

Pesticide residue and food quality analysis laboratory: An overview

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Effective use of pesticides is essential for the better protection of crops from pests and diseases as well as boosting food production. However, the improper use of pesticides causes a wide range of problems in humans and other non-target organisms. It has been observed that pesticide exposures are increasingly linked to immune suppression, hormone disruption, diminished intelligence, reproductive abnormalities and cancer (Abhilash and Singh, 2009). Although the Indian average consumption of pesticides is far lower than many other developed economies, the problem of pesticide residue is very high in India. Pesticide residue in several crops has also affected the export of agricultural commodities in the last few years. In this context, pesticide safety, regulation of pesticide use, proper application technologies, and integrated pest management are some of the key strategies for minimizing human exposure to pesticides

Reports from the National Health and Family Survey, United Nations International Children's Emergency Fund and, WHO have highlighted that rates of malnutrition among adolescent girls, pregnant and lactating women, and children are alarmingly high in India (Narayan et al., 2019). One of the major factors responsible for malnutrition is the nutritional status of food. Working toward the nutritional parameters of food (proximate analysis) is an essential need in India.

Over the last few years, the safety concern relevant to aflatoxin content in spices, nut and nut products has resulted in the rejection of these Indian products by other developed countries like European

Union, US etc. Because these products cause hepatotoxicity and carcinogenicity in human beings (IARC, 1993). Similarly, the problem of aflatoxicosis is also reported in livestock animals (Frisvad et al., 2006).

Ground and surface water are the major sources of drinking water supply in rural and urban areas of India. Water with high Total Dissolved Salt (TDS) levels becomes difficult to consume and is not acceptable for drinking according to the Bureau of Indian Standards (BIS). Besides, high-soluble salts can directly injure the roots, interfering with water and nutrient uptake causing nutrient deficiencies that compromise plant health. The presence of toxic ions such as lead, nitrate, cadmium and arsenic present in water can also lead to several serious health problems (Jaishankar et al., 2014)

Considering all the above issues, UAS, Raichur established "The Pesticide Residue and Food Quality Analysis Laboratory" (PRFQAL) at main campus. It is a state-of-the-art NABL-accredited laboratory dedicated to testing pesticide residues, heavy metals, food proximate and aflatoxin contaminants in agricultural produce and commodities to cater to the needs of various stakeholders viz., farmers, scientists and, students from different SAUs, ICAR institute and private agencies, food and processing industries, food grain packers and exporters. The laboratory began to function in 2016 and obtained the National Accreditation Board for Testing and Calibration Laboratories (NABL) accreditation as per ISO/IEC 17025:2017. PRFQAL is also a part of two national programs viz., All India Network Project (AINP) in persistence and dissipation of pesticides in different

crop ecosystems and Monitoring of Pesticide Residues at National Level (MPRNL) sponsored by the Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare Government of India.

Objectives of PRFQAL

➤ To standardize analytical methods for pesticide residue, heavy metals and aflatoxins in agricultural and horticultural crops and their commodities

➤ To study persistence, dissipation and decontamination of selected pesticides in different agroecosystems and food products

➤ To analyze pesticide residues in different market, farmgate and organic samples (fruits, vegetables, cereals & pulses). This data aids in establishing Maximum Residue Limit (MRL), helping to prevent export rejection.

➤ To analyze the nutrient quality parameters in

Scope of analysis at PRFQAL

Sl.No	Scope	Parameters	Equipment Used
1	Pesticide Residues	NABL accredited: 74 pesticides non-NABL: 45 pesticides	LC-MS/MS, GC-MS/MS
2	Heavy Metals	NABL accredited: 14 heavy metals for fruits & vegetables 07 heavy metals for cereals & pulses 16 heavy metals for water	ICP-MS
3	Food Proximate Composition	NABL accredited: protein, fat, carbohydrate, energy, ash, moisture, fibre and refractions	Protein: Automatic distillation and titration unit Fat: Fat extraction unit Fibre: Fibre extraction unit Ash: Muffle furnace Moisture: Hot air oven Carbohydrate & Energy: By calculation method Refractions: By balance
4	Water Quality Analysis (drinking water, surface water and ground water)	NABL accredited: 12 parameters as per ISO 10500 (2012)	UV Visible Spectrometer, PH meter, Turbidity meter, Conductivity meter
5	Honey Quality Analysis	NABL Accredited- moisture, specific gravity, ash, total reducing sugars, sucrose and acidity non-NABL: fructose glucose ratio, fructose % and glucose %	Ion- Exchange Chromatography
6	Aflatoxin Analysis	NABL accredited: AFG2, AFG1, AFB2 and AFB1	UHPLC
7	Environmental Gas Estimation	Methane (CH ₄), carbon dioxide (CO ₂) and nitrous oxide (N ₂ O)	GC-ECD, GC-FID
8	Food Adulterants	non-NABL: curcumin, congo red, metanil yellow and sudan dye	UHPLC

farm and processed products.

- To analyze the physio-chemical parameters, heavy metals and pesticide residue in drinking water, groundwater and surface water.
- To analyze the aflatoxin in nut & nut products and spices.
- To determine honey quality parameters as per FSSAI standards
- To analyze pesticide residue in biopesticide samples laced with pesticides, provided by the Government of Karnataka.
- To create awareness among the farmers and

general public on the importance of residue-free food, safe and judicious use of pesticides by conducting training programs.

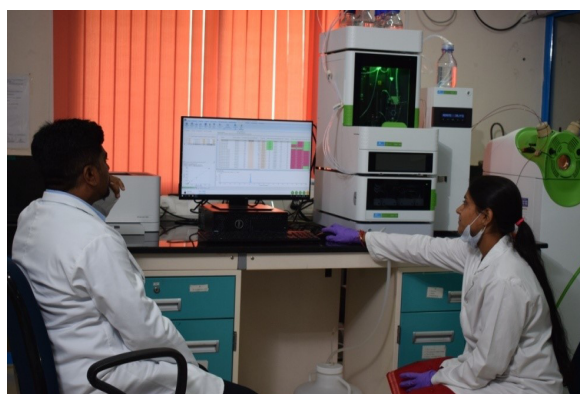
Conclusion

The state-of-the-art laboratory PRFQAL established under UAS, Raichur is catering to the needs of farmers, students, scientists, manufacturers, industrialists and various other stakeholders. It is our privilege to serve the stakeholders for the benefit of the society, state and the country.

Laboratory equipped with advanced equipment



LC-MS/MS (Shimadzu 8040)



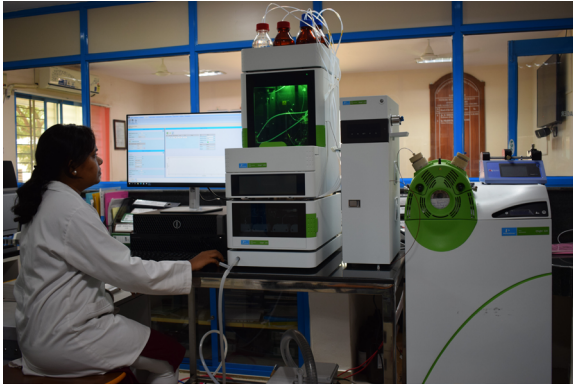
LC-MS/MS (Perkin Elmer Qsight 420)



GC-MS/MS (Shimadzu-TQ 8030)



ICP-MS (Perkin Elmer Nexon 350X)



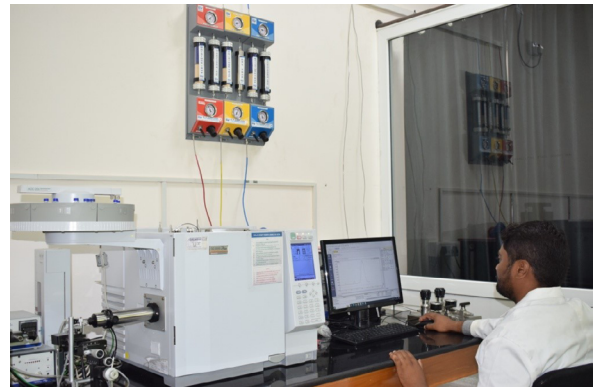
LC-MS/MS (Perkin Elmer Qsight 220)



Ion Exchange Chromatography (Metrohm 930 compact IC)



GC-ECD (Agilent Technologies 7820 A)



GC-FID & TCD (Shimadzu)



Fat, Fiber and Protein Estimation Unit



Water Quality Testing



UHPLC Shimadzu (Nexera X2)



Sample Extraction Room

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