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What are the scientific challenges in moving from targeted to non-targeted methods for food fraud testing and how can they be addressed? – Spectroscopy case study

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1 What are the scientific challenges in moving from targeted to non- 2 targeted methods for food fraud testing and how can they be 3 addressed? – Spectroscopy case study

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14 Abstract

15 Background

16 The authenticity of foodstuffs and associated fraud has become an important area. It is estimated
17 that global food fraud costs approximately \$US49b annually. In relation to testing for this
18 malpractice, analytical technologies exist to detect fraud but are usually expensive and lab based.
19 However, recently there has been a move towards non-targeted methods as means for detecting
20 food fraud but the question arises if these techniques will ever be accepted as routine.

21 Scope and Approach

22 In this opinion paper, many aspects relating to the role of non-targeted spectroscopy based methods
23 for food fraud detection are considered: (i) a review of the current non-targeted spectroscopic
24 methods to include the general differences with targeted techniques; (ii) overview of in-house
25 validation procedures including samples, data processing and chemometric techniques with a view
26 to recommending a harmonized procedure; (iii) quality assessments including QC samples, ring trials
27 and reference materials; (iv) use of "big data" including recording, validation, sharing and joint usage
28 of databases.

29 Key findings and Conclusions

30 In order to keep pace with those who perpetrate food fraud there is clearly a need for robust and
31 reliable non-targeted methods that are available to many stakeholders. Key challenges faced by the
32 research and routine testing communities include: a lack of guidelines and legislation governing both
33 the development and validation of non-targeted methodologies, no common definition of terms,
34 difficulty in obtaining authentic samples with full traceability for model building; the lack of a single
35 chemometric modelling software that offers all the algorithms required by developers.

36 Keywords

37 Food Authenticity; Spectroscopy; Chemometric Model; Non-Targeted; Scientific Opinion;
38 Harmonisation

39 Introduction

40 Food fraud, in one guise or another, has been documented in literature since the times of the
41 ancient Greeks. However, in more recent times, food fraud has garnered much greater notoriety due

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