

The importance of method validation

Introduction

Millions of measurements and tests are carried out every day in laboratories around the world. The results underpin important decisions, for example: as a way of valuing goods for trade purposes; supporting healthcare; checking the quality of pharmaceuticals, drinking water, food and feed; and providing evidence in criminal investigations. Virtually every aspect of society is supported in some way by analytical work.

The cost of laboratory work is high and additional costs may arise from decisions made on the basis of the results. Tests showing food to be unfit for consumption may result in compensation claims. Confirmation of the presence of banned drugs could result in imprisonment. Clearly it is important to show that results are reliable.

The validation process

Most analysts know that method validation is important, but exactly why, how and when it should be done is not always clear.

Method validation is the process whereby the laboratory demonstrates whether or not a method is 'fit for purpose' (Fig. 1). This means that the tests carried out should be appropriate with respect to uncertainty, cost, time etc. The final report should present analytical data in such a way that the customer can, readily, interpret it and draw appropriate conclusions.

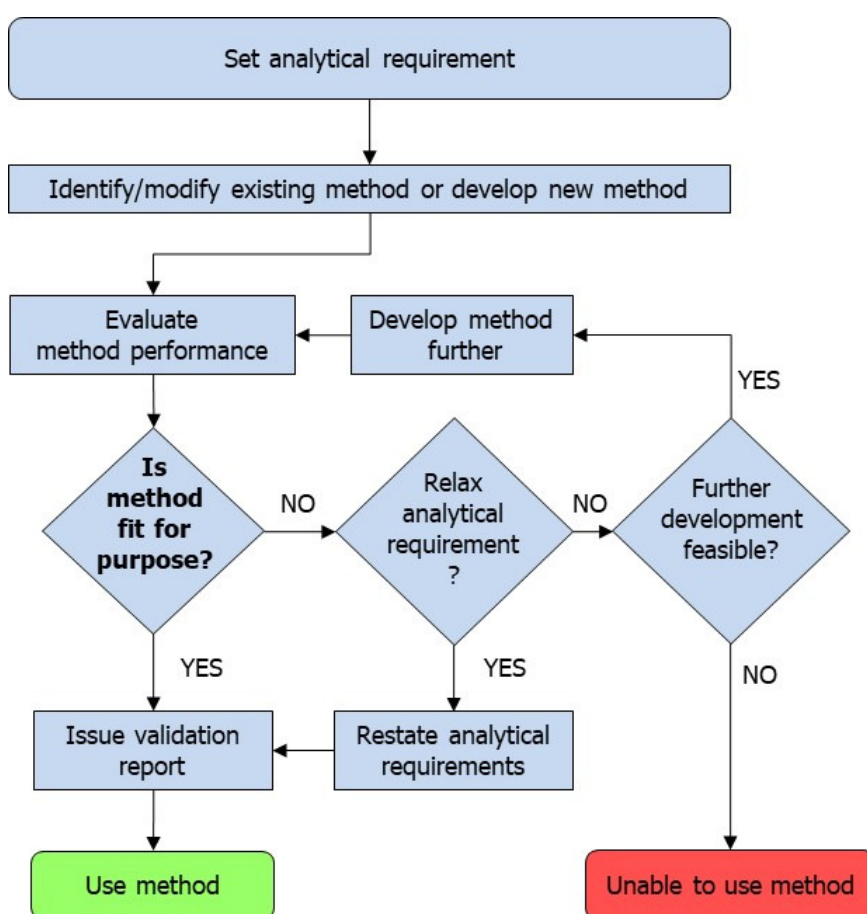
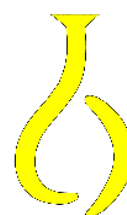


Fig. 1. The method validation process. The laboratory 'translates' the customer's problem into an analytical requirement, i.e. the method performance required to solve the problem. Method validation includes a stage where various performance characteristics are evaluated and then compared with analytical requirements.



Eurachem

A FOCUS FOR
ANALYTICAL CHEMISTRY
IN EUROPE

The Eurachem Guide

A Guide from Eurachem (Fig. 2) gives practical advice on how method validation can be accomplished. The Guide and its supplements [1-3]:

- Indicate how to plan, record and report validation studies to best support the statement of 'fitness for purpose';
- Provide key definitions and the rationale behind the experiments for assessing the various performance characteristics (Fig. 3);
- Include quick reference tables that suggest experiments together with the necessary statistical calculations for evaluation and reporting each performance characteristic;
- Provide support to the analyst on how to make the best use of method validation data for setting up an internal quality control plan;
- List over 80 useful literature resources and reference documents.

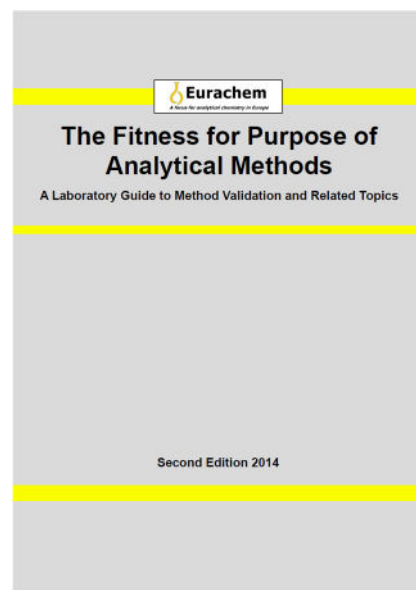


Fig. 2. The Eurachem Guide is available free of charge at www.eurachem.org.

Extent of validation studies

Precision <ul style="list-style-type: none">• Repeatability• Intermediate precision
Trueness (bias)
Selectivity
Working range
Linearity/linear range
Analytical sensitivity
Limit of detection
Limit of quantification
Ruggedness (robustness)

Any method validation study will require the laboratory to investigate several performance characteristics (Fig. 3). Exactly which characteristics are studied will depend on the analytical application. Verification of the performance of a standard method requires substantially less work than validation of a method developed in-house. Legislative/sectoral requirements must also be considered.

Sampling and subsampling can be part of the measurement or testing procedure and must, in those cases, be validated. Even if these steps are performed elsewhere, it is useful to include information about them in the validation plan/report.

Fig. 3. The most common performance characteristics studied during in-house method validation.

More information / further reading

1. B. Magnusson and U. Örnemark (eds.) Eurachem Guide: The Fitness for Purpose of Analytical Methods – A Laboratory Guide to Method Validation and Related Topics (2nd ed. 2014). ISBN 978-91-87461-59-0. Available from www.eurachem.org.
2. V. Barwick (ed.), Planning and Reporting Method Validation Studies – Supplement to Eurachem Guide on the Fitness for Purpose of Analytical Methods (1st ed. 2019). Available from www.eurachem.org.
3. H. Cantwell (ed.) Blanks in Method Validation – Supplement to Eurachem Guide on The Fitness for Purpose of Analytical Methods, (1st ed. 2019). Available from www.eurachem.org.