol Strain Index

Strain Name	Designation	Code	WDCM
Klebsiella pneumoniae CRE	NCTC® 13442	MM59	
Lactobacillus brevis	NCTC® 13386 / ATCC® 8287	MM76	
Legionella pneumophila serogroup 1	NCTC® 11192 / ATCC® 33152	MM08	00107
Listeria innocua	NCTC® 11288 / ATCC® 33090	MM92	00017
Listeria monocytogenes	NCTC® 7973 / ATCC® 35152	MM48	00109
Listeria monocytogenes	NCTC® 13372 ATCC® 7644	MM77	
Listeria monocytogenes	NCTC® 11994	MM87	00019
Neisseria gonorrhoeae	NCTC® 8375 / ATCC® 19424	MM05	
Neisseria gonorrhoeae	NCTC® 12700 / ATCC® 49226	MM96	
Proteus mirabilis	NCTC® 13376 / ATCC® 14153	MM43	
Proteus mirabilis	NCTC® 10975	MM68	
Proteus vulgaris	NCTC® 4175 / ATCC® 13315	MM09	
Pseudomonas aeruginosa	NCTC® 12903 / ATCC® 27853	MM10	00025
Pseudomonas aeruginosa	NCTC® 12924 / ATCC® 9027	MM40	00026
Pseudomonas aeruginosa	NCTC® 13359 / ATCC® 15442	MM41	
Pseudomonas aeruginosa	NCTC® 10662 / ATCC® 25668	MM65	00114
Rhodococcus equi	NCTC® 1621 / ATCC® 6939	MM97	00028
Saccharomyces cerevisiae	NCTC® 10716/ ATCC® 9763	MM50	00058
Saccharomyces cerevisiae	NCPF® 3178	MM73	
Salmonella Nottingham	NCTC® 7832	MM84	
Salmonella Poona	NCTC® 4840	MM89	
Salmonella Typhimurium	NCTC® 12023/ ATCC® 14028	MM11	00031
Serratia marcescens	NCTC® 13382 / ATCC® 8100	MM12	
Staphylococcus aureus	NCTC®12981 / ATCC® 25923	MM13	00034
Staphylococcus aureus	NCTC® 12973 / ATCC® 29213	MM14	00131
Staphylococcus aureus	NCTC® 7447 / ATCC® 6538P	MM30	00033
Staphylococcus aureus	NCTC® 10788 / ATCC® 6538	MM46	00032
Staphylococcus aureus	NCTC® 6571 / ATCC® 9144	MM85	00035
Staphylococcus aureus (MRSA)	NCTC® 12493	MM64	00212
Staphylococcus aureus (MRSA)	NCTC® 13373 / ATCC® 43300	MM91	00211
Staphylococcus epidermidis	NCTC® 13360 / ATCC® 12228	MM15	00036
Streptococcus agalactiae	NCTC® 8181 / ATCC® 13813	MM16	
Streptococcus pneumoniae	NCTC® 12695 /ATCC® 6303	MM19	
Streptococcus pneumoniae	NCTC® 12977 /ATCC® 49619	MM95	
Streptococcus pyogenes	NCTC® 12696 /ATCC® 19615	MM20	
Vibrio parahaemolyticus	NCTC® 10885	MM06	00185
Yersinia enterocolitica	NCTC® 12982 / ATCC® 9610	MM80	00038

Selectrol Strains Listed by WDCM Number

WDCM	Strain Name	Designation	Code
00001	*Bacillus cereus*	NCTC® 10320 / ATCC® 9634	MM21
00003	*Bacillus subtilis*	NCTC® 10400 / ATCC® 6633	MM29
00007	*Clostridium perfringens*	NCTC® 8237 / ATCC® 13124	MM45
00008	*Clostridium sporogenes*	NCTC® 532 / ATCC® 19404	MM31
00009	*Enterococcus faecalis*	NCTC® 775 / ATCC® 19433	MM17
00011	*Enterococcus hirae*	NCTC® 13383 /ATCC® 10541	MM35
00012	*Escherichia coli*	NCTC® 12923 / ATCC® 8739	MM38
00013	*Escherichia coli*	NCTC® 12241 / ATCC® 25922	MM02
00014	*Escherichia coli* O157 (non-toxigenic)	NCTC® 12900 / ATCC® 700728	MM93
00017	*Listeria innocua*	NCTC® 11288 / ATCC® 33090	MM92
00019	*Listeria monocytogenes*	NCTC® 11994	MM87
00025	*Pseudomonas aeruginosa*	NCTC® 12903 / ATCC® 27853	MM10
00026	*Pseudomonas aeruginosa*	NCTC® 12924 / ATCC® 9027	MM40
00028	*Rhodococcus equi*	NCTC® 1621 / ATCC® 6939	MM97
00031	*Salmonella* Typhimurium	NCTC® 12023/ ATCC® 14028	MM11
00032	*Staphylococcus aureus*	NCTC® 10788 / ATCC® 6538	MM46
00033	*Staphylococcus aureus*	NCTC® 7447 / ATCC® 6538P	MM30
00034	*Staphylococcus aureus*	NCTC® 12981 / ATCC® 25923	MM13
00035	*Staphylococcus aureus*	NCTC® 6571 / ATCC® 9144	MM85
00036	*Staphylococcus epidermidis*	NCTC® 13360 / ATCC® 12228	MM15
00038	*Yersinia enterocolitica*	NCTC® 12982 / ATCC® 9610	MM80
00053	*Aspergillus brasiliensis*	NCPF® 2275 / ATCC® 16404	MM94
00054	*Candida albicans*	NCPF® 3179 / ATCC® 10231	MM42
00055	*Candida albicans*	NCPF® 3255 / ATCC® 2091	MM28
00058	*Saccharomyces cerevisiae*	NCTC® 10716/ ATCC® 9763	MM50
00082	*Enterobacter cloacae*	NCTC® 13380 / ATCC® 23355	MM01
00085	*Enterococcus faecalis*	NCTC® 13379 / ATCC® 51299	MM52
00087	*Enterococcus faecalis*	NCTC® 12697 / ATCC® 29212	MM18
00090	*Escherichia coli*	NCTC® 9001 / ATCC® 11775	MM75
00097	*Klebsiella pneumoniae*	NCTC® 9633 / ATCC® 13883	MM04
00107	*Legionella pneumophila* serogroup 1	NCTC® 11192 / ATCC® 33152	MM08
00109	*Listeria monocytogenes*	NCTC® 7973 / ATCC® 35152	MM48
00114	*Pseudomonas aeruginosa*	NCTC® 10662 / ATCC® 25668	MM65
00131	*Staphylococcus aureus*	NCTC® 12973 / ATCC® 29213	MM14
00156	*Campylobacter jejuni*	NCTC® 11322 / ATCC® 29428	MM82
00175	*Enterobacter aerogenes*	NCTC® 10006 / ATCC® 13048	MM26
00185	*Vibrio parahaemolyticus*	NCTC® 10885	MM06
00211	*Staphylococcus aureus* (MRSA)	NCTC® 13373 / ATCC® 43300	MM91
00212	*Staphylococcus aureus* (MRSA)	NCTC® 12493	MM64

Notes

tcs biosciences

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