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MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding (MoU) is made on the 30th day of October 2017 at Chennai.

Between

VISTAS (hereinafter referred as VELS University) with its Registrar placed at Velan Nagar, P.V. Vaithiyalingam Road, Pallavaram, Chennai-600117, Tamil Nadu, India.

&

AVANZ BIO PVT. LTD., M.E.S.Road, East Tambaram, Chennai, Tamil Nadu, India, an ISO Certified Private Laboratory, and includes its assigns, legal heirs and successors represented by its Managing Director Mr. V. Prathap Raju, Managing Director.


Dr. A.R. VEERAMANI
Registrar
Vels University (VISTAS),
Pallavaram, Chennai - 600 117


AVANZ BIO PRIVATE LIMITED
No. 12, M.E.S. Road,
Tambaram East,
Chennai-600059.

The parties realize the benefits of sharing their expertise and enter into the formal statement of collaboration in the form of memorandum of understanding for the purpose of academic interaction and research activities beneficial to institute and industry.

I. Purpose of the Agreement

Vels University and Avanz Bio Pvt. Ltd. jointly agree to subscribe to a relationship in order to promote the following activities between the two parties.

The parties collaborate, cooperate and interact to achieve the following scopes of this MoU.

1. The Parties intend to pursue collaboration on fundamental, academic research, related to Biotechnological applications.
 - 1.1. Examples of research works under the title to Biotechnological applications of Marine and Terrestrial Microorganisms, Screening of marine and terrestrial microorganisms for the production of industrial enzymes, bioactive secondary metabolites, biological control agents and bio fertilizers, development of aquaculture products.
 - 1.2. Examples of research works under the title Bioremediation of environmental pollution.
 - 1.3. Research works under the title Cancer Biology and Molecular Biology.
2. Both parties exchange the technical expertise such as experimental procedures, instrumental knowledge and development of new protocols in Fields.
3. Both parties agree to exchange the expertise of their working staff under mutual convenience when requested by either Party. For example, Avanz Bio Pvt. Ltd. can request to utilize the expertise of Vels University staff for their technical events. However, exchange of faculties or staff or scientist is to be done under mutual convenience of the Parties when such exchanges doesn't affect the normal functioning of the Parties. During Conferences, Seminars, Symposia and Workshops organized by either Party, above mentioned exchange of working staff may avail with mutual concerns.
4. Both institutes agree to utilize their Laboratory Instrument Facilities without any payments when such utilizations don't affect the normal functioning of the other.

II. Legal Framework

The Registrar of Vels University and the Managing Director of Avanz Bio Pvt. Ltd. may, in accordance with their respective policies and procedures, initiate agreements to


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Registrar
Vels University (VISTAS),
Pallavaram, Chennai - 600 117.


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This is to certify that Ms. A. FATHIMUTHU, B.Tech. Biotechnology from Department of Biotechnology, Vels University, Chennai – 600 117, has participated in “Hands-on Training on Nanotechnology” held from 11th December 2017 to 21st December 2017 at Avanz Bio Pvt. Ltd., East Tambaram, Chennai- 59.

Dr. V. PRITHIVIRAJ, Ph.D.
Chairman

V. PRATHAP RAJU
Director

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Principal Scientist



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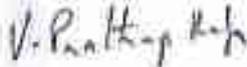
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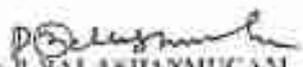


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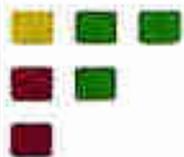
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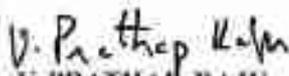
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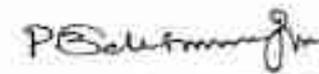


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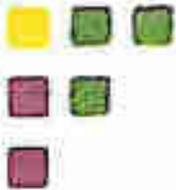
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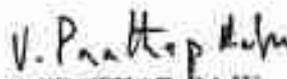
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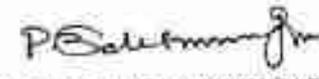


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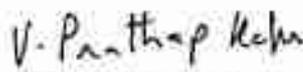


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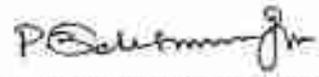
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Chairman

[Signature]
Director

[Signature]
Principal Scientist



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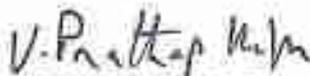
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Dr.V.PRITHIVIRAJ,Ph.D.
Chairman

19-07-2017

To
The Registrar,
Vels University,
Pallavaram,
Chennai, Tamil Nadu 600117,
India

Dear Sir/Madam,
Sub.: Consultancy work - Reg.

Warm Greetings!

We Avantz Biotek Lab a world class Biotech state- of-the-art Research Facility and had justifiably earned its reputation as unique establishment in the field of Biological Sciences. We are working in many biological aspects except in bioinformatics field; it will be good enough if you can work in Docking extraction and characterization of macroalgae (Red and Brown algae).Send me a proposal with the experts in this field in your department and the duration of the project will be three months.

Thank you

Regards



Dr. V. Prithiviraj
Chairman
Avanz Bio Pvt. Ltd.
Chennai - 600117

Dr.V.PRITHIVIRAJ,Ph.D.
Chairman

Date: 31.07.2017

To
The Registrar,
Vels University,
Pallavaram,
Chennai, Tamil Nadu 600117,
India

Dear Sir,

Sub.: Confirmation for doing consultancy work - Reg.

Ref: Consultancy work - Reg., dated 24.07.2017

Warm Greetings!

We sincerely appreciate your acceptance of the consultancy work. We agree with quoted amount for the carrying out the project work. Please complete the project work within the stipulated period of time and send the completed report.

Regards



Handwritten signature and a circular stamp with text in Tamil and English.

Avanz Bio Pvt Ltd No: 12, M.E.S road, East Tambaram, Chennai - 600059.

MAIL: avanzbioresearch@gmail.com, info@avanzbiopvtltd.com

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Dr.V.PRITHIVIRAJ,Ph.D.
Chairman

Date: 06.11.2017

To
The Registrar,
Vels University
Pallavaram,
Chennai, Tamil Nadu 600117,
India

Dear Sir,

Sub.: Department of Bio-Engineering – Vels University – Payment for consultancy work – Reg.

Ref: Consultancy work - Reg.,

Warm Greetings!

We have received your completed project report and we are satisfied with the work, we have sent you a cheque of Rs.10,000/- (Rupees Ten Thousand only) towards your completed consultancy work.

Thank you

Regards



Dr. V. Prithiviraj
Chairman
Avanz Bio Pvt. Ltd.



RESEARCH ARTICLE

Preliminary Phytochemical Analysis of the Crude extract of Marine Red and Brown Seaweeds

Thiruchelvi. R^{1*}, Jayashree. P¹., Hemashree. T¹, Hemasudha T. S¹., Balashanmugam. P².

¹Department of Bio-Engineering, School of Engineering, Vels Institute of Science Technology and Advanced Studies, VISTAS, Pallavaram, Chennai-117

²Avanz Bio Pvt. Ltd., East Tambaram, Chennai-69

*Corresponding Author E-mail: thiruchelvi.se@velsuniv.ac.in

ABSTRACT:

The seaweed is a large and diverse group of marine macro algae that can be found in intertidal and sub tidal coastal regions around the world. Seaweeds are simpler in their structural composition because they take up the nutrients into their blades or fronds directly from the seawater, unlike more complex land plants which take up the nutrients through their roots. There are three different types of marine macro algae—red algae (Rhodophyta), brown algae (phaeophyta), green algae (chlorophyta). They are grouped according to their unique photosynthetic pigments, which give them their characteristic color and unique properties. Secondary metabolites from natural resources are a potential source that leads and drugs can be exploited to combat antimicrobial resistance in microorganisms. The present study investigated to explore the preliminary phytochemical constituents of marine red and brown seaweed such as *Gracilaria corticata*, *Gracilaria edulis*, *Sargassum wightii* where Methanol, Acetone and Aqueous were used as a solvent system for the preparation of the extract.

KEYWORDS: Seaweeds, *Gracilaria corticata*, *Gracilaria edulis*, *Sargassum wightii*, Phytochemical, solvents.

INTRODUCTION:

Seaweeds constitute a vital and important part of the marine ecosystem. It was estimated that about 90% are algae, and over 50% of global photosynthesis were contributed from algae¹. Seaweed has no formal definition. Seaweed may belong to one of several groups of multicellular algae such as the red algae, green algae and brown algae, but these three groups do not have a common multicellular ancestor. Seaweeds are commonly grown close to the littoral zone. The genera of *Sargassum wightii* and *Gracilaria* are free floating and occupy a wide range of ecological niches and also used widely in the field of medicine².

Over the past decades seaweeds had been consumed by humans as a medicine, food and their extracts have generated enormous amount of interest in the pharmaceutical industry as fresh source of bioactive compounds with lots of massive medicinal potential³. Marine seaweed was used as the potent source of human health because of its active constituents which is responsible for its various pharmacological activities. Being a unique plant structure and its biochemical composition, it could be exploited for its multi-functional properties in the form of food and medicine⁴. The seaweeds offer more curative properties both externally and internally by intake of raw and dried seaweeds which may give more healthy benefits. Seaweeds are toxin free and also provide hundreds of organic compounds⁵.

Among the coastal region of Tamilnadu, South India supports a rich vegetation of marine algae. Among macro algae brown and red algae were growing abundantly in the shores of Kanyakumari and Ramanathapuram districts of Tamilnadu state, India.

EVALUATION OF ANTIBACTERIAL, ANTIOXIDANT, AND ANTICANCER POTENTIALS FROM MARINE RED ALGAE *GRACILARIA CORTICATA*

JAYASREE P¹, THIRUCHELVI R^{1*}, BALASHANMUGAM P²

¹Department of Bio-Engineering, School of Engineering, Vels Institute of Science, Technology and Advanced Studies, Pallavaram, Chennai - 600 117, Tamil Nadu, India. ²Avanz Bio Pvt. Ltd., Chennai - 600 059, Tamil Nadu, India. Email: thiruchelvi.se@velsuniv.ac.in

Received: 28 March 2018, Revised and Accepted: 05 May 2018

ABSTRACT

Objective: The present study was to evaluate the biological activity of Red algae, *Gracilaria corticata*, collected from the southeast coast of Mandapam, Ramanathapuram, Tamil Nadu. Seaweeds are rich in bioactive compounds. Seaweeds are highly diverse group of organism from secondary metabolites of the natural source are a potential source. The marine seaweed is the interesting group of their broad spectrum of biological activities such as antibacterial, antioxidant, and anticancer.

Methods: The antibacterial activity of *G. corticata* was tested against *Staphylococcus aureus* and *Escherichia coli* by disk diffusion method. *In vitro* antioxidant activity was determined by 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging assay. 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide assay was employed to study the anticancer activity against (MDA-MB 231) human breast cancer cell line.

Results: The DPPH assay screening of methanolic extract of *G. corticata* showed specific activity of inhibition. In antibacterial shows the growth of two virulent strains of pathogenic bacteria, *E. coli* and *Bacillus subtilis*. In anticancer activity obtained results indicated that the methanol extracts of *G. corticata* were cytotoxic against (MDA-MB231) human breast cancer cell.

Conclusion: These results show that *G. corticata* has a great biological potential, which could be considered for future uses in pharmaceutical, food, and cosmetics purpose.

Keywords: Seaweeds, *Gracilaria corticata*, Antibacterial, Antioxidant, Anticancer.

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INTRODUCTION

In recent years, natural products have been playing a major role in search of novel drugs against many infectious diseases, inflammation, cancer, and many other complex illnesses. They are considered as treasure for researchers due to their enormous structural diversity and complexity. The marine algae or seaweed represents a largely untapped source for the isolation of novel bioactive compounds [1].

Seaweeds are the primitive angiosperm that has incomparable mineral source, particularly marine red and brown algae. They are used as commercial products; stabilizers, thickeners, emulsifiers, foods, etc. In recent years, phycologists focus the bioactive substances of marine plants because of the presence of macro and trace elements and their cell wall composition. Seaweeds or marine algae are classified into three main categories: Brown algae (Phaeophyta), green algae (Chlorophyta), and red algae (Rhodophyta) [2]. Thus, macroalgae have been recognized as a promising ultimate source of bioactive secondary metabolites with antitumor [3], antibacterial, antioxidant, anti-inflammatory, anticancer, anticholesterolemic activity, antidiabetic activity, and hepatoprotective activity [4]. Several red algae contain agar as a water-soluble sulfated galactan located in the intercellular spaces. Agar is a mixture of polysaccharide, which can be composed of agarose and agarpectin with similar structural and functional properties as carrageenan of red algae [5]. Thus, the study was to assess antibacterial, antioxidative, and anticancer potentialities of *G. corticata* settled along the Mandapam coast of Tamil Nadu.

METHODS

Collection of sample

The sample *G. corticata* (Red algae) was collected from intertidal zone of Mandapam coast (Lat. 9°17'N; Lon. 79°19'E) of Gulf of Mannar,

southeast coast of Tamil Nadu, India. The collected sample was cleaned with seawater to remove the epiphytes and sand particle, and the sample has been packed in polythene bag and brought to laboratory. Then, the sample was washed with freshwater and shade dried. The shade dried sample is stored.

Sample identification

The seaweeds were identified and authenticated by Dr. Ganesan, Senior Scientist, Central Salt and Marine Research Institute, Mandapam Camp, Ramanathapuram, Tamil Nadu, India (Fig. 1).

Preparation of extract

Methanol extraction

The acetone extract of *G. corticata* was extracted using 50 g of the power sample with 150 ml of acetone. The mixture was placed in the orbital shaker for 24 h at 32°C in room temperature. After squeezing, the solvent was taken out and extraction liquid was filtered using Whatman filter paper. The extracted sample was condensed using Soxhlet extractor at 50°C.

Aqueous extraction

The aqueous extract of seaweed *G. corticata* was dried. After drying, 3 g of seaweed is measured and pulverize it gently. Then, add 50 ml of distilled water to the added seaweed in the conical flask. The solution was filtered using Whatman filter paper and the filtered solution was condensed using Soxhlet extractor. The solution was stored in a refrigerator for further use as crude extract of aqueous.

Antibacterial activity

The *G. corticata* tested against various Gram-positive and Gram-negative strains using agar disc diffusion technique with *Escherichia coli* and *Bacillus subtilis* both bacterial culture were smeared in the agar disc

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Preliminary Phytochemical Analysis of the Crude extract of Marine Red and Brown Seaweeds (AbstractView.aspx?PID=2018-11-10-36)

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ABSTRACT:

The seaweed is a large and diverse group of marine macro algae that can be found in intertidal and sub tidal coastal regions around the world. Seaweed are simpler in their structural composition because they take up the nutrients into their blades or fronds directly from the seawater, unlike more complex land plants which take up the nutrients through their roots. There are three different types of marine macro algae—red algae (Rhodophyta), brown algae (phaeophyta), green algae (chlorophyta). They are grouped according to their unique photosynthetic pigments, which give them their characteristics color and unique properties. Secondary metabolites from natural resources are a potential source that leads and drugs can exploited to combat antimicrobial resistance in microorganisms. The present study investigated to explore the preliminary phytochemical constituents of marine red and brown seaweed such as *Gracilaria corticata*, *Gracilaria edulis*, *Sargassum wightii* where else Methanol, Acetone and Aqueous were used as a solvent system for the preparation of the extract.

KEYWORDS:

Seaweeds, *Gracilaria corticata*, *Gracilaria edulis*, *Sargassum wightii*, Phytochemical, solvents.

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