### Faculty of Applied Sciences Sabaragamuwa University of Sri Lanka



# **OUT OF THE PRESS** Our publications - February

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# PEER-REVIEWED JOURNAL ÅRTICLES

2 Our Publications - February

Faculty of Applied Sciences

### Anti-diabetic, lipid peroxidase, antimicrobial, anti-oxidant, general toxicity properties and polyphenol content of *Psidium guajava*, *Garcinia quaesita*, and *Cinnamon verum* extracts along with their potential as nutraceuticals

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### Abstract

Sri Lanka has a rich Ayurvedic biodiversity and plant-based extracts have attracted significant interest due to their potential therapeutic properties. However, there is limited scientific evidence supporting their therapeutic effects. This study aims to evaluate the biological activities of extracts from selected plants for utilizing them in nutraceutical preparation. Aqueous extracts of Psidium guajava (Gu) leaves, Cinnamon verum bark (CB), Cinnamon verum leaves (CL), and Garcinia quaesita (Ga) leaves were prepared by sonication followed by freeze-drying. These extracts were screened in vitro for their anti-diabetic activity using alpha-glucosidase inhibition, lipid peroxidase using spectrophotometry, antibacterial properties using agar disk diffusion, and preliminary cytotoxicity using brine shrimp lethality assay. Total phenolic content (TPC) was determined using Folin-Ciocalteu spectrometric method, total flavonoid content (TFC) was determined using spectrophotometric method and antioxidant activity was assessed using ferric reducing antioxidant power assay (FRAP) and 2,2'-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays. The extracts that demonstrated the best results were combined to evaluate the synergistic effects of their combination. The results indicated that P. guajava exhibited the highest alpha-glucosidase inhibition activity, with an  $IC_{50}$  value of 17.50 ± 0.40 ppm, compared to acarbose (IC<sub>50</sub> = 336.09  $\pm$  0.32 ppm). In addition, C. verum bark demonstrated the most potent lipid peroxidase inhibition activity, with an  $IC_{50}$  value of 229.85 ± 24.23 ppm, compared to the BHT standard (IC<sub>50</sub> 135.02  $\pm$  9.28 ppm). Furthermore, CB showed the highest antibacterial activity against the selected bacterial strains (Escherichia coli ATCC 25922, Staphylococcus aureus, Streptococcus pneumonia, and Methicillin-resistant Staphylococcus aureus). With the exception for the G. quaesita extract, the other three extracts showed no general toxicity in the brine shrimp lethality assay. Gu extract showed elevated levels of TPC and TFC and measured at 136.88  $\pm$  1.42 mg GAE/g and, 11.02  $\pm$  0.22 mg quercetin/g, respectively. The CB extract demonstrated significantly high total antioxidant activity in the FRAP assay, yielding  $174.92 \pm 2.29$  mg Trolox/g, and IC<sub>50</sub> value of 8.89 ± 0.31 ppm in the DPPH assay (compared to  $126.40 \pm 2.92$  ppm for the ascorbic acid standard). In summary, the aqueous extracts from the leaves of P. guajava and the bark of C. verum have excellent functional properties. A combination of these plant extracts can enhance certain bio activities, indicating potential nutraceutical applications.

### About the Journal

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### DPST

## Enhanced Photoelectrochemical performance by rapid electron transfer in reduced graphene oxide/CaWO<sub>4</sub> composite photoanode

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### ABSTRACT

Scheelite oxides and their derivatives are renowned for their exceptional stability, high photocatalytic efficiency, and versatile structural design, positioning them as a promising category of semiconductor photocatalysts. In this study, Scheelite calcium tungstate (CaWO<sub>4</sub>) films were fabricated on fluorine-doped tin oxide (FTO) substrates using the chemical bath deposition (CBD), followed by calcination. Graphene oxide (GO) was independently synthesized via the Hummers' method and subsequently deposited onto the CaWO<sub>4</sub> films through electrophoretic deposition (EPD) to form reduced graphene oxide/CaWO<sub>4</sub> (rGO/CaWO<sub>4</sub>) composites. The incorporation of rGO was found to play a crucial role in enhancing electron transport within the rGO/CaWO<sub>4</sub> films. In photoelectrochemical (PEC) water splitting, the rGO/CaWO<sub>4</sub> demonstrated a remarkable photocurrent of 13  $\mu$ A cm<sup>-2</sup> at 1 V, far exceeding the 0.4  $\mu$ A cm<sup>-2</sup> achieved by pristine CaWO<sub>4</sub> under identical conditions. This 32.5-fold enhancement in photocurrent is attributed to the rapid electron transfer facilitated by the rGO in the composite structure.

#### About the Journal

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# **CONFERENCE PROCEEDINGS**

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### DNR

### Reconstructing the Tectonic Evolution and Rifting Dynamics of the Gulf of Mannar Basin Offshore Sri Lanka

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### ABSTRACT

The Gulf of Mannar basin, located between the west coast of Sri Lanka and the southeast coast of India, contains Late Jurassic to Recent sediments and a Mesozoic failed rift. This study aimed to reconstruct the tectonic evolution of the basin, which is understudied, with emphasis on the syn-rifting stage. During the study, available seismic profiles across the Mannar basin, stratigraphic columns of exploration wells (EPWs), onshore and offshore sedimentary and faulting data of both the Sri Lankan and Indian sides, and magmatic activity of the basin were analyzed. The results reveal the presence of onshore lurassic sedimentary deposits on both sides while the Late Jurassic sedimentary (L-JS) sequence marks the onset of deposition over the basement. Moreover, The Late Cretaceous, thick shale deposits interbedded with sandstones occur on both sides of the basin. Most faults extend up to the end of the Late Cretaceous on both the Sri Lankan and Indian sides of the basin. Onshore IS deposits and Late Cretaceous, thick shale deposits interbedded with sandstones on both sides indicate a shared depositional history. Turonian and Maastrichtian sedimentary sequences further support this correlation, with igneous intrusions. Igneous rocks are encountered in the Pearl-I EPW (~76.8  $\pm$  4.5 Ma), and Barracuda EPW (~62  $\pm$  0.6 Ma) located on the Sri Lankan side and in the GMS-I EPW (~89.1  $\pm$  0.65 Ma), and Mannar-1 EPW (60  $\pm$  8 Ma) located in the Indian side of the basin. Onshore faults in southwest Sri Lanka indicate five major faulting episodes as at  $159 \pm 18$  Ma, 144  $\pm$  14 Ma, 120  $\pm$  10 Ma, 94  $\pm$  8 Ma, and 70  $\pm$  10 Ma. Synchronous sedimentation supports the idea that Sri Lanka was juxtaposed with India before the Late Jurassic. Subsequently, the Mannar basin had a three-stage rifting evolution; the earliest faults (159  $\pm$ 18 Ma-120  $\pm$ 10 Ma) dated in southwest Sri Lanka mark the first rifting phase in the basin and related to the Late Jurassic breakup of Greater India, Sri Lanka, and Antarctica. Igneous rocks in the Pearl-I EPW and in the GMS-I EPW and faulting in southwest Sri Lanka  $\sim$  94 ± 8 Ma mark the second rifting phase and are related to the Madagascar-India rift. Igneous rocks in the Mannar-I and Barracuda EPWs and faulting in southwest Sri Lanka ~ 70  $\pm$  10 Ma mark the third rifting phase and are related to the Deccan Flood Basalt magmatism. These findings suggest a complex, multi-stage rifting history in the Mannar basin.

### About the Conference

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Geological Society of Sri Lanka

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### DNR

### Sheared Rocks of the Ranna Complex and Ussangoda: Implications for the Highland Complex–Vijayan Complex Boundary Shear Zone in Southern Sri Lanka

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### ABSTRACT

The Ranna Complex (RC) is a kilometer-scale crustal segment within the Highland Complex (HC), located near the lithotectonic boundary between the HC and the Vijayan Complex (VC) in southern Sri Lanka. Notably, it exposes amphibolite-facies lithologies similar to those of the VC. Recent studies suggest that the RC could either represent a layered basic intrusion or a tectonic window of the VC. This study aimed to investigate the field occurrence and structural characteristics of rocks in the RC and its adjacent areas, collect rock samples for geochemical analysis, and assess their significance for defining the HC/VC boundary. The research involved geological fieldwork, along with petrographic and microstructural analyses using an optical microscope. The findings reveal that sheared rocks, ranging from mylonite to ultramylonite and protomylonite, are exposed along the Ussangoda coast. Centimeter-scale quartzofeldspathic to guartz-rich layers form protomylonite, interlayered with mylonite and ultramylonite derived from garnet ± hornblende-biotite gneiss. In some cases, thinned quartzofeldspathic to quartzrich layers enclose mantled porphyroclasts. Additionally, intensely deformed metagranitoids in Rekawa exhibit folded and thinned guartzofeldspathic layers, boudinaged mafic layers, and parasitic to tygmatic folds. Elsewhere in the RC, less deformed metagranitoids contain guartzofeldspathic to guartz-rich layers and local shear zones. The presence of mylonite, mantled porphyroclasts, and parasitic folds suggests dominant non-coaxial deformation. The metagranitoids with quartzofeldspathic and quartz-rich layers in the RC indicate that similar rocks towards Ussangoda have undergone more intense deformation, forming protomylonitic guartzofeldspathic to guartz-rich layers. We interpret that the rocks from the RC towards Ussangoda represent a deeper structural level of a ductile shear zone between the HC and the VC, where the HC was thrusted over the VC. Furthermore, the serpentinite occurrences in and north of Ussangoda may represent remnants of an oceanic crust obducted during the HC's thrusting over the VC. Based on these findings, we conclude that the RC is not a tectonic window but rather an exposure of VC rocks. Consequently, we redefine the HC/VC boundary in southern Sri Lanka.

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