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Notice for the PhD Viva Voce Examination

Ms Ashlay George (Registration Number: 2071403), PhD scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore will defend her PhD thesis at the public viva-voce examination on Tuesday, 7 November 2023 at 10.30 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Fabrication of Molecularly Imprinted Electrochemical Sensors for Food Additives**
Discipline	:	**Chemistry**
External Examiner (Outside Karnataka)	:	**Dr K V Radhakrishnan** Professor Organic Chemistry Section CSIR - National Institute for Interdisciplinary Science and Technology (NIIST), Pappanamcode, Thiruvananthapuram Kerala - 695019
External Examiner (Within Karnataka)	:	**Dr Denthaje Krishna Bhat** Professor Department of Chemistry National Institute of Technology Surathkal Karnataka
Supervisor	:	**Dr Anitha Varghese** Professor Department of Chemistry School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029 Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar

Place: Bengaluru
Date: 21 October 2023

ABSTRACT

Molecularly imprinted polymers (MIPs) have emerged as a promising technique for the preparation of synthetic polymers with specific binding sites for target molecules. These polymers have found applications in various fields, including sensing, where they serve as a recognition element for the detection and quantification of analytes in chemical and biological environments. In recent years, MIPs have been utilized as sensing materials for biomolecules, food additives, pesticides, metal ions, and other target species.

This work presents the development of MIP-based electrochemical sensors for the selective and rapid detection of food additives, namely tartrazine, 4-hexylresorcinol, butylated hydroxy anisole, and brilliant blue FCF. Conducting polymers, metal nanoparticles and 2D material-based electrode modifications have been employed in the preparation of MIPs for electrochemical sensing applications. Investigations reveal a significant enhancement in the electrochemical oxidation/reduction current of the analytes upon the surface modifications applied to the Carbon Fibre Paper (CFP) substrate. The surface morphology of the modified electrodes was characterized using techniques such as Field Emission Scanning Electron Microscopy (FESEM), Electron Diffraction X-ray (EDX), X-Ray Photoelectron Spectroscopy (XPS), Optical Profilometry, and Fourier Transform Infrared Spectroscopy (FTIR). Nyquist plots demonstrated the lowest charge transfer resistance at the finally modified working electrodes compared to other control electrodes. Optimization of experimental conditions, including pH effects, investigation of reaction mechanisms through scan rate variations, determination of the number of cycles required for film electrodeposition to achieve maximum current response, and determination of the potential window, was carried out using cyclic voltammetry (CV). The quantification of analytes was performed using Differential Pulse Voltammetry (DPV). Analytical validation of real samples was carried out using the finally modified electrode. Overall, this work demonstrates the simplicity and selectivity of the novel approach in developing ultrasensitive voltammetric sensors for the studied food additives.

Keywords: *Electrochemical Sensors, Food Additives, Molecularly Imprinted Polymers*

Publications:

1. **Ashlay George**, Anila Rose Cherian, Biju Jacob, Anitha Varghese, and Thandavarayan Maiyalagan. "Design optimisation and fabrication of amino acid based molecularly imprinted sensor for the selective determination of food additive tartrazine." *Food Chemistry* 404 (2023): 134673. https://doi.org/10.1016/j.foodchem.2022.134673

2. **Ashlay George**, Anila Rose Cherian, Libina Benny, Anitha Varghese, and Gurumurthy Hegde. "Surface-engineering of carbon fibre paper electrode through molecular imprinting technique towards electrochemical sensing of food additive in shrimps." *Microchemical Journal* 184 (2023): 108155. https://doi.org/10.1016/j.microc.2022.108155

Patent Published:

1. **George Ashlay**, Varghese Anitha, 'Molecularly Imprinted Conducting polymer Based Electrochemical Sensor for 4-Hexylresorcinol in Shrimps' Publication Date: 05-11-2021 Patent Office: IN, Application No: 202141044123