



FOODSAFER

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FoodSafeR is a 4-year Horizon Europe funded research project that started in October 2022.

The project aims to design, develop, and test the building blocks of an innovative proactive and holistic food safety warning and management system, which focuses on emerging of food safety hazards and associated risks.

FoodSafeR embodies integrated approaches to hazard characterisation and risk management in a comprehensive suite of future-oriented case studies, tools, methods, strategies, models, guidance, and training materials.

These resources are being made available in the **FoodSafeR Open Digital Hub**, a one-stop-shop platform uniting a community of professionals from the European and international food safety system.



This Project has Received funding from the European Union's Horizon Europe Research and Innovation Programme Under Grant Agreement No. 101060698



Combating the illegal addition of toxic chemicals to food that poses unchecked food hazards

Introduction

Adulteration of turmeric for economic profit using the toxic “lead chromate” is an emerging global health concern. This study aims to provide a comparative evaluation of energy dispersive X-ray fluorescence spectroscopy with a focus on matrix optimised calibration approaches. Furthermore, the prevalence of lead chromate adulteration in turmeric powder sourced from the main supply chain categories, including branded, open/market/non-branded both within India and international products, was investigated. Three different analytical techniques were used to assess the adulteration in the turmeric samples using 3 different calibration approaches (Empirical, Fundamental Parameter and Matching Library). Results showed that handheld XRF using a generic geochemical calibration gave good results and can be used for sample screening as well as quantitative analysis for higher Pb values, having an analysis time of 90 seconds without any extensive sample preparation. Branded samples had the highest incidence of Pb enrichment, highlighting the supply chain’s vulnerability for domestic branded products which is counter to the well documented situation in Bangladesh. Overall, this study presents a thorough, in-depth assessment of the effectiveness of different ED-XRF methods. By addressing both methodological optimization and real-world prevalence, the study contributes to the enhancement of analytical techniques and promoting a safer and more transparent turmeric market.



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The Team

The FoodSafeR consortium of 19 leading academic, research and industry organisations from across Europe, is led by FFOQSI.

FFOQSI is the Austrian Competence Centre for Food and Food Quality, Safety and Innovation. It is a multidisciplinary joint research hub that encompasses scientific, national and international business partners food safety authorities and stakeholders, technology SMEs and startups from the food system.

The FoodSafeR Advisory Board of 25 leading stakeholders from the food safety field gives us a global reach.



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Materials and Methods

Around 78% of the world's turmeric production originates from India. For this study, 12 different sites were selected with 9 of them being major producers (Minhas, 2022). 270 dried turmeric powdered samples were collected categorised as follows: (N-53) Open /Market samples, (N-199) branded samples and (N-18) international samples. We extended our analysis by including samples from 3 majorly used e-commerce platforms. Also, 124 international and and 80 branded samples were included, reaching the 474 samples in this study.

Analysis was carried out by placing sample cups on the nose of the portable XRF covered with an X-ray shielding lid using the empirical factory calibration settings.

Resources:

European Commission (EC), 2021. Commission Regulation (EU) 2021/1317 and 2021/1323 Has Amended Regulation (EC) No 1881/2006, as Regards Maximum Levels of Cadmium and Lead, Respectively, in Certain Foodstuffs (Text with EEA Relevance).

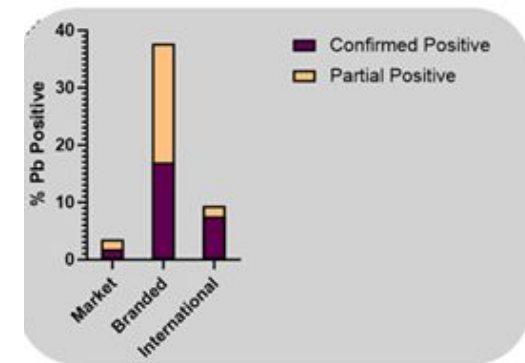
Food Safety and standards (FSSAI), 2011. Food Safety and Standards (Contaminants, Toxins and Residues) Regulations, 2011.

Minhas A., 2022. India: Turmeric production volume by state 2022, Statista.

Shaktawat, Y., 2018. Asia's largest ever wholesale spice market is right here in this city, Curly Tales.

Summary of the findings

The utilization of PXRF as both screening as well as quantitative technique revealed 53 positive results. These results were further categorized into two distinct classes: "partial positive," indicating results that were below the LOD of PXRF (2mg Pb /kg) marked as ND but still giving a Pb value during analysis and "confirmed positive," indicating results that showed a Pb value above specified regulatory limits of 1.5 mg/kg.



PXRF showed a rapid and reliable way for qualitative and semiquantitative analysis of toxic elements like Pb and Cr using inbuilt default calibration. However, despite its high LOD, PXRF holds the potential to be used for real-time analysis for low-resourced countries like India, where regulatory limits are higher (10 mg Pb/kg) as compared to EU (1.5 mg Pb/kg, EC, 2021) in turmeric for lead (FSSAI, 2011). While PXRF holds as a promising, efficient technique to be used for on-field screening of toxic metal adulteration in turmeric, BXRf showed a potential to become a 1st line of validation for PXRF results. However, these measures cannot entirely replace ICP-MS but can be able to decrease the frequency of its utilization.