

RELIABILITY OF ANALYTICAL METHODS' RESULTS: A BAYESIAN APPROACH TO ANALYTICAL METHOD VALIDATION

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Methods validation is mandatory in order to assess the fitness of purpose of the developed analytical method. Of core importance at the end of the validation is the evaluation of the reliability of the individual results that will be generated during the routine application of the method. Regulatory guidelines provide a general framework to assess the validity of a method, but none address the issue of results reliability. In this study, a Bayesian approach is proposed to address this concern. Results reliability is defined here as “*the probability (π) of an analytical method to provide analytical results (X) within predefined acceptance limits ($\pm \lambda$) around their reference or conventional true concentration values (μ_T) over a defined concentration range and under given environmental and operating conditions.*” By providing the minimum reliability probability (π_{\min}) needed for the subsequent routine application of the method, as well as specifications or acceptance limits ($\pm \lambda$), the proposed Bayesian approach provides the effective probability of obtaining reliable future analytical results over the whole concentration range investigated. This is summarized in a single graph: the reliability profile. This Bayesian reliability profile is also compared to two frequentist approaches, the first one derived from the work of Dewé et al. [1] and the second proposed by Govaerts et al. [2]. Furthermore, the applicability of the Bayesian reliability profile is shown using as example the validation of a bioanalytical method dedicated to the determination of ketoglutaric acid (KG) and hydroxymethylfurfural (HMF) in human plasma by SPE-HPLC-UV.

[1] Dewé W., Govaerts B., Boulanger B., Rozet E., Chiap P., Hubert Ph., *Chemometr. Intell. Lab. Syst.* 85 (2007) 262-268.

[2] B. Govaerts, W. Dewé, M. Maumy, B. Boulanger, *Qual. Reliab. Engng. Int.* 24 (2008) 667-680.