



Notice for the PhD Viva Voce Examination

Ms Chaithra K P (Registration Number: 2090185), 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 Thursday, 19 December 2024 at 10.30 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	Physicochemical Modifications on Fibrous Substrates for Sensing and Separation Applications
Discipline	:	Chemistry
External Examiner - I	:	Dr Suresh Kumar Kailasa Associate Professor Department of Chemistry Sardar Vallabhbhai National Institute of Technology Surat - 395 007 Gujarat
External Examiner - II	:	Dr Hari Prasad Dasari Professor Department of Chemical Engineering National Institute of Technology Karnataka, Surathkal Mangalore - 575025 Karnataka
Supervisor	:	Dr Vinod T P Associate 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.

Place: Bengaluru
Date: 16 December 2024

Registrar

ABSTRACT

Fibers are forms of matter characterized by flexibility, fineness, and a high length-to-thickness ratio, embodying properties such as large surface area, flexibility in surface functionalities, superior mechanical performance, ability to absorb dye and moisture, etc. Fibers can be transformed into coils, yarns, or fabrics by twisting or overlapping, resulting in fibrous substrates that are self-standing, flexible, and exhibit excellent mechanical properties. The porosity, functionality, hydrophobic and hydrophilic properties, and functional characteristics for desirable applications can be achieved by various physical and chemical modifications of fiber substrates. These physicochemical modifications render the fibers suitable for specialized applications such as food spoilage detection and wastewater treatment.

Existing modification strategies for preparing indicators for food quality monitoring are not user-friendly, equipment-free, and cannot be used without training and expertise. In this regard, we focused on developing simple physicochemical modifications of fibrous substrates for food-quality monitoring. In our first work, natural jute fiber was subjected to delignification to incorporate pH-sensitive anthocyanins to monitor fish quality. In the second work, we developed a new rub-coating strategy to anchor halochromic anthocyanins directly from anthocyanin-rich red cabbage onto paper substrates, avoiding the extraction of anthocyanins to create a functional colorimetric interface to monitor the quality of fish. Similarly, in our third work, an easy-to-use milk spoilage indicator has been developed by rub-coating hibiscus flowers on paper. The color change produced by the indicator was quantified using the free Android app based on L*, a*, b* and RGB values, making this indicator consumer-friendly and instrument-free. Existing traditional single-function nanofiber substrates are not suitable for treating complex wastewater. We fabricated a low-cost modified fibrous-based membrane by incorporating photocatalytic metal-oxide nanoparticles into cellulose acetate and polyvinylpyrrolidone nanofibers via electrospinning. The composite membranes exhibited oil/water separation, dye adsorption, and photocatalytic dye degradation properties. The results presented in this thesis are expected to inspire further investigations and applications related to fiber substrates.

Keywords: *Modification of fiber substrates; Physicochemical properties; Halochromic Indicator paper; Food spoilage monitoring; Smartphone-based detection; Electrospinning; Waste water treatment*

Publications:

1. **Chaithra K P**, Sonia Theresa Benjamina, and Vinod T. P., pH-indicator based on delignified jute fiber and red cabbage anthocyanins for monitoring fish spoilage using a smartphone application, *Microchem. J.*, 2024, doi: 10.1016/j.microc.2024.111068.
2. **Chaithra K P**, Vinod T. P. and Prasiddha Nagarajan, Smartphone application-based colorimetric fish freshness monitoring using an indicator prepared by rub-coating of red cabbage on paper substrates, *Colloids Surf. A: Physicochem. Eng. Asp.*, 2023, doi: 10.1016/j.colsurfa.2023.132553.
3. **Chaithra K P** and Vinod T. P., A smartphone coupled freshness indicator prepared by rub-coating of hibiscus flowers on paper substrates for visual monitoring of the spoilage of milk, *ChemistrySelect*, 2022, doi: 10.1002/slct.202201839.
4. **Chaithra K P**, Gayathri B, Aiswarya P S, Vinod T. P. "Food quality indicators-based intelligent food packaging" in *Smart Food Packaging: Innovations and Technology Applications*, Wiley, 2024