Faculty of Applied Sciences
Sabaragamuwa University of Sri Lanka

Out of the Press

Our publications - December

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Peer-reviewed Journal Articles

DFST

Brinjal, turkey berry, and winged bean extracts: Total phenolic content and antioxidant activity

Sameera Priyadarshana, Konara Somawathie, Mohamed Shafras, Darsiga Sivanandarajah

Abstract

Despite the known impact of cooking on the food's nutritional value, the variation in bioavailability and bioaccessibility of bioactive compounds after digestion remains inadequately understood. This study aimed to compare the effect of different cooking methods on the total phenolic content and antioxidant activity of bioaccessible and bioavailable extracts of brinjal (*Solanum melongena* L.), turkey berry (*Solanum torvum* L.), and winged bean (*Psophocarpus tetragonolobus* L.). Each vegetable was cooked by six methods using different combinations of coconut oil, coconut milk, and spices. The cooked vegetables were digested in vitro to evaluate their bioaccessible and bioavailable total phenolic content and antioxidant activity. The total phenolic content was determined by the Folin Ciocalteu method. Free radical scavenging activity, total antioxidant capacity, and reducing power were evaluated by the DPPH, ABTS, and FRAP assays, respectively. All the cooking methods significantly increased the total phenolic content and antioxidant activity of the extracts compared to their raw forms. The vegetables cooked with oil, milk, and spices generally showed higher total phenolics and antioxidant activity than those cooked by the other methods. We found a strong positive correlation between the total phenolic content and various antioxidant parameters. The highest bioaccessibility index for phenolic compounds was registered in the brinjal extract cooked with oil and in the turkey berry and winged bean extracts cooked with oil, milk, and spices. Different cooking methods exhibited varying effects on the antioxidant activity of bioaccessible compounds. In bioavailable extracts, variability was observed for the total phenolic content and antioxidant activity among different cooking methods for brinjal, turkey berry, and winged bean. The ABTS and FRAP assays showed the highest total phenolic content and antioxidant activity in all the vegetables cooked with coconut oil, milk, and spices.

About the Journal

Foods and Raw Materials

Impact Factor – 4.3

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DFST

Research Methods in Antidiabetic Studies: Implications of Sri Lankan Herbs

Gayani Imanthika Dias, Mohamed Shafras, Monica Gulati, Bhupinder Kapoor, Avijit Majumdar

Abstract

Diabetes is an escalating global health concern, and Sri Lanka records one of the highest prevalence rates in Asia. Increasing scientific interest has focused on the antidiabetic potential of Sri Lankan medicinal plants, supported by the country's rich biodiversity and traditional healing practices such as Ayurveda. This review examines the research methodologies used to evaluate the antidiabetic activity of Sri Lankan herbs, based on literature retrieved from Web of Science, PubMed, and Google Scholar. Studies on approximately 50 plant species that are extensively used in Ayurvedic practice are discussed, highlighting in vitro, ex vivo, in vivo, clinical, and in silico approaches such as enzyme inhibition and glucose uptake assays. Although numerous studies demonstrate the antidiabetic effects of aqueous and organic extracts, the specific bioactive compounds responsible for these activities remain largely unidentified. This review emphasizes methodological advances, current research gaps, and Sri Lanka's growing contribution to the global search for novel plant-derived antidiabetic agents.

About the Journal

Bulletin of Pharmaceutical Sciences

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DNR

Shear Fractures and Faulting Across Multiple Phases in the Exhumed Lower Crust Beneath Sri Lanka: Evidence from Charnockitic Gneiss in Galgoda, Balangoda

Lalindra V. Ranaweera, and Nuwan S. Wanniarachchi

Abstract

The Precambrian middle to lower crust exposed in Sri Lanka has abundant fractures formed during the brittle deformation related to the opening up and subsequent evolution of the Indian Ocean. This study examines the attitude, shear sense indicators and palaeostress axes of shear fractures (n = 136) in the charnockitic gneiss in Galgoda near Balangoda. The analysis revealed the presence of a conjugate shear fracture system along with three other sets of shear fractures. The shear fractures represent reactivated tensile fractures, a conjugate normal fault, and a strike-slip fault formed at multiple phases. Slickenside striations on the fracture surfaces delineate two different movement directions, clearly substantiating a change in stress regimes. The normal faulting likely occurred around 144 million years ago, followed by strike-slip faulting, indicating the shift in stress regimes from extensional tectonics to strike-slip tectonics. We suggest that the formation of major landforms such as Horton Plains escarpment in the nearby area is closely linked to these brittle structures.

About the Journal

Journal of the Geological Society of Sri Lanka

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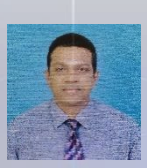

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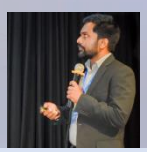

DNR

Geological and geochemical characterization of newly discovered phoscorites within the Kawisigamuwa carbonatite-phoscorite complex, Sri Lanka

H.M.T.G.A. Pitawala, Lei Zhao, Mingguo Zhai, N.H. Malshan, L.V. Ranaweera, Xianhua Li

Abstract

The Kawisigamuwa carbonatite-phoscorite complex of Sri Lanka represents a rare and significant addition to the global inventory of phoscorites occurrences. These phoscorites are composed of apatite, magnetite, diopside, and phlogopite, with trace amounts of calcite. This study integrates comprehensive field, petrographic, mineralog- ical, and geochemical analyses to document their petrological and geochemical characteristics and to unravel their petrogenesis. The mineralogical composition and distribution of light rare earth elements (LREEs), featuring relatively flat variation patterns and minor Eu anomalies, closely align with those reported in phoscorites from other globally significant complexes. While only pyroxenite is currently exposed as an ultramafic lithology, the presence of other ultramafic rocks beneath the thick weathering profile cannot be excluded. The petrogenesis of these phoscorites likely involved the initial immiscibility of Fe-P-enriched carbonatite magma, followed by fractional crystallization. The lower concentrations of incompatible trace elements, along with Sr-depleted apatite, suggest complex magmatic processes, potentially involving a metasomatized lithospheric mantle source with possible crustal interaction. Along the contact zones between phoscorites and the country rock, the hydrothermal alteration has significantly overprinted the primary mineralogical and geochemical signatures. The intensity of alteration varies from a few millimeters to decimeters. The formation of hornblende and feldspar indicates interaction with high-temperature fluids during later hydrothermal processes. This study highlights the distinctive features of the Kawisigamuwa carbonatite-phoscorite complex and emphasizes the need for further investigations, including isotopic and detailed mineralogical studies, to unravel the precise source materials, magmatic evolution, and postmagmatic alteration processes influencing this exceptional geological system.

About the Journal

Journal of Asian Earth Sciences

Impact Factor – 2.4

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DNR

Weathering induced surface transformation and trace metal affinities of plastic nurdles discharged from the X-Press Pearl ship accident (2021–2024)

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Abstract

This study evaluated the pollution level at Sarakkuwa Beach and examined weathering-induced volume loss and surface chemical changes in nurdles compared to pristine nurdles. Sand samples were collected at four time points (16, 24, 28, and 40 months), following initial nurdle spillage. Chemical composition of nurdles were analyzed using Fourier transform infrared (FTIR) spectroscopy and X-ray photoelectron spectroscopy (XPS), while digital microscopic imaging was used to reveal surface morphology. Volume reduction of randomly selected nurdles was quantified using densitometric titration. Conducted Pellet Pollution Index (PPI) analysis shows that after 40 months still Sarakkuwa beach highly contaminated with the nurdles (11.71 ± 7.47 pellets per m^2). FTIR spectra showed new absorption bands corresponding to C=O, S=O, –C=C stretching, and C–O–C bending vibrations that were absent in pristine nurdles, evidencing chemical alterations resulting from weathering. The XPS spectra of nurdles revealed peaks corresponding to As3d, N1s, Li1s, and S2p, indicating prolonged chemical exposure. The percent volume reductions of weathered nurdles collected at four time points after the accident were 47.92 ± 18.79, 57.1 ± 14.98, 61.22 ± 20.65 and 64.87 ± 17.23%, respectively, indicating ongoing size reduction and the release of micro/nanoplastics into the environment. Rapid weathering onset is attributed to the immediate exposure to hazardous chemicals and fire, followed by a gradual degradation over time, influenced by factors like UV irradiation, atmospheric oxygen exposure, and wave action. This study elucidated the enduring presence of nurdles from the MV-XPP ship, suggesting long-term implications on size reduction and their interaction with aquatic organisms and human health.

About the Journal

Marine Environmental Research

Impact Factor – 3.2

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Geology, Mineralogy, and Genesis of Gem-Quality Corundum in Sri Lanka - A Review

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Abstract

Corundum is the major gem mineral found in most of the gem fields of Sri Lanka, and it consists of the most expensive and rare gemstones, including sapphires and rubies. Corundum occurs in mafic and alkaline geological environments, which are mainly associated with rocks depleted in silica and enriched with alumina. The source rocks of corundum formation are skarns, pegmatites, marbles, garnetiferous gneisses, and the contact rocks of charnockites. High temperature, pressure, contact metamorphism, and the presence of aluminium-rich meta-sediments, together with extensive fluid activity, affect the corundum formation, all of which are evident in the Highland Complex of Sri Lanka. Therefore, most of the gem formations are confined to the Highland Complex. The majority of the corundum deposits found in Sri Lanka could be attributed to the metamorphic origin, while several localities are of magmatic origin. The geochemistry of the sedimentary gem deposits supports the identification of the mineralogy and geology of the primary source to a certain extent. While Sri Lanka's gem deposits have been studied previously, a comprehensive review focusing specifically on the geological setting, primary and secondary occurrences, and the role of geochemistry and geochronology in understanding corundum provenance has not yet been conducted. Therefore, this review highlights the knowledge gaps in the geochronology and geochemistry of primary and secondary corundum gem deposits, providing new insights into future research directions on Sri Lankan corundum gem deposits.

About the Journal

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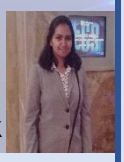

Conference Proceedings

DPST

Light Curve Modeling of Eclipsing Binary Systems with Delta Scuti Component

J. A. D. M. Dharmathilaka, J. Adassuriya, K. P. S. C. Jayaratne, Jordi L. Gutiérrez

Abstract

Astroseismology in eclipsing binaries with Delta (δ) Scuti components offers a powerful means to derive stellar parameters and probe internal structures. To enable accurate frequency analysis, binary characteristics must be disentangled from the observed light curves. This study utilizes the LC2015 light curve modeling method, followed by the DC2015 differential correction process, integrated into the Wilson-Devinney (WD) eclipsing binary modeling code. The analysis focuses on two δ Scuti binary systems, KIC 8504570 and SX DRACONIS (Dra), using Kepler and TESS photometric data, supplemented by literature-derived initial stellar parameters. The DC2015 process employs the Levenberg-Marquardt algorithm to minimize the difference between observed and modeled light curves. The refined models provide highly accurate stellar parameters, including primary and secondary star temperatures ($T_{eff,1}$ and $T_{eff,2}$), mass ratio (q), and primary star luminosity (L_1) with associated errors. For KIC 8504570: $T_{eff,1}$ (7400.9 ± 1.6) K, $T_{eff,2}$ (5450.4 ± 1.0) K, q (0.5208 ± 0.0002), and L_1 (11.8043 ± 0.0006)L⊙. For SX Dra: $T_{eff,1}$ (7729.7 ± 1.1) K, $T_{eff,2}$ (4927.5 ± 0.5) K, q (0.4772 ± 0.0006), and L_1 (7.0474 ± 0.0015)L⊙.

About the Conference

Proceedings of the 41st Technical Sessions

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Institute of Physics, Sri Lanka

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DPST

Stellar Parameter Estimation and Frequency Analysis of KIC 11973705

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Abstract

Delta (δ) Scuti stars are a class of pulsating variables located within the classical instability strip on the Hertzsprung-Russell diagram. These stars exhibit a complex internal structure, comprising a mixture of both radial and non-radial pressure modes oscillations. KIC 11973705 is a double mode pulsating star, observed in photometry at Quarter 9 by Kepler mission. However, the lack of observational constraints for KIC 11973705 target has limited the comprehensive study of stellar parameters. To overcome this issue, the study delivers a theoretical approach for the estimation of stellar parameters for KIC 11973705 with minimal observational inputs. The effective temperature (T_{eff}) and surface gravity (log g) were adopted from the literature. In addition, visual (*V*) band magnitude and parallax were obtained for the estimation of stellar parameters through established theoretical approaches, which mainly include the dustmaps python package, the distance modulus formula, the Stefan-Boltzmann law, relationship to the surface gravity, and the polynomial transformation equations. The absolute magnitude of *V* band, *M*V = 2.83±0.02 mag; Bolometric Correction, BC_V = 0.0348±0.0015 mag; *B-V* color index = 0.2641 mag; and Bolometric Magnitude M_{bol} = 2.86±0.02 mag were the newly estimated parameters for the KIC 11973705. In addition, a detailed frequency analysis was performed to identify the pulsation characteristics using Period04 software. The dominant fundamental frequency was found to be 2.9002±0.0005 d^{-1} and derived minimum *p* mode threshold frequency for the KIC 11973705 was 2.1095 d^{-1} In summary, this study yields an estimation of new stellar parameters for the first time for KIC 11973705.

About the Conference

Proceedings of the Postgraduate Institute of Science Research Congress (RESCON)
7 – 8 Nov 2025
Postgraduate Institute of Science, UOP

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DPST

Refinement of Stellar Parameters for the Eclipsing Binary System KIC 8569819 Using Stellar Modeling Approach

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Abstract

Eclipsing binary systems with a Delta (δ) Scuti component serve a vital role in deriving precise fundamental stellar parameters and testing stellar evolution models. This study mainly focuses on the Kepler target KIC 8569819, a detached eclipsing binary system that consists of a δ Scuti pulsating component. The quarter 9 photometric data observed by the Kepler mission were used for the analysis. The binary nature of the KIC 8569819 system was modeled using the Wilson-Devinney (WD) code and extracted new set of stellar parameters. This comprehensive study mainly focuses on the application of the Differential Correction (DC2015) process after the initial fitting done by the Light Curve modeling (LC2015) process for the disentanglement of the binary nature from the observed light curve. Subsequently, an improved set of stellar parameters for both primary and secondary components of the KIC 8569819 system was determined. The DC2015 modeling process yielded an orbital inclination of i = 89.88 ± 0.03 degrees, primary component luminosity L = 10.911 ± 0.005 L⊙, the effective temperature of the primary component of $T_{eff,1}$ = 7155 ± 9 K and the effective temperature of the secondary component of $T_{eff,2}$ = 5956 ± 7 K. Additionally, the values for the radius 1.790 R⊙ and 0.986 R⊙, bolometric magnitude 2.56 mag and 4.65 mag, and surface gravity 4.17 cm s^{-2} and 4.46 cm s^{-2} , were found as refined stellar parameters for both primary and secondary components of the KIC 8569819 binary system respectively. These results not only deliver an updated and highly accurate stellar model for KIC 8569819 but also provide reliable input for the future analysis of mode identification of pulsation frequencies in the field of Asteroseismology.

About the Conference

International Research Conference of the Open University of Sri Lanka (IRC-OUSL)
12 - 14 Nov 2025
Open University of Sri Lanka

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