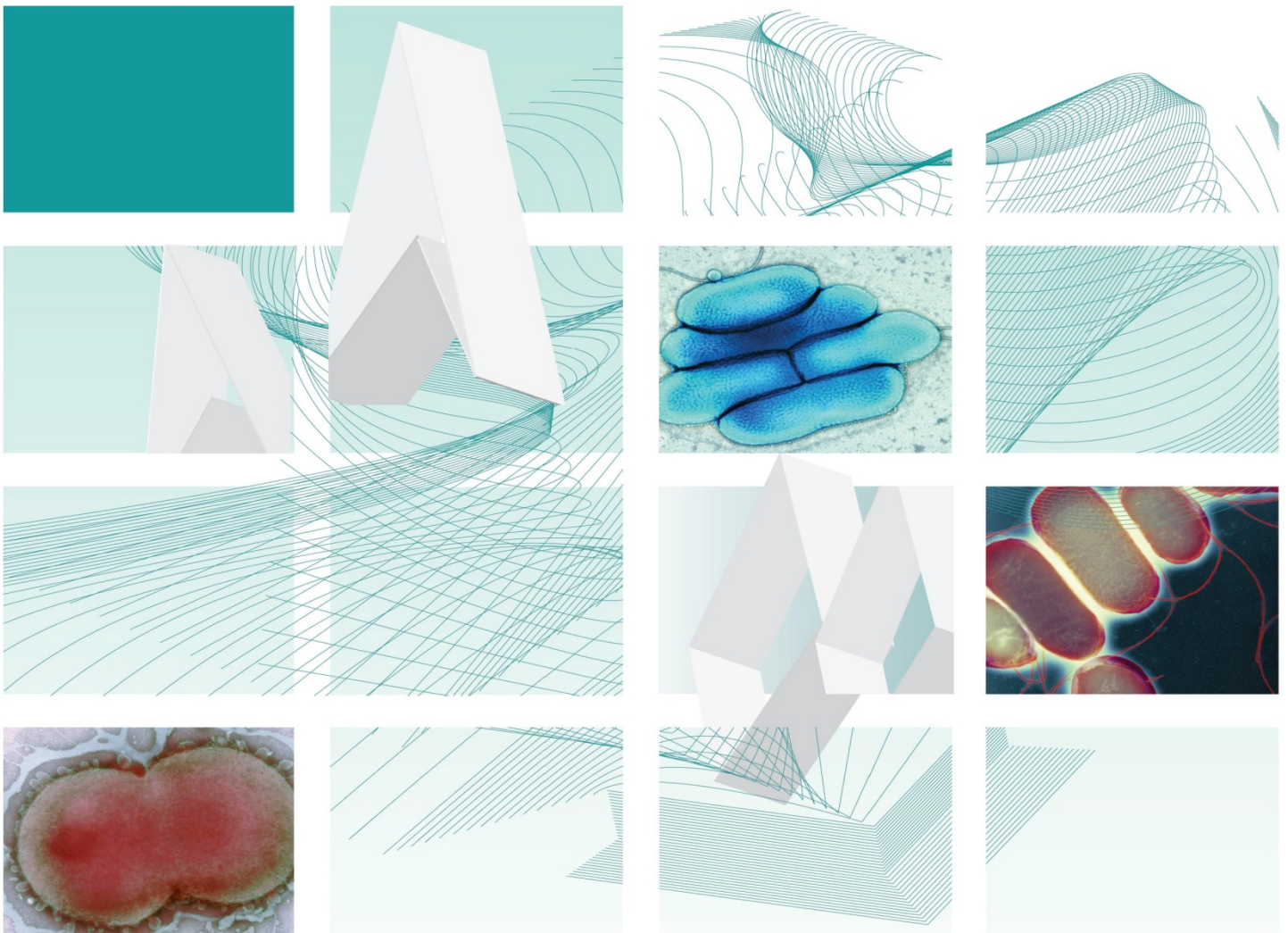




# UK Standards for Microbiology Investigations

## Potassium Hydroxide Test



## Acknowledgments

UK Standards for Microbiology Investigations (SMIs) are developed under the auspices of Public Health England (PHE) working in partnership with the National Health Service (NHS), Public Health Wales and with the professional organisations whose logos are displayed below and listed on the website <https://www.gov.uk/uk-standards-for-microbiology-investigations-smi-quality-and-consistency-in-clinical-laboratories>. SMIs are developed, reviewed and revised by various working groups which are overseen by a steering committee (see <https://www.gov.uk/government/groups/standards-for-microbiology-investigations-steering-committee>).

The contributions of many individuals in clinical, specialist and reference laboratories who have provided information and comments during the development of this document are acknowledged. We are grateful to the Medical Editors for editing the medical content.

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UK Standards for Microbiology Investigations are produced in association with:



Logos correct at time of publishing.

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NICE has accredited the process used by Public Health England to produce Standards for Microbiology Investigations. Accreditation is valid for 5 years from July 2011. More information on accreditation can be viewed at [www.nice.org.uk/accreditation](http://www.nice.org.uk/accreditation).

For full details on our accreditation visit: [www.nice.org.uk/accreditation](http://www.nice.org.uk/accreditation).

## Amendment Table

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Each SMI method has an individual record of amendments. The current amendments are listed on this page. The amendment history is available from [standards@phe.gov.uk](mailto:standards@phe.gov.uk).

New or revised documents should be controlled within the laboratory in accordance with the local quality management system.

Amendment No/Date.	5/07.01.15
Issue no. discarded.	2.2
Insert Issue no.	3
<b>Section(s) involved</b>	<b>Amendment</b>
Whole document.	Hyperlinks updated to gov.uk.
Page 2.	Updated logos added.
Scope of the document.	The scope has been updated with information and references.
Technical information/Limitations.	This section has been updated and references added.
Safety Considerations.	References updated.
Reagents/Equipment.	This section has been updated and referenced.
Quality Control Organisms.	The quality control organisms have been validated by NCTC.
Procedures and Results.	Information and references updated.
Flowchart.	This flowchart has been modified for easy guidance.
References.	Some references updated.

# UK Standards for Microbiology Investigations<sup>#</sup>: Scope and Purpose

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## Users of SMIs

- SMIs are primarily intended as a general resource for practising professionals operating in the field of laboratory medicine and infection specialties in the UK.
- SMIs provide clinicians with information about the available test repertoire and the standard of laboratory services they should expect for the investigation of infection in their patients, as well as providing information that aids the electronic ordering of appropriate tests.
- SMIs provide commissioners of healthcare services with the appropriateness and standard of microbiology investigations they should be seeking as part of the clinical and public health care package for their population.

## Background to SMIs

SMIs comprise a collection of recommended algorithms and procedures covering all stages of the investigative process in microbiology from the pre-analytical (clinical syndrome) stage to the analytical (laboratory testing) and post analytical (result interpretation and reporting) stages.

Syndromic algorithms are supported by more detailed documents containing advice on the investigation of specific diseases and infections. Guidance notes cover the clinical background, differential diagnosis, and appropriate investigation of particular clinical conditions. Quality guidance notes describe laboratory processes which underpin quality, for example assay validation.

Standardisation of the diagnostic process through the application of SMIs helps to assure the equivalence of investigation strategies in different laboratories across the UK and is essential for public health surveillance, research and development activities.

## Equal Partnership Working

SMIs are developed in equal partnership with PHE, NHS, Royal College of Pathologists and professional societies.

The list of participating societies may be found at <https://www.gov.uk/uk-standards-for-microbiology-investigations-smi-quality-and-consistency-in-clinical-laboratories>.

Inclusion of a logo in an SMI indicates participation of the society in equal partnership and support for the objectives and process of preparing SMIs. Nominees of professional societies are members of the Steering Committee and Working Groups which develop SMIs. The views of nominees cannot be rigorously representative of the members of their nominating organisations nor the corporate views of their organisations. Nominees act as a conduit for two way reporting and dialogue. Representative views are sought through the consultation process.

SMIs are developed, reviewed and updated through a wide consultation process.

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<sup>#</sup>Microbiology is used as a generic term to include the two GMC-recognised specialties of Medical Microbiology (which includes Bacteriology, Mycology and Parasitology) and Medical Virology.



## Quality Assurance

NICE has accredited the process used by the SMI Working Groups to produce SMIs. The accreditation is applicable to all guidance produced since October 2009. The process for the development of SMIs is certified to ISO 9001:2008.

SMIs represent a good standard of practice to which all clinical and public health microbiology laboratories in the UK are expected to work. SMIs are NICE accredited and represent neither minimum standards of practice nor the highest level of complex laboratory investigation possible. In using SMIs, laboratories should take account of local requirements and undertake additional investigations where appropriate. SMIs help laboratories to meet accreditation requirements by promoting high quality practices which are auditable. SMIs also provide a reference point for method development.

The performance of SMIs depends on competent staff and appropriate quality reagents and equipment. Laboratories should ensure that all commercial and in-house tests have been validated and shown to be fit for purpose. Laboratories should participate in external quality assessment schemes and undertake relevant internal quality control procedures.

## Patient and Public Involvement

The SMI Working Groups are committed to patient and public involvement in the development of SMIs. By involving the public, health professionals, scientists and voluntary organisations the resulting SMI will be robust and meet the needs of the user. An opportunity is given to members of the public to contribute to consultations through our open access website.

## Information Governance and Equality

PHE is a Caldicott compliant organisation. It seeks to take every possible precaution to prevent unauthorised disclosure of patient details and to ensure that patient-related records are kept under secure conditions.

The development of SMIs are subject to PHE Equality objectives <https://www.gov.uk/government/organisations/public-health-england/about/equality-and-diversity>. The SMI Working Groups are committed to achieving the equality objectives by effective consultation with members of the public, partners, stakeholders and specialist interest groups.

## Legal Statement

Whilst every care has been taken in the preparation of SMIs, PHE and any supporting organisation, shall, to the greatest extent possible under any applicable law, exclude liability for all losses, costs, claims, damages or expenses arising out of or connected with the use of an SMI or any information contained therein. If alterations are made to an SMI, it must be made clear where and by whom such changes have been made.

The evidence base and microbial taxonomy for the SMI is as complete as possible at the time of issue. Any omissions and new material will be considered at the next review. These standards can only be superseded by revisions of the standard, legislative action, or by NICE accredited guidance.

SMIs are Crown copyright which should be acknowledged where appropriate.

### **Suggested Citation for this Document**

Public Health England. (2015). Potassium Hydroxide Test. UK Standards for Microbiology Investigations. TP 30 Issue 3. <https://www.gov.uk/uk-standards-for-microbiology-investigations-smi-quality-and-consistency-in-clinical-laboratories>

## Scope of Document

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Many *Bacillus* and *Clostridium* species organisms that have lost some of the integrity of their cell wall, appear Gram negative on staining resulting in possible misidentification.

The potassium hydroxide test may aid in differentiation between Gram positive and Gram negative organisms and is a useful complement to the Gram stain and the antibiotic disc test<sup>1,2</sup>. Like the Gram stain reaction, the test is based on differences in the chemistry of the bacterial cell wall.

This SMI should be used in conjunction with other SMIs.

## Introduction

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In the presence of potassium hydroxide, Gram negative cell walls are broken down, releasing viscid chromosomal material which causes the bacterial suspension to become thick and stringy. Gram positive organisms remain unaffected. Hence the alternative name for this procedure, the “String Test”.

## Technical Information/Limitations

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The Potassium hydroxide test has its advantages; it is simple and easy to use, rapid and inexpensive. In laboratories where large numbers of cultures have to be processed, the above test may be used in addition to Gram stain for preliminary differentiation.

Although useful, a negative test does not prove conclusively that an organism is Gram positive<sup>3</sup>.

Older cultures (>48hr) may turn positive after 30sec of mixing the bacteria in the KOH solution giving unreliable results. This is common with certain species such as *Achromobacter* species, *Brucella melitensis*, *Pseudomonas paucimobilis*, *Moraxella* species, etc<sup>3</sup>.



## 1 Safety Considerations<sup>4-20</sup>

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Refer to current guidance on the safe handling of all organisms and reagents documented in this UK SMI.

**Potassium hydroxide is an irritant.**

All work likely to generate aerosols must be performed in a microbiological safety cabinet.

The above guidance should be supplemented with local COSHH and risk assessments.

Compliance with postal and transport regulations is essential.

## 2 Reagents and Equipment<sup>1</sup>

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Discrete colonies growing on solid medium

3% potassium hydroxide in water

Microscope slide

Bacteriological straight wire/loop or disposable alternative

## 3 Quality Control Organisms

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### Positive Control

*Escherichia coli*                      NCTC 10418

### Negative Control

*Staphylococcus aureus*      NCTC 6571

**Note:** These strains are validated by NCTC to give this result.

## 4 Procedure and Results<sup>1,21,22</sup>

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### 4.1 Potassium Hydroxide Procedure

- Place one drop of 3% potassium hydroxide solution on a clean microscope slide
- Emulsify a few colonies of the suspect organism to the drop of potassium hydroxide to make a dense suspension
- Stir continuously for 60sec and then gently pull the loop away from the suspension
- Observe any changes - a string of the suspension will follow the loop when it is raised

## **Interpretation**

### **Positive Result**

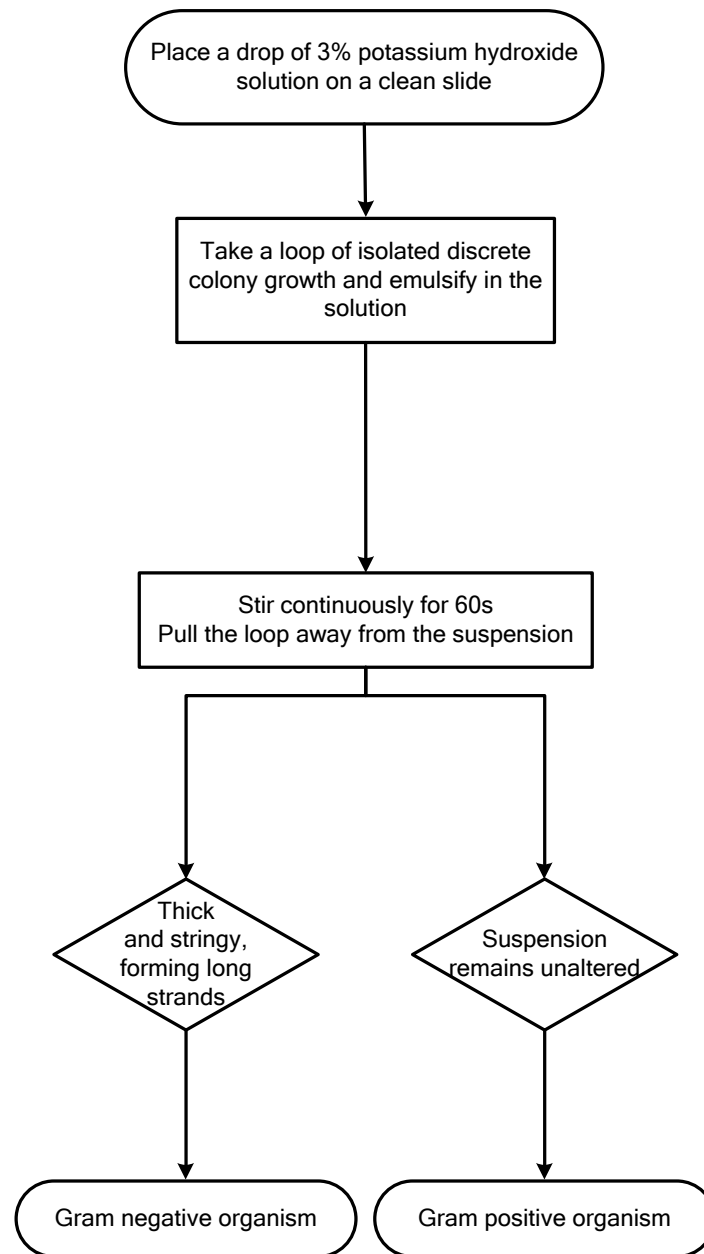
Organisms become thick, stringy and form long strands within the first 30sec. This is seen in Gram negative bacteria.

### **Negative Result**

Organisms leave the suspension unaltered or absence of stringing. This is seen in Gram positive bacteria.

## Appendix: Potassium Hydroxide Test

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Note:

Positive control

Escherichia coli NCTC 10418

Negative control

Staphylococcus aureus NCTC 6571

The flowchart is for guidance only.

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