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PAGE 1

CONTENTS

Public Private Partnership Programme

PAGE 2

Research Projects Awarded up to 2023.

PAGE 2 & 3

How locally made telescope optics and astronomy instruments contributed to observe sky for detecting meteors

PAGE 4

Solid-state degradation by Lipolytic fungi: a promising approach for fats, oils, and grease (FOG) treatment in wastewater

PAGE 5 & 6

Diversity and bioactivities of the dry zone macrofungi

PAGE 7 & 8

Target Oriented Research Projects Progress Review Meetings Patent Received for product/process development Signing of MOU with George Steuart Health (Pvt) Ltd. Staff Achievements Appreciation of Service



Public Private Partnership (PPP) programme

NRC Public private partnership program Call for expressions of interest (EOI) from the private sector

Advances in R&D in S&T will lead to the development of value-added products and services that are competitive in the global market, which will form an essential pillar of Sri Lanka's envisaged economic development aimed at becoming the Wonder of Asia. To accomplish this goal, research carried out in Sri Lanka needs to be demand-driven by addressing the needs of key industries of the country, which are expected to drive the economy forward.

The NRC Public Private Partnership Programme: Call for expressions of interest (EOI) from the private sector The Public-Private Partnership (PPP) Programme introduced by the National Research Council (NRC) forms partnerships between the public sector and private sector to conduct research that will contribute to the national economy. Prior to entering to the partnerships, we are willing to identify your research needs under any of the following thematic areas;

- Value addition to natural resources and minerals of Sri Lanka
- Renewable energy, energy storage and green hydrogen
- Nutraceuticals and lead medicinal compounds from Sri Lankan bio resources
- Agriculture, climate change and food security &
- Other [which will have direct benefits to the economy]

Further details of the PPP programme including the process, partnership type, funding and EOI concept note format can be viewed by visiting https://www. nrc.gov.lk/index.php/private-public-partnership-programe/.

Research Projects Awarded up to in 2023

| Grant No | Principal Investigator Name & The Institute | Title |
|-------------|---|--|
| 22-003 | Dr. Vasana Kiridana University of Peradeniya | Association of maternal BMI and gestational weight gain with cord blood DNA methylation, adipokine levels, offspring anthro- pometry, early childhood cardio-metabolic parameters and the effect of lifestyle modification on growth during infancy |
| 22-044 | Prof. Prasanna Galhena University of Kelaniya | Detection and validation of molecular abnormalities in bone marrow aspiration samples obtained from patients with myelod- ysplastic syndrome using an "in-house" developed bone marrow transport medium |
| 22-011 | Prof Lallindra Gooneratne University of Colombo | "A Comparison of the Degree of Platelet Inhibition in Sri Lankan Coronary Artery Disease Patients on Clopidogrel and Ticagrelor" |
| 22-053 | Dr Rukshani Haputhanthri The Open University of Sri Lanka | Cinnamon essential oil nanocapsules incorporated starch based food packaging with antimicrobial properties. |

Some Highlights of Achievements of NRC Research Projects

Highlights of achievements of a few research projects are presented in this newsletter and hereafter, in each Newsletter, NRC will present to the reader a few more outputs of research projects funded by the NRC.

How locally made telescope optics and astronomy instruments contributed to observe sky for detecting meteors

Achievements in Investigator Driven Research Projects NRC Grant No: IDG 16-012

Introduction

Astronomical instruments are the tools that enable us to explore the wonders of the universe and learn more about their origins, structure, and evolution. They are essential for advancing our scientific knowledge and inspiring our curiosity and imagination. Therefore, this research was aimed to design, make, and set up a camera network and a telescope cluster to monitor meteors entering the earth's atmosphere near Sri Lanka The project had three main phases: the first phase focused on developing a wide-field camera unit for detecting meteors, the second phase focused on making a Telescope Mirror Coating Machine, and the third phase focused on developing a wide-field telescope cluster. The specific objectives of this research were to create infrastructure for astronomy research and raise awareness of astronomy-related phenomena among the general public.

VOLUME 02 | ISSUE NO 02 | JUNE 2023 |

Outputs

The research work produced several intellectual property claims as well as scientific publications. The All-Sky camera developed was a focus of two National Patents and a Patent Cooperation Treaty (PCT). The telescope mirror coating machine is the first this type of locally build machine in Sri Lanka that can coat telescope mirrors up to 25 cm in diameter. The wide-field telescope cluster can take wide-field images of the sky and will be used for sky survey.



Figure 1: The All-Sky camera placed at University of Colombo

Outcomes

The research project produced knowledge in making wide-field sky monitoring cameras and telescopes. Especially, the research has gained technology in making telescope mirrors and can be scaled up to start mass production. Also, the knowledge gained while making this coating machine can be used to make more machines with better capabilities. The All-Sky camera unit made in this research is a unique product and has shown to have a high commercial value in the international market.



Figure 2: Detected meteors from the network

The telescope mirror making process has shown to be able to make quality optics. Therefore, a bigger project was started under the World Bank grant scheme AHEAD ICE to commercialize the outcome of this research project. Thus, the outcomes of this research will

be taken beyond the laboratory scale for mass pro-



Figure 3: Fabricated and coated locally, this type of mirrors used in the telescope cluster

Way forward

duction.

The camera unit and telescopes made in the research have shown to have a high commercial value in the local and international market. This helped us securing a research grant worth SLR 35 million for scaling up the camera and telescope making process. The astronomical instrument making research is new to the Sri Lankan research environment. Therefore, it made our work challenging in every possible angle. However, the hard work of our team ensured achieving the goals to the full capacity. This project has opened a new research field in the country, and we are currently using and maintaining the facilities already gained for further research work.



Prof. G.D.K. Mahanama Department of Physics University of Ruhuna

Solid-state degradation by Lipolytic fungi: a promising approach for fats, oils, and grease (FOG) treatment in wastewater

Achievements in Investigator Driven Research Projects NRC Grant No: IDG 12-086

Introduction

Fats, oils, and grease (FOG) pose a significant challenge in wastewater treatment systems due to their slow biodegradability and inhibitory effects on the treatment process. The conventional methods for FOG treatment often involve hydrolysis, which produces long-chain fatty acids (LCFAs) that further complicate the functional efficiency of the system. The present study aimed to address this persistent problem by exploring an innovative approach known as solid-state degradation by lipolytic fungi. The objective is to evaluate the effectiveness of this novel method as a means of bio-augmentation in the treatment of FOG.

Outputs

To conduct the study, the grease trap waste samples were collected and dried to achieve a moisture content of 25–35% (Figure 1). The dried samples were then mixed with coir fiber at a concentration of 1% w/v to facilitate proper aeration within the reactor. Each 10 mg/g dry weight of substrate was inoculated with 1 mL of a spore suspension containing lipolytic fungi at a concentration of 1×10^7 spores/mL. The moisture content in the reactor was subsequently increased to 65%, and the system was incubated at a temperature of 30 °C.



Raw grease trap waste



Extracted grease trap waste as FOG

Figure 1: Grease trap waste before treatment

After 72 hours of post-incubation, the degradation efficiency of the lipolytic fungi isolates was assessed (Figure 2). The results demonstrated a significant degradation efficiency of approximately 50%. This substantial reduction in FOG content indicated the potential of lipolytic fungi as an effective agent for FOG treatment. The breakdown of FOG by the lipolytic fungi is attributed to their enzymatic and hydrolytic capabilities, enabling the conversion of slowly biodegradable particulate organic matter into readily biodegradable soluble organic matter.

Outcomes

Implementing solid-state degradation by lipolytic fungi can alleviate the inhibitory effects caused by the accumulation of LCFAs in wastewater treatment systems. This approach offers a sustainable solution for FOG treatment, reducing environmental pollution and minimizing operational challenges in wastewater treatment plants.

Way forward

Further research is warranted to optimize the solid-state degradation process and explore the potential of different lipolytic fungi species. Additionally, the long-term effects of this approach on the overall performance and stability of wastewater treatment systems need to be investigated. Ultimately, the adoption of solid-state degradation by lipolytic fungi holds great promise for enhancing FOG treatment efficiency and promoting sustainable wastewater management practices.



Dr. Ayomi Witharana Department of Zoology and Environment Sciences Faculty of Science University of Colombo



Figure 2: Degradation of raw grease trap waste: a) After 3 days b) After 5 days c) After 7 days

Acknowledgement:

This study was conducted in the Department of Civil Engineering, University of Moratuwa, Sri Lanka. The Researcher is grateful to Emeritus Professor N Ratnayake, University of Moratuwa, Professor Jagath Manatunge, Department of Civil Engineering, University of Moratuwa and Professor Chandrika M. Nanayakkara, Department of Plant Sciences, University of Colombo for their invaluable guidance and support. The NRC financial support for the research project to purchase major equipment is well acknowledged (12-086).

Diversity and bioactivities of the dry zone macrofungi Achievements in Investigator Driven Research Grants NRC Grant No: IDG 11-040

Introduction

Macrofungi produce distinctive fruiting bodies that are large enough to be seen by naked eyes. From times immemorial, *macrofungi* have been valued as edible and medicinal provisions for humankind. Although a large number of edible mushrooms are available in Sri Lanka, only a few species have been domesticated so far. Owing to the high protein content with a complete profile of essential amino acids, mushrooms can also be a solution to protein malnutrition as well. Wild edible mushrooms present a variety for local cuisine and with the domestication and commercialization it can provide a livelihood for the low-income families. At the same time, mushrooms have been well recognized for their medicinal properties such as antimicrobial, anticancer, antioxidant, immunomodulating, etc. Sri Lanka being a tropical biodiversity hotspot, harbours a wide variety of *macrofungi* of which the diversity and biotechnological potential has not been fully explored so far.

Hence, the study was conducted along three main themes: (i) Assessing morphological and molecular di-

diversity of **macrofungi** in selected dry zone forest reserves in Sri Lanka and optimization of culture conditions of the edible counterparts; (ii) Investigating metabolites of Sri Lankan macrofungi against cancer related targets and (iii) Investigation of antimicrobial activity of metabolites of **macrofungi** collected from the dry zone and study of the nutritional composition of edible forms.

Outputs

In biodiversity studies, a total of 108 different types and among them 53% was **polypores** and 28% was agarics. In addition 06 different types of jelly fungi, 03 types of boletes and 10 Ascomycetes were encountered. Agarics such as **Panaeolus sphinctrinus**, **Panaeolus foe***nisecii*, Lecoagaricus rubrobrunneus, Pleuroflammula praestans, Anthracophyllum lateritium, Coprinopsis strossmayeri, Agrocybe subpediades, Gymnopilus lepidotus, Psilocybe cubensis, Gyrodontium sacchari and polypores such as Fulvifomes fastuosus, Fuscoporia gilva, Fuscoporia senex, Fomitopsis feei, Austrlohydnum dregeanum, Phanerochaete chrysosp chrysosporium, Earliella scabrosa, Panus conchatus, Panus similis, Trametes cubensis, Trametes elegans, Trichaptum byssogenum, Stereum hirsutum are new records and their detailed descriptions were added to the wealth of macrofungal diversity in Sri Lanka, as a result of this study. Cultivation technologies have been developed for Schizophyllum commune, Auricularia polytricha and Lentinus squarrosulus using agriculture residues as alternative substrates.



Figure 1

Among the 107 macrofungi screened for antioxidant activity, Fulviformes fastuosus, Phellinus repandus and Anthracophyllum lateritium exhibited promising results and hence employed in extended cytotoxicity experiments. All three species reported potent cytotoxicity against cancer cell lines Hep-2, RD, and HepG-2 with minimal toxicity for normal CC-1 cells. Bioactivity guided isolation of active principles from crude extracts of F. fastuosus and P. repandus were performed using different chromatographic techniques, 1D, 2D NMR spectrometric methods and mass spectrometry. Inoscavin A and ergone were identified as active compounds. The compelling cytotoxic effect observed in the present study implies the ethnopharmacological potential of these fungi and their active metabolites in the remedy of cancer.



Figure 2

Nutritional analysis of indigenous edible mushrooms revealed distinct proximate nutritional profiles. They were rich in essential amino acids and unsaturated fatty acids. **Termitomyces eurrhizus**, **T. heimii** and **T. microcapus** can be potentially used to enrich the nutritional quality of food consumed by Sri Lankan rural communities, due to their superior nutritional values including high protein and low carbohydrate contents. Investigation of antimicrobial properties revealed that **Serpu-***Ia* sp., *A. late*

ritium, Fomes sp., C. byrsina and H. rubiginosa possess antibacterial activity while Flavodon flavus, C. aspera, C. caperata, T. byssogenum and X. polymorphapossess showed antifungal activity.



Figure 3

Bioassay-guided fractionation of a mycelium culture of **P. tricoloma** resulted in two known ergostane-type compounds. Three novel metabolites serpulanine A to *C* were isolated from an extract of a **Serpula sp. Serpu***lanine* A showed total class I/II HDAC enzyme inhibitory activity in A9 murine metastasis cells with IC50 at 7µM.



Figure 4

Outcomes

A fungarium has been established at the Department of Plant Sciences, University of Colombo for the dry zone macrofungi. A database and a coffee table book have been published for fungi enthusiasts to identify macrofungi easily. One US patent and one Sri Lanka patent has been received for 'A novel method to isolate inoscavin A from **Fulviformes fastuosus** and medicinal preparation thereof to treat rhabdomyosarcoma cancer conditions. Five articles in SCI journals, 06 in other per reviewed journals and 16 abstract publications stemmed from the research.



Figure 5

Way forward

Intriguingly, current research work provides a novel and effective method to isolate inoscavin A from **F. fastuo***sus* as a stable and quality product. In future, this novel method can be effectively used for the preparation of anti-tumor drug using inoscavin A. The remarkable antimicrobial activity of serpulanine A permits further research on antimicrobial drug development.



Figure 6

Detection of apoptotic cell morphology by acridine orange-ethidium bromide staining of RD cells treated with inoscavin A: A- Negative control; B- 20 ng/mL; C-50 ng/mL; D- Cycloheximide as the positive control (5 mM; 50 µL) (X40).



Prof. Chandrika M. Nanayakkara Department of Plant Sciences University of Colombo

Events / Staff Highlights

Target Oriented Research Projects Progress Review Meetings

The NRC conducted annual progress review meetings for the following grants.

NRC TO 16-07: Ensuring food security through developing climate smart crop varieties and cultivation techniques in Sri Lanka

NRC TO 16-15 : Development of a Model Treatment Facility for Remediation of Total Dissolved Solids and Fluoride in Groundwater – A Sustainable Solution for Dry Zone Drinking Water Problems

Patent Received for product/process development

Title of the Invention: Biocompatible thin films to remove metal ions and water hardness from water and preparation method thereof NRC Grant Number: NRC TO 16-18 Research Grant Title: Development of advanced materials-based filters for water purification Principal Investigator: Prof. Rohini M. de Silva Institute: University of Colombo



Signing of MOU with George Steuart Health (Pvt) Ltd.



An agreement was signed for commercialization of the patented finding of the NRC Grant No: 17-029, Title: Development of an antidiabetic agent from **Coccinia** grandis (L.) Voigt (Cucurbitaceae) for diabetes mellitus with George Steuart Health (Pvt) Ltd.

Staff Achievements



Ms. A. K. D. M. Perera, Administrative Officer of NRC completed a Diploma in Human Resource Management at National Institute of Labour Studies (Year: 2023)



Ms. Thushari Wickrama, Procurement Officer of NRC completed Master degree of Business Administration at University of Colombo (Year: 2019 / 2021)



Accounts Officer, Ms. Erandi Dayarathna resigned from NRC in May 2023

Appreciation of Service



Driver, Mr. Thilina Sandaruwan resigned from NRC in June 2023

EDITORIAL COMMITTEE Prof. H. Dodampahala / Chairman /NRC Prof. H. A. Dharmagunawardana / Council Member Prof. P. Ravirajan / Council Member Prof. T. Seresinhe / External Member Dr. Seetha I. Wickremasinghe / External Member Dr. Shanika Jayasekara/CEO /NRC

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