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दस्ताचा प्रकार M.O.U

दस्त नोंदणी करणार आहात का ?

नोंदणी होणार असल्यास दु. निबंधक कार्यालयाचे नाव

मिळकतीचे वर्णन

मोबदला रकम

मुद्रांक शिक्का घेणाऱ्याचे नाव व पत्ता

दुय्यम दस्तऐवजाचे नाव व पत्ता

हस्ते

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सदर मुद्रांक लिपीक

MEMORENDUM OF UNDERSTANDING (MOU)

BETWEEN

AMITY UNIVERSITY JHARKHAND

City Campus, Nivaranpur, Main Road, Ranchi-834001, Jharkhand

Website: www.amity.edu/ranchi/

AND

PROGRESSIVE EDUCATION SOCIETY'S

MODERN COLLEGE OF ARTS, SCIENCE & COMMERCE

Pune University Circle, Pashan Road, Ganeshkhind, Pune-411 016, Maharashtra

Website: www.moderncollegegk.org

15/6/2021

PREAMBLE

In the spirit of intellectual cooperation scholarly exchange, and the development of national partnership with institutions, Amity University Jharkhand and Progressive Education Society's Modern College of Arts, Science and Commerce agree to establish a program of exchange and collaboration on related matters of mutual interest that may emerge over time.

The MEMORANDUM OF UNDERSTANDING (MoU) made on 15th June 2021 between the **Amity University Jharkhand, Ranchi,** a private University under section 3 of the University Grants Commission Act, 1956 having its office at - **City Campus, Ranchi, Jharkhand, through Prof. (Dr.) Raman Kumar Jha,** Vice-Chancellor (hereinafter referred to as the party of the **"First Part / AUJ"** which expression shall, unless repugnant to the context thereof, include its, successors and assigns) and **Progressive Education Society's Modern College of Arts, Science and Commerce, having its office at Ganeshkhind, Pune** through **Dr. Sanjay S. Kharat,** its Principal (hereinafter referred to as the party of the **"Second Part / MCASCGK"** which expression shall, unless repugnant to the context thereof, include its, successors and assigns).

SCOPE AND OBJECTIVES OF MoU:

The scope and objectives of MoU are defined as:

AUJ and **MCASCGK** agree to sign this MoU for sharing academic ideas, offering internships, hands-on or on-job training to students/faculty of each signing party, project work for students, faculty/student exchange for collaborative research programs besides organizing joint events, mutually acceptable to each of the signing party and to get the Mutual Benefits.

DURATION OF MoU:

This MoU comes into effect from the date of its signing and will remain in force for a period of **FIVE YEARS.** Its validity can be extended by mutual agreement between both the parties.

RESPONSIBILITIES OF AUJ, RANCHI, JHARKHAND AND MCASCGK, GANESHKHIND, PUNE:

Common Roles of AUJ and MCASCGK:

1. The purposes of the cooperation are to promote cooperative research and to facilitate the exchange of ideas, the development of new knowledge, and to enhance high quality research acumen. The major thrust of the research on which the parties will cooperate i.e., **Academic Research.**

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The modes of cooperation will include:

(a) Exchanges of faculty and students for the purposes of research, teaching and events.

(b) The development and implementation of cooperative research projects, professional development programs, and capacity-building efforts.

(c) The dissemination of findings through scholarly publication, white papers and in the media.

2. To achieve the goals of this cooperation, both parties will, insofar as the means of each allow:

   (a) Promote institutional exchange by inviting faculty, researchers and student of the partner institution to participate in appropriate research activities.

   (b) Organize symposia, conferences and meetings on timely research issues.

   (c) Develop and carry out joint research programs, and

   (d) Exchange information pertaining to the agreed-upon research areas.

3. Prior to the initiation of any particular project or activity, the specific terms of cooperation and exchange for that project will be discussed and agreed upon in writing by the appropriate responsible representatives of both institutions.

4. Both parties understand that all financial arrangements for specific exchange activities must be mutually agreed upon and will depend on the availability of funds. In addition, the scope of the activities will be subject to funds available at the institutions for the type of collaboration undertaken and any financial assistance that may be obtained by either from external sources.

5. Either party may propose to the other specific individual research projects for collaboration. Such proposal may be made at any time and the parties will develop an agreement for each agreed-upon project. The protection and exploitation of any intellectual property arising out of a research project will be addressed in each individual project agreement early on and ongoingly.

6. The fund of joint research project will be used 60% by the PI (Principal Investigator) and respective institution according to the mutual consent among PI and Co-PI (Co-Principal Investigator) following the term and conditions of respective funding agency.

7. Both institutions must adhere with research ethics and must go for approval by the national or/and international ethical committees.

15/6/2021

8. Each institution agrees to release and hold the other harmless from and against any claims, damages, liability or costs, to the extent such claims damages, liability or costs arise from the negligent or willful acts or omission of the other university or any of its agents or employees in connection with their respective performance under this MoU.
9. The parties agree that in the course of implementing this MoU, they will not engage in unlawful discrimination on the grounds of race, gender, sexual orientation, age, religion, social class, national or ethnic origin or disability.
10. Amendments to this MoU may be made at any time after consultation and agreement between the two institutions. Any such amendment must be in writing and signed by both parties.
11. This MoU will remain in force for a period of five years from the date it is fully executed. The MoU can also be suitably modified, as agreed to by both the parties, to reflect an increased scope, nature of engagement/activities including financial commitments, if any. Prior to the expiration date, the MoU may be reviewed for possible renewal for a further five-year period.

Specific Roles of AUJ:

1. Provide technical support and facility for the students under the undergraduate (UG)/postgraduate (PG)/PhD programs.
2. AUJ will provide the academic staff and necessary infrastructure for UG/PG/PhD courses mutually for smooth conduct of the programs.
3. Exchange of information through lectures and practical relating to their activities in field of mutual interest.
4. Provide internship to the UG / PG students.
5. Provide Dissertation projects to the PG.
6. Arrange observer ship programs for the students.
7. Sharing of information periodically and regularly.

Specific roles of MCASCGK:

1. Provide technical support and facility for the students under the undergraduate (UG)/postgraduate (PG)/PhD programs.
2. MCASCGK will provide the academic staff and necessary infrastructure for UG/PG/PhD courses mutually for smooth conduct of the programs.

Modern College of Arts, Science & Commerce Ganeshkhind Pune-16

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3. Exchange of information through lectures and practicals relating to their activities in field of mutual interest.
4. Provide internship and summer training to the graduate (UG) /postgraduate (PG) students.
5. Provide Dissertation projects to the postgraduate (PG) students.
6. Arrange observer ship programs for the students.
7. Sharing of information periodically and regularly.

Common Activities by Both the Parties

1. Both institutions agree to supply workspace, library and technical facilities as applicable.
2. The consultancy and travel expenses related to the visits for lectures/sessions will be reimbursed by the host institute on mutually agreed terms.
3. The MoU may be amended, renewed and terminated by mutual written agreement between the Heads of both the institutes.
4. Either institute shall have the right to terminate this MoU upon 60-day prior notice period to the other Institute.
5. AUJ and MCASCGK mutually agree to exchange staff / students for their projects, clinical training/internship, on job training, project work, and student/faculty exchange and for collaborative research programs to get the Mutual Benefits and the charges will be borne by individual students as per the institutes rules and regulations.
6. AUJ and MCASCGK mutually agree to help each other to establish and develop laboratories, research centers, etc. as and when required.
7. Faculty of AUJ and MCASCGK depending on their qualifications and experience can act as co-guides to the students pursuing the post-graduation and Ph.D. programs at AUJ and MCASCGK as the case may be, and according to the rules and regulations of each party.
8. Areas for faculty development shall be identified and joint proposals shall be submitted to various funding agencies like ICMR, ICAR, SERB, DST, DBT, BRNS, and RGSTC etc.
9. Both the institutes will participate in relevant government programs / schemes to take mutual benefits of Institute - Institute collaborations wherever possible.

Dated: 15/4/2021

10. AUJ and MCASCGK mutually agree that publications of the joint research carried out will be done jointly by both the institutes incorporating the names of all the contributors.

11. This document is in no way intended to create a legal or binding obligation on either party. It serves only as a record of the parties' current intentions to enhance relationship of the Institute and Institute going forward.

NOTICES:

Any notices given under this Agreement will be in writing and delivered by e-mail or speed post or by hand addressed to the parties as follows:

AUJ

Address: AMITY UNIVERSITY JHARKHAND

City Campus, Nivaranpur, Main Road, Ranchi-834001, Jharkhand, Tel. No: 0651-6605200

MCASCGK

Address: Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-411016.

MISCELLANEOUS

a. **Assignment.**

Neither party may assign this Agreement or the rights there under without the prior written consent of the other party.

b. **Survival.**

Any of the sections that include any other rights and obligations under this Agreement which by their nature should survive, shall survive the expiration or termination of this Agreement.

c. **Severability**

If any provision of this Agreement becomes or is declared illegal, invalid, or unenforceable, such provision will be divisible from this Agreement and will be deemed to be deleted from

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this Agreement. If such deletion substantially alters the basis of this Agreement, the parties will negotiate in good faith to amend the provisions of this Agreement to give effect to the original intent/object of the parties under this MoU.

d. **Independent Entities.**

AUJ and MCASCGK are independent parties and neither is an agent, joint venture partners, or partner of the other.

e. **Order of Precedence.**

In the event of any inconsistency between the terms of this Agreement and the documents referenced or incorporated herein or any other document, correspondence or agreement concerning this Program between the Parties and/or their employees, the terms of this Agreement will prevail.

f. **Entirety.**

This Agreement represents the entire agreement and understanding between the parties with respect to its subject matter and supersedes any prior and/or contemporaneous discussions, representations, or agreements, whether written or oral, of the parties regarding this subject matter.

g. **Amendments.**

The Amendments or changes to this Agreement must be in writing and signed by duly authorized representatives of both the parties. No amendment or modification of this MoU shall be valid unless the same is made in writing by both the parties or their authorized representatives and specifically stating the same to be an amendment of this agreement. The modification/changes shall be effective from the date on which they are made / executed unless otherwise agreed to.

h. **Counterparts.**

This Agreement may be executed in multiple counterparts, each of which will be deemed an original, but all of which will constitute one and the same Agreement, and the signature pages from any counterpart may be appended to any other counterpart to assemble fully executed counterparts.

15/6/2021

i. **Coordinators from both the parties**

Following coordinating faculty members from each party will take responsibilities for smooth conduct and optimal utilization of this MoU, and the activities proposed under it:

AUJ:

1. Dr. Sumira Malik

Assistant Professor, Amity Institute of Biotechnology, Amity University Jharkhand, Ranchi-834010

2. Dr. Rahul Kumar

Assistant Professor, Amity Institute of Biotechnology, Amity University Jharkhand, Ranchi-834010

MCASCGK:

1. Dr. Vinay Kumar

Associate Professor, Modern College of Arts, Science & Commerce, Ganeshkhind, Pune-411 016

2. Dr. Uttara Oak

Assistant Professor, Modern College of Arts, Science & Commerce, Ganeshkhind, Pune-411 016

j. **Dispute Resolution.**

- In event of dispute or claim between the parties concerning the interpretation of any provision of this agreement or the performance of any of the terms/obligations of/under this Agreement, such matter or matters in dispute shall be first settled amicably by mutual discussion between the **Vice-Chancellor of AUJ** and **Principal of MCASCGK** failing which through the Arbitration process. Both the parties after due discussion shall appoint an Arbitrator for resolving the dispute arising out of this Agreement.

Now, therefore, for and in consideration of the foregoing premises the parties have signed the Memorandum of Understanding on 15th Day of June 2021.

15/6/2021.

SO AGREED:

PARTIES

Vice-Chancellor	Principal
Amity University Jharkhand, City Campus, Nivaranpur, Main Road, Ranchi-834001, Jharkhand, Tel. No: 0651-6605200	**Progressive Education Society's** **Modern College of Arts, Science and Commerce,** Ganeshkhind, Pune-411016, Maharashtra Tel. No. 020-25634021
23/06/2021 VICE CHANCELLOR Amity University Campus, Nivaranpur, Main Road, Adjoining Over Bridge, Ranchi, Jharkhand.	15/6/2021 Principal Modern College of Arts, Science and Commerce Ganeshkhind, Pune

WITNESS

1. ..... 23/06/2021 (Dr. Amit Kr. Dulle)

2. ..... 23/06/2021.

WITNESS

1. ..... (Dr. Vinay Kumar)

2. ..... (Dr. Uttara Oak)

Dated: 15.06.21

Dated: 15.06.21

Modern College Ganeshkhind Pune-16

AMITY UNIVERSITY
JHARKHAND

"International Conference on Challenges and Opportunities in Biotechnology (ICCOB-2021)"

Certificate of Appreciation

This is to certify that **Dr. Vinay Kumar**, Associate Professor of Department of Biotechnology, Modern College (Savitribai Phule Pune University), Ganeshkhind, Pune, India
has delivered an invited lecture entitled
miRNA Biotechnology for Developing Climate-smart Crops
as **Keynote Speaker** in the Two Days
"International Conference on Challenges and Opportunities in Biotechnology (ICCOB-2021)"
organized by
the Amity Institute of Biotechnology, Amity University Jharkhand, Ranchi, India
from
11th to 12th November' 2021.

Dr. Biswarup Samanta
Program Coordinator
(EAS & JMC,AUJ)

Prof. (Dr.) Ajit Kr. Pandey
Director, AUJ

Prof. (Dr.) Raman Kr. Jha
Vice -Chancellor, AUJ

*without reference number, this certificate is invalid

Reference No. AUJ/05/AIBN/BT/ICCOB-21/2021/KS355

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A perspective review on medicinal plant resources for their antimutagenic potentials

Sumira Malik[1] · Kawaljeet Kaur[2] · Shilpa Prasad[1] · Niraj Kumar Jha[3] · Vinay Kumar[2,4]

Received: 30 June 2021 / Accepted: 16 August 2021

Abstract

Mutagens present in the environment manifest toxic effects and are considered as serious threat for human health and healthcare. Recent reports reveal that medicinal plant resources are being explored for identifying potent antimutagenic as well as cancer preventing agents. There is mounting evidence that cancer and other mutation-related diseases can be prevented with the use of medicinal pant resources including crude extracts, active fractions, phytochemicals, and pure phytomolecules. These medicinal plant resources possessing antimutagenic potentials have been shown to target molecular mechanisms underlying the mutagenic impacts. Technological advents and high-throughput screening/activity methods have revolutionized this field, though several potent plants and their active principles have been reported as effective antimutagens. The translational success rate needs to be improved, but the trends are encouraging. In this review, we present the current understandings and updates on various mutagens in the environment, toxicities related/attributed to them, the resultant mutations (and cancer), and how medicinal plants come to the rescue. A perspective review has been presented on whether and how medicinal plant resources can be an effective approach for addressing mutagens in the environment. An account of medicinal plant resources used as antimutagenic agents has been given along with the underlying mechanism of action and their therapeutic potential in various models of cancer. Recent success stories, current challenges, and future prospects are discussed.

Keywords Mutations · Mutagens · Antimutagenic · Antimutagens · Medicinal plants · Phytochemicals

Introduction

Mutagens are the agents that are capable of causing mutations that primarily alters the genetic content of an individual which is usually heritable. Mutations can occur spontaneously or be induced by factor known as mutagen leading to insertion, deletion, or duplication of the nucleotide, resulting in a change of gene product. The word "mutagen" has evolved from word "gen," found in various scientific terms meaning the "origin." Various environmental mutagens can be classified as physical and chemical agents and can cause permanent variation in the genetic constituency of an individual which may lead to certain degenerative disease (Bhattacharya 2011). Most mutagens are responsible for causing human cancers and possible genotoxic effects in future generation(s) through germ cells (Yagi 2017). Studies on the cancer treatment by the reactivation of P53 gene using murine double minute 2 inhibitors have resulted in the elimination of cancer cells (Gupta et al. 2019). Similarly, in recent years, microRNAs (miRNAs) has emerged as a potential treatment therapy for cancer (Behl et al. 2020). However, their leading disadvantages have moved the research to the medicinal plant resources with their antimutagenic potentials for treating cancers (Ooi et al. 2021). As we use the term "environmental mutagens," it mainly comprises the word "environment"

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with the chemical and physical factors surrounding an organism.

The physical mutagens that basically surround us are electromagnetic radiation, such as X-rays, gamma rays, UV light, and particle radiation comprising of fast and thermal neutrons (beta and alpha particles) (Kodym and Afza 2003). Different types of radiation are capable of causing chromosomal translocations, gene mutations, and chromosomal aberrations (Nakamura 2012). With no threshold value for radiation, even a small quantity can initiate the mutation event(s) in the organism. Therefore, the possible result of mutation mainly depends upon the dose and the duration of exposure, targeted cell cycle phase, and the capacity of the DNA repair system in that particular organism (Dhakal et al. 2021). Ionizing radiation such as X-rays can break DNA sequences at different positions that can lead to chromosomal rearrangement. Other radiations like lower-energy UV-rays are able to infiltrate cellular and nuclear membranes causing damage to DNA by cross-linking two nitrogenous bases together (Rastogi et al. 2010). The ionizing and UV radiation are proficient to cause double-stranded DNA breaks that require a perfect mechanism to repair of such damages, and to meet this requirement, cells possess cell cycle checkpoints and mechanisms designed to hold cell division until the damaged DNA gets repaired (Ralston 2008).

However, chemical mutagens such as acridine stains and base analogs can affect the replication, via attacking the DNA and leading to deamination, alkylation, and hydroxylation of nitrogenous bases. They are mainly comprised of food stains such as acridine and other various combustion products found in cigarette smoke, car exhausts, and materials involved in plastics industry such as styrene, butadiene, polychlorinated biphenyls, and vinyl chloride (Honma 2020a). Chemical mutagens target the exclusive DNA base-pair chemistry via different mechanisms. Studies have identified mutagens that can cause modifications in DNA nucleotides by deaminating the bases, hence leading to their resemblance with different nucleotides and affecting the overall machinery of DNA replication (Suehiro et al. 2021). Further rounds of DNA replication can permanently incorporate such changes in the genetic information (Ralston 2008). However, other studies have documented biological mutagens such as viruses and transposons that are capable of causing mutagenic effects (Ralston 2008).

Mutagens and related problems

Changes in DNA constituents of a cell exposed to mutagens may result into negative impacts. Some mutations can be silent not effecting the type and amount of protein formed; other mutations can cause deleterious consequences including complete deterioration of protein production or function (Ralston 2008). Chemical mutagens like alkylating agents (N-methyl-N′-nitro-N nitrosoguanidine (MNNG) and ethyl methane sulfonate (EMS)) are capable of affecting DNA bases by transferring alkyl group that can form monoadducts in genetic material, resulting in DNA strand breakage and thus mispairing (Ralhan and Kaur 2007). Mutagens that are base analogs can substitute a particular base in genetic material due to similar structure, hence causing transitions and tautomerization. Direct-acting mutagens such as sodium azide (NaN_3) can cause structural damage to genetic material, while some compounds like benzo[α]pyrene (BP) can affect DNA indirectly by inducing the chemical synthesis that can influence DNA (Sloczynska et al. 2014). The transformation of promutagen into the actual mutagen can take place in such cases.

Mutations and cancer

Mutations that causes cancer have been into the research limelight in recent decades, and it has been claimed by a number of researchers that defective DNA repair pathway genes are a common cause of malignancies and genetic abnormalities. Each gene present in an individual is destined to have a specified function. Some genes are responsible to carry out cell division properly without any hitch. However, if these genes are mutated, the cell will divide uncontrollably, potentially leading to cancer. Various mutagens such as chemical, radiation, and other factors promote gene mutations leading ultimately to cancerous conditions. Certain cancers are related to a specific gene mutation that can be inherited in a family, thus making them heritable. Various studies have been conducted till date on the genes involved in cancer but majorly data available suggest the role of breast cancer genes 1 and 2 (BRCA1 and BRCA2) (Ralston 2008). Studies suggested the mutations in these two genes associated with breast cancer as these genes were highly involved in DNA repair and altering cell division by participating in replication. The BRCA proteins have also been reported to interact directly with Rad51, a DNA repair protein involved in DNA damage (Scully et al. 1997). Thus, suggesting that mutations in the *BRCA* genes can cause mis-regulation of DNA repair system and further leading to tumorigenesis (Ralston 2008).

The present review highlights on medicinal plants and their resources that comprise antimutagenic potentials and can be explored. The goal of this review is to gain a better understanding of the antimutagenic capabilities of diverse medicinal plants by reviewing the published studies in recent years. Various scientific databases were used to look for reports on the antimutagenic properties of medicinal plants published between 1990 and 2020. An overview of the identified molecules or enzymes that are being targeted is also presented, with an emphasis on anti-carcinogenic and/or antimutagenic activity. Recent advancements in the medicinal plant research have paved the way for better understanding and future prospects of the use of natural components as cancer preventatives.

Mutagens in the environment and related toxicity

The term mutagen is also often used to refer a carcinogen since these mutagens cause cancer as one of the consequences of the severe mutations at genetic level. Mutagenesis occurs when an organism's genetic information is altered as a result of exposure to mutagens. Mutagens are categorized as exogenous (environment) mutagens and endogenous (DNA-damaging agents) mutagens which are cellular byproducts (Reha-Krantz 2013). Endogenous mutagens include alkylating agents, water, and free radicals such as reactive oxygen species (ROS) and reactive nitrogen species (RNS) which are produced during the process of aerobic metabolic activity. Exogenous (environment) mutagens can further be classified into three categories: the first category includes ionizing radiation, sunlight, UV, mycotoxins, and plant alkaloids; the second category includes mutagens that are introduced into the environment through the domestic activities including food and water resources, and fluctuating environmental conditions such as temperature. The third category of environmental mutagens includes mutagens that are developed through environmental and occupational sources responsible for causing cancers in industry employees (Sugimura et al. 2000). Dixit and Kumar et al. (2018) provide a general classification of mutagens, as indicated in Fig. 1. According to the National Research Council of the USA, around 70,000 chemicals have been identified as environmental mutagens and their number is rapidly increasing (Honma 2020b). There are large number of environmental mutagens produced through industries, as food additives, through laboratories and agricultural sources in the environment. However, majority of these mutagens have unknown biological effects dependent on individual's genetic constitution along with environmental factors (Honma et al. 2021).

Naturally derived mutagens

Humans are exposed to hazardous and carcinogenic chemicals present in food on natural sources. Majority of natural mutagens are either produced through mold growth in raw and processed foods and allied products like poultry and other meat items, seafood, beside others (Sharma et al. 2021). Natural mutagens are also known to be produced by plants as natural pesticides. Although the guidelines and permissible exposure limits of such natural mutagenic contaminants including mycotoxins and plant-based mutagens are imposed, it is very difficult to regulate or eliminate them. The information of environmental mutagens present in food as food additives, adulterant, dietary component, product of food processing with their different, and toxic effect in humans are listed in Table 1.

Mutagens derived from pesticides

Pesticides are chemicals used for controlling the pests that damage crops. However, pesticides are potentially toxic for other organisms, including humans, and should be handled with care (Xue et al. 2021). Vegetables, fruits, grains, and other foods are vulnerable commodities for pesticide residues. Various mutagens derived from pesticides and their toxic effects are mentioned in Table 1.

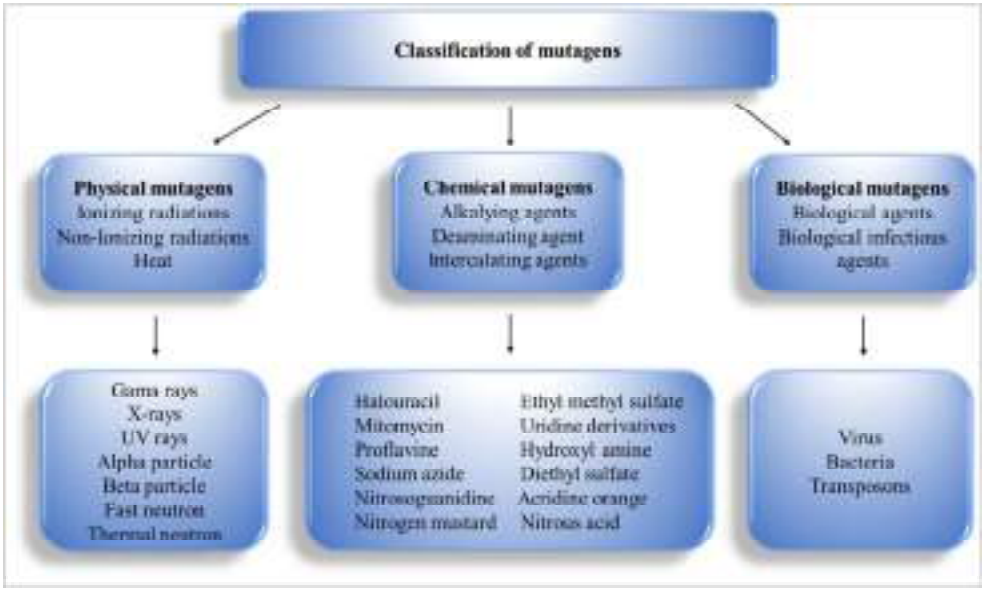

Fig. 1 Different types of mutagens in the environment and their classification

Table 1 Mutagens in different components of the environment and the related toxicity issues

S. No	Name of mutagen	Source	Toxic effects	Reference
1.	Propyl gallate; sorbic acid; nitrites, nitrates	Food preservative	Genotoxic, cytotoxic	Hasegawa et al. (1984); van der Heijden et al. (1986); Mukherjee et al. (1988); William et al. (1999); Silva and Lidon (2016).
2.	Allura red, Brilliant blue FCF, Erythrosine B, Fast green, Sunset yellow, Tartrazine	Food color	Food intolerance, hypersensitivity, carcinogenic immunosuppressive	Shimada et al. (2010); Swaroop et al. (2011); Kus et al. (2015); Dwivedi et al. (2015).
3.	Saccharine, Aspartame Sucralose, Neotame Acesulfame K	Food sweetener	Carcinogenic, hepatotoxic chromosomal abnormality, diarrhea, migraine, genotoxic	Mukhopadhyay et al. (2000); Weihrauch and Diehl (2004); Roberts (2007); Soffritti et al. (2007); Bigal and Krymchantowski (2006).
4.	Acrylamide, Heterocyclic amines, Polyaromatic hydrocarbons, Chloropropanols, Nitrosoamines, Furan	Food processing product	Neurotoxic, genotoxic, carcinogenic	Jakszyn and Gonzalez (2006); Pandey et al. (2006); Pandey and Das (2006); El Ramy et al. (2007); Sinha et al. (2009); Baer et al. (2010).
5.	Flavonoids, Pyrolizidine, alkaloids, glucosinolates, catechol type phenolics, linear furanocoumarins, alkenyl benzenes, ethyl acrylate, sesamol, benzyle acetate	Plant based compounds	Carcinogenic, chromosomal alternations	Schrader (2003)
6.	Alfatoxin B1	Aflatoxins	Chromosomal aberrations in animal and human cells	Rastogi et al. (2006)
7.	Fumonisins, Tricothecenes	Fusarium toxins	Chromosomal aberration, tumorigenic	Ueno (1980); Marasas (2001); Missmer et al. (2006); Ma and Guo (2008); Zhou et al. (2010), Saxena et al. (2011)
8.	Organophosphates, Carbamates, Organochlorines, endosulfan	Chemical pesticides	Mutagenic, carcinogenic	Mandal et al. (2018)
9.	Arsenic, cadmium, lead, mercury	Heavy metals	Carcinogenic, cardiovascular toxicity, nephrotoxic neurotoxic	Mandal et al. (2018); Tchounwou et al. (2012)
10.	Chromium, nickel, selenium, antimony	Hazardous trace elements	Carcinogenic, mutagenic, teratogenic	Cohen et al. (1993); Palaniappan and Karthikeyan. (2009); Nagajyoti et al. (2010); Wilbur et al. (2012)
11.	Mucochloric acid, chlorinated butenoic acids, brominated trihalomethanes, dichloroacetonitrile, ichloroacetonitrile	Water disinfection process	Mutagenic	Schrader (2003)
12.	Fecapentaenes	Feces	Carcinogenic (colon)	Schrader (2003)
13.	X-rays, gamma rays (ionizing radiation)	Radioactive elements in the earth, cosmic rays, radon gas, man-made artificial dose dependent radiations	Cardiovascular toxicity, carcinogenic, organ failure, hematopoietic syndrome	Menon et al. (2016)
14.	UV radiation (ionizing radiation)	Metal industries, smoking cigarettes, and cadmium-contaminated workplaces	Cataract, erythema, pigmentation	Daryoush et al. (2018)
15.	Visible light	Black light, sunlight	Thermal injury to eye retina, photo aging of skin	

Table 1 (continued)

S. No	Name of mutagen	Source	Toxic effects	Reference
16.	Infrared radiation	Light bulb, laser beam, sunlight	Thermal injury to eye retina, cataract, corneal heating and burn, tissue heating	
17.	Magnetic waves	Laser, remote control, far infrared laser	Tissue heating	
18.	Radiofrequency radiation	Television, power grids, and lines	Body tissue accumulation, poor muscular response, and nervous transmission	
19.	Static field (non-ionizing radiation)	Magnetic resonance imaging, strong magnetic field	Accumulation of charge on body, nausea, magnetic vertigo	

Heavy metals as mutagens

A wide range of heavy metals such as copper (Co), nickel (Ni), arsenic (As), lead (Pb), cadmium (Cd), zinc (Zn), and mercury (Hg) are major environmental pollutants that attribute for severe toxicity, sustenance in the environment, and accumulation in biological entities (Jamla et al. 2021). Different sources of these heavy metals include weathering of metal-bearing rocks, volcanic eruptions, anthropogenic activities, industrial and mining processes, and agricultural activities. As a result, the mobilization of these heavy metals increases, causing disturbance in biogeochemical cycles, pollution of different ecosystems, and imposing threat to public health. Furthermore, heavy metals such as Cd, Hg, As, and Pb when mixed with the food may exert deleterious toxic and carcinogenic effects (Tchounwou et al. 2012; Mandal et al. 2018; El-Samad et al. 2021). Table 1 enlists the hazardous effects of certain heavy metals.

Mutagens present in water the and feces

Several mutagenic chlorinated compounds are produced during the water disinfection process, which are harmful to human health as shown in Table 1. Human feces also reveals the presence of mutagenic compounds causing colorectal cancer as an outcome of low fiber and high diet. These mutagenic compounds are synthesized by intestinal bacteria and may cause cancer (Table 1).

Ionizing and non-ionizing radiations as mutagens

Depending on the exposure and concentrations, ionizing radiation encompasses ample of energy to impose deleterious mutagenic impacts on human cells. In case the cells fail to undergo repair mechanism, they may become cancerous or eventually die. The exposure of non-ionizing radiations can also cause serious health effects such as radiation sickness and skin burns resulting in chronic health diseases like cardiovascular disease, lung infection, skin problems, and cancer. The effect of ionizing and non-ionizing radiations as mutagens is mentioned in Table 1.

Medicinal plants and their resources for addressing mutagens in the environment

Mutagens are capable of initiating a variety of chronic degenerative diseases, including inflammation, diabetes, hepatic disorders, cardiovascular disorders, neurological disorders, arthritis, and aging, among others (Bhattacharya 2011). The use of natural antimutagens offers an effective way to control the disastrous effects of mutagens. Antimutagens are the components that reduce mutagenicity of certain compound. Natural

antimutagens are mainly present in plants, including mainly the coumarins, flavonoids, phenols, anthraquinones, carotenoids, saponins, and tannins, (Bhattacharya 2011; El Souda 2021).

Since ancient times, plants are being used for various purposes to support human life and for their healthcare due to their fabulous healing properties. Several active principles synthesized during the secondary metabolism are known to have therapeutic characteristics and could be exploited to aid in the treatment of various diseases and disorders, owing to their safety, efficacy, and cost-effectiveness (Gurib-Fakim 2006; Zamora-Martınez and de Pascual Pola 1992; Dar et al. 2017). Using active principles or therapeutic phytomolecules like reserpine, atropine, digitalis, ergot, and similar compounds, modern medicines have been developed, which explains the greater acceptability of herbal medicines in new forms (Raskin et al. 2002; Veiga et al. 2020). The extracts of various medicinal plants also possess antimutagenic activities that makes them the best tool for combating environmental mutagens. Studies have identified different plant extracts possessing antimutagenic activity including *Smilax china*, *Pteris multifida*, and *Prunella vulgaris* (Lee and Lin 1988; Guo et al. 2019; Liu et al. 2018). The anti-mutagenesis of phytomolecules like eugenol and turmeric oil has been reported (Sukumaran and Kuttan 1995; Jayaprakasha et al. 2002), though it has been a challenge to locate specific active molecules that could be used effectively and easily to control cancer inducing mutagens (Benariba et al. 2013).

A range of compounds present in medicinal plants has been studied for their potential to inhibit carcinogenicity or mutagenicity of their causative agents in the environment (Huang et al. 2009). Different dietary compounds or certain herbs have also been studied to confirm their inhibitory effects on cancer progression, chemo-preventive, anti-inflammatory effects, or antioxidant activities (Surh et al. 2006; Kapinova et al. 2018). Consumption of vegetables, spices, and fruit in balanced or judicious way could be helpful in lowering the risks of cancer (Jochems et al. 2018). These beneficial effects of plant products are often attributed to the presence of steroids and flavonoids, the main components of medicinal plants and human nutrition (Quradha et al. 2019; Akram et al. 2020).

The use of medicinal pant resources such as extract, active fractions, and pure phytochemicals is on constant rise as effective remedy for several human diseases (Sen and Chakraborty 2020). The putative role of plant extracts and phytochemicals have gained a major attention in terms of prevention of cancer and other genetic disorders (Al-Dulaimi et al. 2020). Degenerative diseases such as cancers have become a critical issue worldwide in which DNA damage developed with respect to mutations and chromosomal aberrations, inducing oncogenes and resulting in formation of transformants and cancer growth (Bouguellid et al. 2020). Mutations caused by chemical agents such as base analogs, intercalating agents, and alkylating agents lead to the induction of DNA damage and changes, resulting in the overall increased mutation frequency (Khan and Ahmad 2019). However, these induced or naturally occurring spontaneous mutations can be reduced with the help of antimutagenic agents (Novick and Szilard 1952). For prevention of these mutations, cancer growth, and genetic diseases, various medicinal plant including *Carum carvi*, *Withania somnifera*, *Panax ginseng*, *Mentha spicata*, *Curcuma zedoaria*, *Cassia angustifolia*, *Cymbopogon citrates*, *Ipomoea batatas*, *Glycyrrhiza glabra*, *Citrullus colocynthis*, *Capsicum annuum*, and *Asparagus racemosus* have shown antimutagenic potentials (Akram et al. 2020). Some of the medicinal plants exhibiting antimutagenic potentials are been enlisted in Table 2.

Methanolic extracts of *Rheum emodi* rhizomes and its fractions ethyl acetate showed strong antimutagenic potential with enhanced activity in the presence of mutagens in *Salmonella typhimurium*; further studies by HPLC analysis revealed the presence of four anthraquinones: aloe-emodin, chrysophanol, emodin, and rhein showing antimutagenic activity in the *Rheum emodi* rhizomes (Bhatia et al. 2020). Reports on correlation between cancer and diet have led to the identification of heterocyclic aromatic amines (HAAs) as potent mutagens and carcinogens associated with them (Baena and Salinas 2015). The International Agency for Research on Cancer (IARC) in 2015 released the results of the evaluation of the carcinogenicity of red and processed meat, classifying red meat as “probably carcinogenic to humans” and processed meat as “carcinogenic to humans” (Domingo and Nadal 2017). Therefore, plant resources are seen as having potential to act as effective and safer alternatives to these food resources. Various phytochemicals have gained an importance to counter the mutagenic effects of HAAs via inhibition of xenobiotic synthesis and mutagen bioactivation (Gutiérrez-Pacheco et al. 2020). Gutiérrez-Pacheco et al. (2020) studied the antimutagenicity of *Asclepias subulata* medicinal plant extract against heterocyclic aromatic amines and revealed *Asclepias subulata* as a potent food supplement to decrease the HAA mutagenic potential. The antimutagenic potential of the aqueous extract of *Digitaria sanguinalis* was evaluated using various in vitro assays in mice, resulting in increased number of micronucleated polychromatic erythrocytes (MNPCEs), revealing its high antimutagenic efficiencies (Bajo et al. 2017). Investigation on methanol extracts of *Rhododendron arboreum* leaves and flowers using UHPLC and GC-MS identified 37 phytochemicals responsible for antioxidant, antimutagenic, and cancer cell growth inhibition activities against sodium azide, 4-nitro-ophenylenediamine, and 2-aminofluorene mutagens in TA-98 and TA-100 strains of *Salmonella typhimurium* (Gautam et al. 2020). Previous studies on antimutagenic potentials of *Casimiroa edulis* by

Table 2 Medicinal plants with antimutagenic potentials

Plant name	Resource	Active components	Mechanism	References
Baccharis trimera	Aerial part extract	5,4¢-dihydroxy-7-methoxyflavone (genkwanin), 5,4¢-dihydroxy-6,7-dimethoxyflavone (cirsimaritin), 5,7,4¢-trihydroxy-6-methoxyflavone (hispidulin), and 5,7,4¢-trihydroxyflavone (apigenin)	Reduced mutagenicity of 3-amino-1-methyl-5*H*-pyrido[4,3-*b*]-indole	Nakasugi and Komai (1998)
Aloe vera	Leaf extract	di(2-ethylhexyl)phthalate	Cancer cell growth inhibition	Lee et al. (2000)
Allium cepa	Peel extract	Ferulic, gallic, protocatechuic acids, quercetin, kaempferol	Inhibition of tobacco-induced mutagenicity	Singh et al. (2009)
Carum copticum	Fruit extract	Phenolic terpenoids	Inhibition of mutagenicity against sodium azide and methyl methane sulfonate	Zahin et al. (2010)
Peumus boldus and *Cryptocarya alba*	Leaf extract	Flavonoids, anthocyanins	Decreased mutant spots in somatic cells of *Drosophila melanogaster*	Carmona et al. (2017)
Psidium guajava	leaf extract	Phenolics, alkaloids, glycosides	Inhibited above 70% mutagenicity against sodium azide (NaN3), methylmethane sulfonate (MMS), 2-aminofluorene (2AF) and benzo(a)pyrene (BP)	Zahin et al. (2017)
Glycosmis pentaphylla and *Tabernaemontana coronaria*	Root bark and stem bark extract	Glycozoline, glycozolidine, methyl carbazole 3-carboxylate, skimmianine, dictamine, arborinine, coronaridine, 10-methoxy coronaridine, tabernaemontanine, voacamine, tabernaelegantine	Antimutagenic activity against NPD and sodium azide	Kumar et al. (2017)
Piper Cubeba	Fruit extract	Copaene, isocaryophyllene, a-cubebene	Antimutagenic activity against methyl methane sulfonate, sodium azide, benzo(a)pyrene, 2-aminoflourene	Zahin et al. (2018)
Origanum vulgare	Leaf and stem extract	Tannin, flavonoid, and anthocyanin	Reduced DNA damage and peroxyl-radicals scavenging property	Pandey et al. (2019)
Andrographis paniculata	Leaf extract	Alkaloids, flavonoids, glycosides, saponins, tannins, and phenolic compounds	Reduced structural chromosomal aberrations and sister chromatid exchange in lymphocytes	Purushothaman et al. (2020)
Pueraria lobata	Root extract	Isoflavone	Antimutagenic activities of these compounds against furylfuramide, Trp-P-1, and activated Trp-P-1	Akram et al. (2020)

Ito et al. (1998) identified novel compound (R,S)-5-methoxy-8-[(6,7-dihyroxy-3,7-dimethyl-2-extenyl)oxy]psoralen and casimironin with high antimutagenic effects in the mutagen assay utilizing *Salmonella typhimurium* strain TM677.

In order to treat inflammatory disorders, *Orthosiphon stamineus* tea leaf extracts and powder in the form of capsules and tablets are known food supplements. Basheer and Majid (2010) reported pharmacological properties such as anti-inflammatory, antioxidant, antibacterial, and anti-angiogenetic properties of *O. stamineus*. The cytoprotective, antimutagenic, and anticlastogenic potential of *O. stamineus* ethanolic leaf extracts was studied revealing its increased antimutagenic activity against sodium azide and 2-nitrofluorene in *S. typhirium* TA98 and TA100 cells (Al-Dulaimi et al. 2020). A traditional medicine *Fraxinus angustifolia* has been examined for antimutagenic, antigenotoxic, and antiproliferative efficiency of its leaves and stem bark ethanol extracts, and the results revealed the presence of phenylethanoids (calceolariosides, verbascoside) and scoiridoids (oleuropein and ligstroside) showing strong antimutagenic and curative properties towards cancerous cells (Bouguellid et al. 2020). Studies on methanolic extract of *Achillea millefolium* in combination with methotrexate resulted in decreased damage via induced total protein concentration and reduced creatinine and albumin concentration, indicating its potential antimutagenic activity (Hussein et al. 2019). Couto et al. (2019) investigated the phytochemical profile as well as the antimutagenic potential of *P. bracteosa* aqueous bark extract in *Allium cepa* and *Mus musculus*, and observed the presence of tannins and reducing sugars that caused inhibition in DNA damage and chromosome abbreviation, thus confirming its antimutagenic activity. The antioxidant, anti-inflammatory, and antimutagenic effects of senna and fennel via synergetic mechanisms against deleterious effects of gamma radiation exposure resulted in identification of calcium sennosides as free radical scavenger and fennel as an apoptic inducer against oxidative and inflammatory effects of ionizing radiation (Farid et al. 2020). Bound et al. (2020) further evaluated that the antimutagenic activity resulting in 87.7% inhibition of methylmethane sulphonate induced mutation in *S. typhimurium* TA 1538 indicating their potential application as food preservatives.

Besides tea, other plant products including fruits have been identified with antimutagenic properties over the past decades. *Hylocerecus polyrhizus*, commonly known as dragon fruit with a good source of betacyanin, is consumed globally. Recent reports on the production of colorant powder from dragon fruit peel indicated the antimutagenicity and antioxidant properties (Thaiudom et al. 2021), indicating its valuable usage as food colorant and supplements. Kamiya et al. (2018) identified 2,6-dimethoxy-1,4-benzoquinone, fertaric acid, and caftaric acid from the juice of *Vitis coignetiae* as anti-inflammatory ingredients exhibiting antimutagenic and anti-tumorigenic property during different stages of mouse skin tumorigenesis, revealing DBQ as an essential compound with chemoprotective properties. A native plant *Myrciaria dubia* found in the Amazon region and rich in ascorbic acid, carotenoids, and phenolic antioxidant compounds is consumed in the form of juices all over the world for its health benefits (da Silva et al. 2019). The study to investigate the *M. dubia* juice in contrast to DNA damage and genomic instability using Salmonella/microsome assay revealed the antimutagenic and antigenotoxic effects of *M. dubia* juice in mice (da Silva et al. 2019).

The replacement of animal oils with plant oils such as olive, soy, corn, sunflower, canola, and palm as a main dietary or food supplements is being considered and explored worldwide in high quantities because of their therapeutic properties and their essential role in human health (Costa et al. 2020). The investigation on the chemical composition of *Acrocomia aculeata* macauba pulp oil and its anti-inflammatory, antimutagenic, and antioxidant properties revealed the presence of phytonutrients and antioxidant compounds such as carotenoids and fatty acids exhibiting versatile nutritional and pharmacological properties (Costa et al. 2020). Recent reports on *Elaeagnus angustifolia* plant extracts indicated its novel role as the anti-oxidant, anti-inflammatory, anti-microbial, and anti-cancerous properties resulting in effective pain alleviations in rheumatoid arthritis patients and reduced wound healing time in injured person (Hamidpour et al. 2016). Beside plants, fungal and algae extracts are also being studied to investigate the antimutagenic efficiencies in context to human health. The study of antimutagenic effects of methanol extracts of *Cetraria aculeata*, *Cladonia chlorophaea*, and *Cetrealia olivera* lichen species using *Escherichia coli-WP2*, Ames-*Salmonella* (TA1535 and TA1537), and sister chromatid exchange test systems resulted in the strong antimutagenic potencies on TA1535 and TA1537 strains (Ceker et al. 2018).

Molecular mechanisms underlying the antimutagenicity of phytochemicals

Mutagenicity is generally defined as the initiation of certain changes in the DNA, the genetic material of an individual that could be permanent and heritable too (Hong et al. 2011). Point mutations, frameshift mutations, and other forms of mutations are possible. Point mutations are responsible to alter only single nucleotide, or a few located within a gene and is further divided into mainly three types: a base pair substitution, where one base pair is replaced with another; deletion where one or more base pair is removed; and insertion in which extra base pair is added (Hoffmann et al. 2003). Certain compounds referred as antimutagens can control, decrease, or remove the dangerous mutagenic effects caused by the mutagens

Table 3 Plant-based antimutagenic compounds and their mechanisms of action

S. No.	Plants resources	Mechanism/s of action	Antimutagen/s	Reference
1.	*Acacia salicina*, Lichen species, *Mangifera indica* L. stem bark, *Phellinus rimosus* extract, Wheat Powder, Wheat bran, *Organoselenium*, *Bichalcophenes*	Antioxidant effects	Lipoic acid	Agar et al. (2010); Gulluce et al. (2010); Ajith and Janardhanan (2011); Chatti et al. (2011); Collins et al. (2012); Roy et al. (2012) Frassinetti et al. (2012); Morffi et al. (2012); Pesarini et al. (2013); Nardemir et al. (2015); Unal et al. (2013)
2.	*Acacia salicina, Terminalia arjuna*	Chemical interaction with a mutagen	Cysteine, Pyrrolidine-2,5-dione derivatives, Aminoalkanolic derivatives of xanthones, Bichalcophenes	Watanabe et al. (1994); Marnewick et al. (2000); Pękala et al. (2013); Sloczynska et al. (2014)
3.	*Mangifera indica* L. stem bark; *Phellinus rimosus* extract, *Terminalia arjuna*, *Salvia officinalis* (Sage), *Ocimum basilicum* (basil)	Inhibit metabolic activation of pro-mutagens	Phytoconstituents, β-aminoketones, nitrogen- and oxygen-containing hetero-cyclic compounds	Gulluce et al. (2010); Kaur et al. (2010); Ajith and Janardhanan (2011); Morffi et al. (2012); Nikolic et al. (2012); Turhan et al. 2012)
4.	Green tea, pauchong tea, oolong tea and black tea	Scavenge electrophilic mutagens and bind to the outer membrane transporters thus block mutagen that was transferred into the cytosol	Gallic acid	Hour et al. (1999)
5.	*Aspalathus linearis*	Interact with active mutagenic metabolites, Interfere with cytochrome P450-mediated metabolism of mutagens,	Phenolics	Marnewick et al. (2000); (De Flora et al. (2001)
6.	*Acacia salicina*	Direct interaction with electrophilic metabolites of mutagens	-	Boubaker et al. (2011)
7.	*Acanthopanax divaricatus* extract	Eliminate mutagenic compounds from the cells	Phytoconstituents	Hong et al. (2011)
8.	Wheat bran, *Salvia officinalis* (Sage), *Ocimum basilicum* (basil)	Modulate repairing enzyme of DNA and error free DNA repair	Cinnamaldehyde, vanillin	Nikolic et al. (2012); Pesarini et al. (2013)
9.	*Syngonanthus* (Eriocaulaceae)	Eliminate mutagens from bacteria, interact with reactive intermediates of mutagens and also influence microsomal enzymes	Xanthones and flavones	de Oliveira et al. (2013)
10.	Mango, guava, pineapple, blueberries	Scavenging of reactive oxygen species (ROS) and protecting the nucleophilic sites of DNA	Polyphenols, gallocatechin, vitamins (β-carotene, α-tocopherol, ascorbic acid), anthocyanins, Ellagic acid, retinoids, polyamines.	Ferguson et al. (2004); Izquierdo-Vega et al. (2017)
11.	*Acacia salicina*, wheat bran, grapefruit	Induce detoxication pathways and influence enzymes that are engaged in the metabolism of mutagens	Isothiocyanates, monocyclic monoterpenoids (limonene, methol), flavonoids, polyphenols, indoles, diterpene esters, naringin, naringenin	Ferguson(2004); Boubaker et al. (2011); Izquierdo-Vega et al. (2017)
12.	Pomegranate	Regulate signaling pathways	Polyphenols, β-glucans	Ferguson et al. (2004); Izquierdo-Vega et al. (2017)
13.	Grapefruit	Inhibit uptake of mutagen	Dietary fibers, probiotics, naringenin	Ferguson et al. (2004); Izquierdo-Vega et al. (2017)

(Sloczynska et al. 2014). Phytochemicals serve as the main source of a variety of active ingredients that exhibit both pharmacological and antimutagenic properties (Kaur et al. 2021). Various studies done under in vitro and in vivo conditions applying animal models have shown antimutagenicity of phytochemicals. However, more and comprehensive studies are needed for the scientific validation of traditional medicinal plants used for their antimutagenic potencies.

Polycyclic aromatic hydrocarbons (PAH) such as benzo(a) pyrene are known strong mutagens and human carcinogens that could be targeted for various genotoxicity studies. PAH is widely distributed in the environment and has paved the way for humans to be exposed to it through their diet. Its carcinogenic effect can be triggered by the use of CYP-450 isoenzyme (Srividya et al. 2012). The presence of phytophenolic catechin, tannins, flavonones, and isoflavones are mainly responsible for genotoxic effects of plant extracts (Grujičić et al. 2020). This is because flavonoids inhibit topoisomerase I and II enzyme, affecting replication and transcription pathways, and thereby resulting in cleavable DNA-enzyme complexes that leads to mutation. The mechanisms that cause plant extracts to show anti-genotoxic effects could be due to activating or inhibiting certain enzymes like glutathione stransferase or CYP1A1 together with polyphenols antioxidant and scavenging properties. The most prime mechanism that causes anti-mutagenesis is scavenging the free radicals. Secondary metabolites present in plants have free radical scavenging activity, oxidase inhibition, and metal chelation, and can induce large-scale changes in the gene expression. Antioxidant properties present in the phytochemicals such as flavonoids especially kaemferol, quercetin, and proanthocyanin have been reported to modulate DNA damage induced by hydrogen peroxide (Hosseinmehr et al. 2008; Keles et al. 2010; Srividya et al. 2012). The plant extract with potent antioxidant and free radical scavenging properties is mainly attributable to phenolic and flavonoid contents. The efficacy of a plant extract depends on its phenolic sub-classes which can be found in dietary supplements as well as therapeutic agents. Certain key compounds isolated from plants such as furoquinoline, quercetin, alkaloids, and isothiocyanates are also regarded as mutagens (Srividya et al. 2012). Although there are scientific evidences available to support the application of plant as traditional medicine, it is still an important issue of research to postulate the active and non-toxic compounds with strong antimutagenic effects.

The antimutagenic action of selected lichen species has been reported using lichen extracts against the free radical formation and lipid peroxidation via as triggering the enzymatic and non-enzymatic antioxidants like superoxide dismutase (SOD), glutathione peroxidase (GPx), and glutathione (Agar et al. 2010; Kotan et al. 2011; Nardemir et al. 2015). The extracts obtained from *Acacia salicina* have been found to protect against DNA strand breaks induced by LA and 4-nitro-o-phenylenediamine (Chatti et al. 2011). Curcumin, a key component of turmeric, has shown to have potent antimutagenic activity against NaN_3 and methyl methane sulfonate (Sloczynska et al. 2014). There are also natural antimutagens that have the ability to inhibit the activation of mutagens via enzyme inhibition responsible for biotransformation. The methanol extracts from lichens showing antimutagenic effects against NaN_3 resulted in inhibition of NaN_3 metabolite L-azidoalanine production (Gulluce et al. 2010). Similarly, phyto-constituents of *Terminalia arjuna* were reported to suppress mutagenic effect via aromatic amine 2-aminofluorene (2-AF) metabolic inhibition (Kaur et al. 2010; Sloczynska et al. 2014).

Antimutagens, on the other hand, show blocking effects by interacting directly with the mutagen before it starts causing damage. Gallic acid (3,4,5-trihydroxybenzoic acid, with

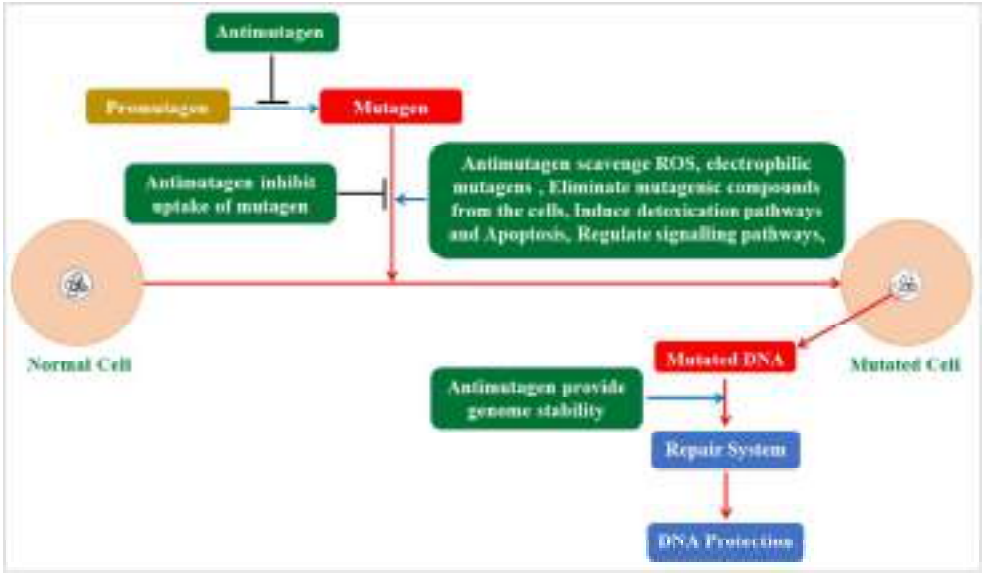

Fig. 2 Plant-based antimutagens and the mechanisms underlying the antimutagenic activities

formula $C_6H_2(OH)_3CO_2H$), a trihydroxybenzoic acid and a phenolic compound obtained from tea leaves, gallnuts, oak bark, sumac, witch hazel, and other plants, acts as a nucleophile to scavenge the electrophilic mutagens and is capable of binding/inserting into the outer membrane transporters, causing mutagen blockage that have reached into the cytosol (Sloczynska et al. 2014). Crude extracts of *Acanthopanax divaricatus* showed antimutagenic activity against direct-acting mutagenic agents by causing their rapid elimination from cells before they could induce any genetic damage (Hong et al. 2011; Sloczynska et al. 2014)

Certain antimutagenic agents have also been reported to be able to work through multiple mechanisms which can be beneficial to sustain protection against diverse mutagens (Sloczynska et al. 2014). The ability of compounds to impact mutagens at a particular time through different pathways facilitates an increase in antimutagenic effectiveness (Zahin et al. 2021). *Phellinus rimosus* extract was reported to affect the intercalation of mutagens which can damage genetic material (Ajith and Janardhan 2011). The extract of *P. rimosus* was found to be effective in removal of free radical species generated by direct and indirect mutagens (Ajith and Janardhanan 2011). Similarly, chloroform extract obtained from *Acacia salicina* was found to be antimutagenic against direct and indirect acting mutagens. This extract acted like a blocking agent, inhibiting the activities of enzymes involved in the metabolism of mutagens and carcinogens (Boubaker et al. 2011). Morffi et al. (2012) investigated the antimutagenic effects of *Mangifera indica* stem bark extract, rich in polyphenols and antioxidants that can protect against DNA damage induced by mutagenic agents. Further investigations resulted in DNA damage protection induced by various tested mutagens, except for NaN_3 (Sloczynska et al. 2014). Pesarini et al. (2013) evaluated antimutagenic effects of wheat bran and found the presence of antioxidant phytic acid that inhibits carcinogenic azoxymethane and prevents DNA damage by modulating DNA repair enzymes. Phenolics can control deleterious mutagen effects through both intracellular and extracellular mechanisms, with extracellular mechanism interfering with the cytochrome P450-mediated metabolism of mutagens and interactions with active mutagenic metabolites which may be related to electrophilic properties of mutagens (De Flora 1998; De Flora et al. 2001; Marnewick et al. 2000; Sloczynska et al. 2014). Table 3 and Fig. 2 present the medicinal plant resources as antimutagenic agents and their mode of action.

Conclusion

Mutagens are emerging threats to humans and the environment as a whole, owing to their reactive and toxic nature. Anthropogenic interventions have triggered their concentrations and frequency of release into the environment. Mutations being the biggest cause of cancers and the resultant mortalities and morbidities, novel and alternative therapies are eagerly looked upon as an effective way to counter this menace. In recent years, medicinal plants with antimutagenic potentials have shown a great potential for treating cancers and eliminating them (Sen and Chakraborty 2020). This review summarizes recent development and updates on antimutagenic properties of various medicinal plants with their active principles with their underlining molecular mechanisms. The growing body of research indicating the antimutagenic properties of many plants has fueled speculation that they could also have therapeutic potential in various models of cancer. Evidences from various researches have suggested many molecular targets playing a key role in mutations, cancers, and genetic diseases depending on the phyto-antimutagenic agents' source and their dosages (Kaur et al. 2021). However, more standard of proof is needed in the future to acquire better knowledge on antimutagenic potencies of medicinal plant sources and the insights into the mechanisms of action against various mutagens.

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Declarations

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08 FEB 2022

प्रथम मुद्रांक लिपीक
कोषागार पुणे यांचेकडे

Memorandum of Understanding

Between

PROGRESSIVE EDUCATION SOCIETY'S

MODERN COLLEGE OF ARTS, SCIENCE & COMMERCE

GANESHKHIND, PUNE, INDIA

And

VAIDJKA AGRO SOLUTIONS PVT. LTD., PUNE, INDIA

This MoU has been entered into

BETWEEN

Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind, Pune, India represented herein by its Principal Dr. Sanjay S. Kharat, referred to as MCASC

And

Vaidika Agro Solutions Pvt. Ltd., with its regional office at A-1, Sundarnagari Aparments, Opp. Atreya Society, Kothrud, Pune- 411 038, Maharashtra, India, represents herein by its Director, Mr. Ketan K. Mane, referred to as VASPL

HEREBY WITNESSETH,

WHEREAS VASPL is a corporate organization, incorporated under the Companies Act 1956. All activities in VASPL are techno-commercial in nature, to address the challenges in the agriculture sector. VASPL has implemented several projects in the rural areas focussing on sustainable agriculture development and inland fisheries development in reservoirs in the Western Ghats. Currently VASPL is doing an assessment on aquaculture and to assess the impact of climatic factors viz. Annual rainfall and Temperature on the local eco-systems. This would help in realising sustainable inland fisheries potential for Maharashtra State which would have associated social benefits.

WHEREAS VASPL was established in 2008, the Fisheries Division was established with a techno-commercial mandate which included

- To facilitate education in aquaculture allied sciences for overall social development.
- To provide research base to improve the productivity of important aquaculture, fisheries and agri-allied activities of the Western Region.
- To develop appropriate plans for conservation of natural resources and sustainable use. To undertake and guide extension education programs, first line sharing of technology, extend services of training, conduct demonstrations and develop appropriate communication network.
- Standardize technologies for aquaculture production, harvesting, marketing, postharvest utilization as also for livestock, fisheries and allied agro-communities for improving the living status of the local population, and women of Western Maharashtra especially in the Western Ghats.
- Provide the necessary production support of breeders and hatcheries of important fish and prawn species of the region and also generate revenue through large aquaculture farms for sustainable growth.

WHEREAS MCASC is an educational institute running under-graduate, post-graduate and doctoral degree programs under Savitribai Phule Pune University, Pune in different subjects under science, commerce and arts faculties. It also has recognized research centres of Savitribai Phule Pune University, Pune in the subjects of Zoology, Biotechnology, Chemistry and Commerce.

WHEREAS VASPL has experience in working on agriculture and aquaculture sector and sustainable livelihood for farmer communities, MCASC and VASPL have agreed to enter into this Memorandum of Understanding (MoU), for jointly developing the projects for subject

to the availability of human, technical and other resources, on the general conditions as herein contained.

NOW, THEREFORE THIS MOU WITNESSETH AS UNDER:-

Article – I
Collaboration

1.1 The parties recognize the particular role of each party in aquaculture research, documentation of traditional knowledge, developing livelihood programs for marginal farmers and promoting the same in rural agricultural areas in the context of the following areas:

i. Research and promotion on aquaculture species.
ii. Research and promotion of new and additional aquaculture livelihood programs for the marginal farmers and other concerned stakeholders.
iii. Research on aquaculture from the point of view of food security and social development.
iv. Documentation and conservation of the indigenous traditional knowledge of the local communities.
v. Developing joint research proposals on above mentioned areas of collaboration.
vi. Technology transfer and promotional programs on above research areas of collaboration.
vii. Internships for researchers of either organization in other institute to strengthen the research work.
viii. Any other research interest as per mutual agreement in the specific areas of expertise.

1.2 The parties will be by virtue of their respective knowledge expertise and availability of resources in their respective fields, recognize the significance and responsibility of work towards developing and implementing collaborative programs.

1.3 The parties agree to collaborate in specific, existing and new development programs related to Article I of this MOU and also consent to work towards developing such need-based projects identified from time to time.

1.4 VASPL and MCASC agree to develop a privileged long term mutually beneficial partnership that will be materialized through different projects.

1.5 VASPL and MCASC agree for collaborative research activities at and the use of aquaculture research and development facilities developed by VASPL at Survey No. 596 Mauje Kashing, Tal. Mulshi, Dist. Pune through their MoU and permission from the Maharashtra Krushna Khore Vikas Mahamandal, Pune.

Article – II
Specific Project Activities

2.1 VASPL and MCASC agree to consider the areas mentioned in Article- I for immediate consideration.

2.2 For each project parties agree to establish the specific terms and conditions through a written communication giving the reference of this MoU.

2.3 VASPL agrees to provide local logistic support in terms of accommodation, laboratory facility and other allied support to MCASC researchers as may be applicable within the context of the MoU.

2.4 MCASC agrees to provide all the technical inputs pertaining to the areas of its expertise and interest as listed in Article-I. VASPL agrees to develop project proposals to suitably address the issues, concerns and interest as agreed by both the parties.

Princi...
Modern College of Arts, Scie... & Commerce, Ganeshkhind, Pu...

2.5 VASPL agrees to joint consultancy proposals with MCASC for organizing workshops, seminars and awareness programs as may be required within the context of this MoU.

2.6 The parties jointly seek opportunities to locate necessary national or international funding for supporting their collaborative activities wherever required. Both the parties agree to extend all the necessary cooperation in developing joint proposals.

2.7 The authorities of each party shall identify a staff member as contact person for the coordination of joint activities during the project period.

2.8 Publications that are developed jointly shall be reviewed and approved by both the parties.

Article – III
Intellectual Property Right

3.1 The documents, technology, products and information generated out of this Agreement shall be a property of MCASC and VASPL. Only if necessary, this would be made available in public domain as well as in parties' respective websites based on mutual consent.

3.2 The parties agree that any form of reproduction, dissemination and sharing would be done based on mutually agreed terms and conditions.

3.3 Unless specifically agreed upon, and stated otherwise by the parties, data and results generated from collaborative activities shall belong and be governed by both the parties jointly. Any article, document and publication on collaborative activity shall acknowledge its collaborative nature and obtain the approval of the competent authorities of the two organizations. For other activities, the parties shall cooperate in information services including document delivery and results dissemination that from time to time shall be mutually agreed.

3.4 Both the parties will acknowledge each other whenever the data in the context of this agreement gets projected at various fora.

Article – IV
Amendment to the Agreement

4.1 Amendment to this agreement shall be made by mutual consent of the parties in writing no variation in terms of scope of this agreement shall be valid or be a binding unless previously agreed upon in writing between the parties in the form of a letter entitled "Amendment of agreement".

4.2 It is specifically agreed between the parties that all the activities in terms of this Agreement shall be drawn and designed with specific relevance to sustainable and "eco-friendly" rural development in the context of MCASC.

Article – V
Entry into Force and Term

Principal
Modern College of Arts, Scie
& Commerce, Ganeshkhind, Pu

5.1 The collaborative activities and programs indicated in this MoU are subject to budgetary appropriations available to each party and applicable laws and regulations of each party.

5.2 This agreement shall enter into force upon signature by the parties. It may be amended by mutual agreements of the parties.

5.3 The validity of this agreement shall be for 5 years and may be renewed or extended by mutual agreement later.

5.4 It is agreed that each party shall have the right to withdraw from the Agreement on a three month notice in writing. Such a termination shall, however, not affect activities

and the remuneration allocated for the activities already approved jointly under the terms of the Memorandum.

Article – VI
Settlement of Disputes

Any dispute or difference, which shall arise between parties hereto, whether in relation to interpretation of this Agreement or to any act or omission by either party to the dispute or as to any act which ought to be done by the parties in dispute or either or them or in relation to any other matter whatsoever touching upon this Agreement shall be referred to the Arbitration and force.
This Agreement is signed on the Twenty Fourth day of December , 2016 two originals in English language, both texts being equally authentic.

IN WITNESS WHEREOF THE COMMON SEAL OF THE AUTHORITY HAS BEEN HEREUNTO AFFIXED AND THE COMMON SEAL OF VASPL, CORPORATE OFFICE, PUNE HAS BEEN HEREUNTO AFFIXED THE DAY AND YEAR FIRST HEREIN ABOVE WRITTEN.

FOR MCASC

Signed:

Name: Principal, Modern College of Arts, Science & Commerce, Ganeshkhind, Pune-16.

Designation:

Date:

FOR VASPL

Signed:

Name: Ketan K. Mane.

Designation: Managing Director.

Date: 04/03/2022.

CONSULTATION INVOICE

Client detail West Coast Aquatics Panshet Pune	P.E. Society's Modern College, ASC, Ganeshkhind Pune 16

Sr. No	Service Details	Quantity	Total
1.	Sample preliminary investigation and Dissection	10 Fish samples	1,500/-
2.	Bacterial Isolation, Pure Stock , Biochemical	12	4,000/-
3.	Sequencing and Bioinformatics analysis	35,400	35,400/-
4.	Antibiotic Resistance Screening	12	2,700/-
5.	Total	-	43,600/-

Dr. Snehal B. Gagare

Department of Biotechnology

Modern College Ganeshkhind, Pune-16

Dr. Sanjay S Kharat

Principal

Principal
Modern College of Arts, Science & Commerce
Ganeshkhind, Pune

Progressive Education Society's
Modern College of Arts, Science and Commerce
Ganeshkhind, Pune 411016.
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- UGC - Recognition No : F-8-290 /2006(CPP-II)
- Best College Award by Savitribai Phule Pune University - 2013
- DST-FIST sponsored college
- STAR College Scheme sponsored by DBT.

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Website: www.moderncollegegk.org

BACTERIOLOGICAL AND MOLECULAR ANALYSIS REPORT

1. SAMPLE COLLECTION:

Submitter: WEST COAST Aquactics Address: Panshet Pune Maharashtra	Collection Date: 19/1/2022 =10 5 live and 5 dead
Site Description: Panshet Dam	
Capture Method: Hand Net	Sampling Method: Selective Diagnostic
Clinical Signs/ Case History: The Samples obtained (*Tialpianilolitcus)* were two months old samples brought to laboratory due to mass mortality. The Biopsy showed extended gall bladder, swollen gill lamellae white patches on the liver.	

2. METHODOLOGY :

Biopsy	Bacterial Isolation and Biochemical characterization	Antibiotic Sensitivity Assay	Molecular Screening	Bioinformatics Analysis
Biopsy of the samples obtained was done by standard method	The infected organs like eye orbit, gills, gall bladder kidney, liver spleen were streaked on media specific for Piscine pathogens	Sensitivity against various assayed by Kirby Bauer's method	Bacterial DNA was isolated and 16 S r RNA gene was amplified and further sequenced	Sequence Obtained analyzed by Sequence scanner and BLAST analysis was performed at NCBI website

3. RESULTS:

The internal organs like eye orbits, kidney, gill lamellae, air bladder spleen and liver were streaked on Trypticase Soya Agar, Brain Heart Infusion media, Cytophaga Agar. The colonies obtained after incubation were taken for Morphological and Biochemical analysis

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I. Isolation, Microbiological and Biochemical analysis

Sequencing of the Isolates gave hit to pathogenic bacteria

Source	Code	Result
Spleen	2 SP AER	*Edwardsiella tarda*
Gill	6G	*Lactococcus lactis*
Gill	2G	*Aeromonas veronii*
Air Bladder	6.3 AB SS	*Aeromonas veronii*
Liver	5L	*Aeromonas veronii*
Spleen	2l AER	*Aeromonas veronii*
Eye Orbit	6.3 EO	*Aeromonas veronii*
Spleen	6.3	*Aeromonas veronii*
Liver	5L	*Aeromonas veronii*
Gill	6.1G	*Aeromonas veronii*
Gill	6.2G	*Aeromonas jundaei*
Kidney	3K	*Aeromonas jundaei*
Gill	2G	*Lactococcus lactis*

II.Antibiotic Sensitivity Assay:

Antibiotics	*Edwardsiella tarda*	*Aeromonas jundaei*	*Aeromonas veronii (Gill)*	*Lactococcus lactis*
AN- Amikacin (30mcg)	S	S	S	R
NET- Netilmycin (10mcg)	S	I	S	NA
CD- Cefadroxil (30mcg)	S	R	R	NA
SF- Sparfloxacin (5mcg)	R	S	S	I
CTX- Ceftriaxone (30mcg)	S	S	S	NA
CIP- ciprofloxacin (5mcg)	S	S	R	I
G- Gentamicin (10mcg)	S	R	I	S
CF- Cefotaxime (30mcg)	S	S	S	I
CFP- Cefoperazone (75mcg)	S	S	S	S
LM- Lomefloxacin (5mcg)	R	S	S	NA
Ceftriaxone+Tazobactam (30/10mcg)	S	R	S	NA
CPZ- Cefoperazone (30mcg)	S	S	S	NA
ACX-Ampiclox(20mcg)	NA	NA	NA	R

**S- susceptible , R- Resistance , I- intermediate NA – Not Applicable*

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The details of antibiotic resistance profile state that *Edwardsiella tarda* is resistant to SF-Sparfloxacin(5mcg) Lomefloxacin (5mcg) and is sensitive to antibiotics mentioned in the table.
Aeromonas jundaei is resistant to CD- Cefadroxil (30mcg) Gentamicin, Ceftriaxone+Tazobactam (30/10mcg) intermediate NET- Netilmycin (10mcg) to the antibiotics mentioned in the table.
Aeromonas veronii is resistant to CD- Cefadroxil (30mcg) ciprofloxacin (5mcg) and Intermediate to Gentamicin. It is sensitive to the antibiotics listed in the table.
Lactococcus lactis is generally recognized as safe by the US FDA and is suitable for the qualified presumption of safety approaches. But other species like *L. garvieae, L. raffinolactis, L. plantarum, and L. piscium* as potential pathogens of aquaculture species

4. TREATMENT

It is observed through the analysis report that there is a multiple infection of *Edwardsiella tarda, Aeromonas veronii, Aeromonas jundaei. Edwardsiella tarda* is a known farmed fish and wild fish pathogen with a broad host range, from Enterobactereace family and *Aeromonas spp,* the most common fish pathogens. The antibiotic used in the treatment should be apart from the ones to which pathogens are resistant to avoid the menace. *Lactococcus lactis* is obtained in the gill lamelleae samples but is regarded as safe organism.The combinations of Cefoperazone(75mcg), Cefotexime (30mcg) Cefepime, Sulphamethoxazole and Tobramycin are recommended.*

*Kindly note the above recommendations are also made with respect to the extensive literature survey that states about the multidrug resistant Aeromonas veronii, Aeromonas jundaei, Edwarsiella tarda that are pathogens associated with aquaculture.

1.Alomar, J.; Loubière, P.; Delbes, C.; Nouaille, S.; Montel, M.-C. Effect of Lactococcus garvieae, Lactococcus lactis and Enterococcus faecalis on the behaviour of Staphylococcus aureus in microfiltered milk. Food Microbiol. 2008, 25, 502–508.
2.Rahkila, R.; Nieminen, T.; Johansson, P.; Säde, E.; Björkroth, J. Characterization and evaluation of the spoilage potential of Lactococcus piscium isolates from modified atmosphere packaged meat. Int. J. Food Microbiol. 2012, 156, 50–59.
3.Matamoros, S.; Pilet, M.-F.; Gigout, F.; Prévost, H.; Leroi, F. Selection and evaluation of seafood-borne psychrotrophic lactic acid bacteria as inhibitors of pathogenic and spoilage bacteria. Food Microbiol. 2009, 26, 638–644.
4.EFSA. Scientific Opinion on the Safety and Efficacy of Lactococcus lactis (NCIMB 30160) as a Silage Additive for All Species.

Checked by
Dr. Snehal B. Gagare
Department of Biotechnology

Dr. Sanjay S. Kharat
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BACTERIOLOGICAL AND MOLECULAR ANALYSIS REPORT

1. SAMPLE COLLECTION:

Submitter: WEST COAST Aquactics Address: Panshet Pune Maharashtra		Collection Date: 1.17/8/2021 =7 individuals 2. 26/8/2021= 11 individuals Collection Time:
Site Description:	Panshet Dam	
Capture Method: Hand Net	Fish Condition at time of Capture: Live	Sampling Method: Selective Diagnostic
Clinical Signs/ Case History: The Samples obtained(*Tialpianilolitcus)* were lethargic showed exopthalmia. On Disection the gall bladder was full, in some it was bursted, air bladder in few were bursted. The gill lamellae, kidney were swollen, fin rays of dorsal fin and tail fins were reduced in size.		

2. METHODOLOGY :

Dissection	Bacterial Isolation	Antibiotic Sensitivity Assay	Molecular Screening	Bioinformatics Analysis
Dissetion of the samples obtained twice was done by standard method	The infected organs like eye orbit, gills, gall bladder kidney, liver spleen were streaked on media specific for Piscine patogens	Sensitivity against various assayed by Kirby Bauer's method	Bacterial DNA was isolated and 16 S r RNA gene was amplified and further sequenced	Sequence obtained analyzed by sequence scanner and BLAST analysis was performed at NCBI website

3. RESULTS:

The streaking on TSA ,Cytophaga , BHI media gave rise to translucent colonies from the source of eye orbits, kiney, gill lamellae, air bladder. The further investigation stated Gram negative , motile bacteria .

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S- susceptible , R- Resistance , I- intermediate

The details of antibiotic resistance profile state that *Citrobacter freundii* is resistant to Ampicillin, Tetracycline, Streptomycin Kanamycin and Intermediate to Nitrofurantoin, trimethoprine, It is sensitive to Co trimoxazole , Chloramohenicol, Cefepime, Genatmicin, Sulphamethoxazole, Neomycin and Tobramycin.

Aeromonas hydrophila is reisistant to Ampicillin, Tetracycline, Nitrofurantoin , Trimethoprine and Intermediate to Gentamicin , Streptomycin. It is sensitive to Chloramphenicol, Cefepime, Kanamycin, Sulphamethoxazole, Co trimoxazole, Neomycin and Tobramycin.

Aeromonas veronii is resistant to Ampicillin, Tetracycline, , Nitrofurantoin , Trimethoprine, Streptomycin and Intermediate to Gentamicin. It is sensitive to Co trimoxazole , Chloramohenicol, Cefepime, Sulphamethoxazole Neomycin and Tobramycin.

4. TREATMENT

It is observed through the analysis report that there is a coinfection of *Citrobacter freundii* an opportunistic pathogen from Enterobactereace family and *Aeromonas spp,* the most common fish pathogens. The antibiotic used in the treatment should be apart from the ones to which pathogens are resistant to avoid the menace. The combinations of Co trimoxazole , Neomycin Chloramohenicol, Cefepime, Sulphamethoxazole and Tobramycin are recommended.*

*Kindly note the above recommendations are also made with respect to the extensive literature survey that states about the multidrug resistant *Aeromonas spp* and *Citrobacter spp* that are forming biofilms and aquatic environment and also pose future potential threat.

1. Seema G. Thomas Milky Abajorga, Maryah A. Glover, Peter C. Wengert, Anutthaman Parthasarathy, Michael A. Savka, Crista B. Wadsworth, Paul A. Shipman and André O. Hudson (2020)Aeromonas hydrophila RIT668 and Citrobacter portucalensis RIT669—Potential Zoonotic Pathogens Isolated from Spotted Turtles Microorganisms 2020, 8, 1805; doi:10.3390/microorganisms8111805

2. Lukman Basri 1 , Roslindawani Md. Nor , Annas Salleh Ina Salwany Md. Yasin , Mohd Zamri Saad Nor Yasmin Abd. Rahaman , Timothy Barkham Mohammad Noor Azmai Amal (2020)Co-Iiffections of Tilapia Lake Virus, Aeromonas hydrophila and Streptococcus agalactiae in Farmed Red Hybrid Tilapia Animals 2020, 10, 2141; doi:10.3390/ani10112141

Checked by:
Dr. Snehal B. Gagare
Department of Biotechnology

Dr. Sanjay S. Kharat
Principal

Principal
Modern College of Arts, Science & Commerce, Ganeshkhind, Pune

भारतीय गैर न्यायिक

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दस्ताचा प्रकार ॲफिडेविट

दस्त नोंदणी करणार आहेत का ? होय/नाही

मिळकतीचे वर्णन

मुद्रांक विकत घेणाऱ्याचे नाव प्राचार्य. डॉ. संजय खरात

पत्ता गणेशखिंड रोड पुणे

दुसऱ्या पक्षकाराचे नाव

हस्ते व्यक्तीचे नाव व पत्ता सौ.कुसुम ठाकुर. गोखलेनगर पुणे

मुद्रांक विकत घेणाऱ्याची सही

22 FEB 2021

प्रथम मुद्रांक लिपीक कोषागार पुणे करिता

Memorandum of Understanding (MOU)

This Memorandum of Understanding Dated 01/04/2022 Is entered in to between Janseva Foundation Pune Located at Navi Peth Pune Maharashtra Pin Code And Department of Sociology Progressive Education Society's Modern College of Arts, Science and Commerce Ganeshkhind Pune 411016 (Here after referred to as the Autonomous College)

The MOU between Janseva Foundation Pune and College is Signed with the Objective of Fostering Collaboration between the two entities to enhance the MOU here under shall Commence on Dated and extend until terminated in either Party hereunder.

CHAIRMAN
Janseva Foundation, Pune.

Modern College, Ganeshkhind, Pune-16

Principal
Modern College of Arts, Science & Commerce, Ganesh Khind, Pune-16.

The Broad list of Programmes that could be Conducted under this MOU Will be as Follows:

- The Janseva Foundation Could work with the College to Design Certificate Course in Gerontology

So as enhance employability, and Inculcate Values among Students

- Janseva Foundation and College Could Conduct Guest Lectures / Seminars for Teachers and Students to enhance their Knowledge and to Create awareness among them.
- Janseva Foundation make available Internship and Hands on Training Programme for Student to enhance Knowledge and Employability Skill among Students
- Janseva Foundation and College Could Conduct Surveys for Research Projects
- Either Party makes available appropriate Infrastructure facilities for the collaboration which may include General Access to the Facilities, Staff, Teaching Content, Classroom Library Facilities Computer and Communication Facilities Stationary and other Materials as may be Required for the various programmes to be offered.
- The MOU is Non – exclusive and each party shall be free to enter similar Collaborations with other Institutions/ Organizations.
- The Parties to this MoU Unless expressly stated in any subsequent written agreement shall have no obligation to Compensate the other in any Manner Each party shall bear their respective expenses Incurred under this MoU.
- This MoU is Valid for a time Period of 3 Years.

Dr. Vinod Shaha, chairman
Janaseva Foundation

CHAIRMAN
Janaseva Foundation, Pune

Principal Dr. Sanjay Sopan Kharat
Modern College of Arts, Science & Commerce, Ganeshkhind Pune16

Principal
Modern College of Arts, Science
& Commerce, Ganesh Khind,
Pune-16.

Witness

Dr. Jayshree Kharche

Dr. Megha Deshpande

Dr. Jyoti Suhas Gagangras
Vice Principal
P.E.S.'s Modern College of Arts
Science & Commerce,
Ganesh Khind, Pune-16.

Prof. B.T. Lavni

Modern College
Ganeshkhind, Pune-16

PE Society's

Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-16

Department of Sociology

Title of the Report- 'Gerontology: Care and Concerns' (workshop)

जेष्ठत्व संकल्पना:,जपणूक व काळजी

Objectives:

- To understand issues related to ageing on the backdrop of 'Healthy Ageing Decade 2021-30' declared by UN.
- To develop a scientific and cross disciplinary approach to analyze intersections of ageing and exploring new area of research and practice.
- Combine knowledge and practice for healthy ageing process in the society.

The workshop started with the felicitation of Guest by Dr.Jyoti Gagangras (HOD, Dept. of Sociology and Vice principal Arts faculty) and Dr. Sandeep Sanap (BSD Officer).

Dr. Jyoti Gagangras (HOD, Dept. of Sociology and Vice principal Arts faculty) taken a overview of Departmental activities and collaborative engagements with BSD, SPPU.

Introduction of the theme/workshop given by Dr.Megha Deshapnde. She proposed that 'Citizen Science' and 'Cross Disciplinary approach' can provide the knowledge pool to understand the aspects of ageing.

Introduction of the guests given by Dr. Jayshree Kharache and Ms. Pooja Yadav/Sawant

In this workshop Inaugural deliberation given by Dr. Vinod Shah (MD, Founder President of 'Janseva Foundation',Pune) working in the field of providing healthy ageing environment. As an experienced practitioner he emphasized the role of the society especially the youth to take care of elderly people with empathy. He also discussed the world scenario of ageing population with sharing the fact sheets and efforts taken by the government

machinery and civil society organizations. Most importantly proposed intergenerational dialogue between the members of the society.

Second session Dr. B.T. Lawani (Director JSF Research Center, affiliated to SPPU) presented the conceptual understanding of Gerontology and different dimensions of the subject. How Economic and Social exclusion and disparity affects the process of healthy ageing. Dr. Lawani emphasized that research in this field can create a balanced approach towards providing solutions to the issues related to ageing. He also guided the participants to this new emerging field of work.

In the last session we open the question answer session for students to take reflection on the subject.

132 Students attended this workshop.

Program comparing done by Ms. Pooja Yadav/Sawant.

This workshop conducted under the able guidance of Dr.Sanjay Kharat (Principal, MCASC), also we are very grateful to Dr.Jyoti Gagangras (HOD, Dept. of Sociology and Vice principal Arts faculty) Dr. Sandeep Sanap (BSD Officer) Dr. Jayshree Kharache and Ms. Pooja Yadav/Sawant for their valuable inputs for the workshop.

Coordinator	Head Department of Sociology	Principal
Dr. Megha Deshpande	Dr. Jyoti Gagangras	Dr. Sanjay Kharat

P. E. Society's
Modern college of Arts, Science & Commerce, Ganeshkhind Pune 16
Department of Sociology

&

Board of Student Development (BSD), Savitribai Phule Pune University

Jointly Organized Workshop on

Gerontology: Care & Concerns

Day & Date : Thursday: 12 May 2022 Time 9: 30 to 12:30

Attendance (Students from other Colleges)

Sr. No.	Name of the Student	Name of the College	Mobile/Phone Number	Signature
1	Shantanu R. Wale	Camp Education	8830976187	Shwale
2	Shubham S. Gaikwad	Camp Education	9922139644	Gaik
3	Harsha D. Salunkhe	Camp Education	7709236928	Salunkhe
4	sonali S. Sonje	Camp Education	8975543008	Sonali

5	Linson Mathew Kutty	Camp Education	8086737508	Linz

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Department of Sociology

&

Board of Student Development (BSD), Savitribai Phule Pune University

Jointly Organized Workshop on

Gerontology: Care & Concerns

Day & Date : Thursday: 12 May 2022 Time 9: 30 to 12:30

Attendance (Modern College,GK)

Sr. No.	Name of the Student	Name of the College	Mobile/Phone Number	Signature
1.	गणेश्वर आहिरे	मॉडर्न गणेशखिंड	7507028678	
2.	अनिल दिपक जाधव	मॉडर्न गणेशखिंड	8999549209	
3.	Yashopal Dabhade	मॉडर्न कॉलेज गणेशखिंड	7350794911	Dabhade
4)	Ganesh Pawar	मॉडर्न कॉलेज गणेशखिंड	7741872381	

5.	Shalmali Gokhale	Modern College, Ganeshkhind	9146683046	Gokhale
6.	Shaikh Ramiza Mobin	Modern Clg, Ganeshkhind	7678059884	Ramiza
7.	Shaikh Noorain Anwar	Modern College, Ganeshkhind	9022153280	Noorain
8.	Yogita Sachin Kokate	Modern College, Ganeshkhind	9975386303	Yskokate
9.	Bharati Ranganath Bhagat	Modern College, Ganeshkhind	9766167632	Bhagat
10	Kadam Kashiram Vitthal	Modern college, Ganeshkhind	9850549367	
11	Damyanti Jadhav	Modern college, Ganeshkhind	9011714440	
12	Akshada Waghwase	Modern college Ganeshkhind	8446163326	Akshada
13	Prathisha Selve	Modern College Ganeshkhind	7499636595	
14.	Kamble Shivani. Anil.	Modern college. Ganeshkhind.	7385899314.	Shkamble
15.	Ashwini. Pawar.	Modern college Ganeshkhind.	9763150125.	
16.	Gauri Dipak parkale	Modern college Ganeshkhind.	7264081100	Gauri

17.	Priyank babasaheb sasane	Modeen college, manoshkhind	9503120642	Priyanka
18	Meghna M. Kamthe	" Sociology.	9372727345	Meghna. MA II Hrly s.
19	V. Bharatalwar	Sociology — MA - 2nd	9921051215	Bharatalwar
20	Aslam I. sayyad	sociology TYBA	9860808578	Aslam Sayyad
21	Dattu Ichorele	sociology TY		
22.	Durgadas Sanjay Kamble	Sociology. SYBA.	9307062600	Kamble
23)	Akash kalu Chavhan	— " — TYBA.	9095966258	
24)	Gade Heushikesh santosh	Modern college, Gk	9766677092	Gade
25)	Shaikane Rushikesh Rameshwar	Modeen college, Ok	8805709820	
26)	Radheshyam Mahadev Bhosar.	— " —	7038857811	
27)	Saurab Sonawane	FyBA	8888017127 7447851972	
28)	Sagar Jadhav.	FYBA	8767643607	

29.	Dhamdhere Prashant Aabaso	FYBA	8766522286	Dhandhere
30.	Bware Revan Bhagwat	F.Y.B.A	7499615379	
31.	pawar chandrakant Balu	FYBA	8421493655	
32.	Patekar Akash dadarao	TYBA	8308712080	
33	Jai Mishra	FY MA	9370894977	Jaimishra
34	TEJas Kale	FYBA	9307145635	TEJas
35	Kishor Paul.	FYBA	7498491764	Kishor Paul.
36.	Manish Mayank Oraon	FYBA	9631970182	
37	Rushabh Piyush Shah	FYBA	9503213261	
38	Sumit Pal Singh	S.Y.BA	7006432129	Sumit Singh
39	GIRIJ Gajanan	SYBA	7620334622	Girija Patil
0	Anil Jadhav	S.Y.B.A	8999549209	

41	Poonam Prakash Pawar	TYBA (C)	9307498045	
42	Vaishnavi Dnyaneshwari Giorade	TYBA(C)	9529036966	VDGiorady

* ONLY FOR MODERN COLLEGE STUDENTS

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Department of Sociology

&

Board of Student Development (BSD), Savitribai Phule Pune University

Jointly Organized Workshop on

Gerontology: Care & Concerns

Day & Date : Thursday: 12 May 2022 Time 9: 30 to 12:30

On

Attendance

Sr. No.	Name of the Student	Name of the College	Mobile/Phone Number	Signature
1.	Chanchal G. Shendre	Modern College, Ganeshkhind	8390626130	
2.	Sumitra Dadasaheb Khilare	Modern, Ganeshkhind	7517089427 7588624168	
3.	Rishikesh Baliram Pawar	modern, Ganeshkhind	7447662127	
4.	Suravi Singh	Modern, Ganeshkhind	8180921076	

5.	Angelina Natasha Bilimoria	Modern, Ganeshkhind	8141667317O	Angelina
6.	Lakshita Purushottam Pagedar	Modern, Ganeshkhind	8767264805	
7.	Neha balraj Jabila	Modern, Ganeshkhind	8766020337	
8)	Roshani Ramesh Khambe	modern. Ganeshkhind	9011431033	Roshani Khambe.
9)	Vaishnavi Bharat Phadtare	Modern college Ganeshkind	8177905320	
10)	Sneha Shivaji Kamble.	Modern college ganeshkhind	8291701072	Kamble.
11)	Indrale Mohini Panditrao	Modern College, ganeshkhind	9665218483	
12)	Bhakti Rajendra Kamble	Modern College, Ganeshkhind	9822590194	Kamble
13)	Shreya Deshpande	Modern College, Ganeshkhind	8605502985	Shreya D.
14)	Bhagyashri Jolbe	Modern college ganeshkhind	7499429243	
15)	Mohini Anil Sawale	Modern College Ganeshkhind	9825299172	Sawale
16)	PRIYANKA PRADIP SAWANT	MODERN COLLEGE GANESHKHIND	9673122084	

17)	Ganjara Sidhir Ghotkule	Modern college ganeshkhind	9623770484	Ghotkule
18)	Bratiksha Jayram Dhadwad	Modern college ganeshkhind	9545614946	Dhadwad
19)	Neha Dattatray. Thorat.	Modern college ganeshkhind.	7350700909	Thorat
20)	Pranali sunil shitole	Modern college ganeshkhind	9119417508	P.S. Shitole
21	Nishigandha M. Sakhare	Mordern. College ganeskhind	7028967033	Sakhare
22)	Tanay satish Ichakanje	Morden college ganeskhind	7350388791	
23)	Samiksha Dipak Kamble	morder college ganeskhind	7219506201	
24)	Priti vishnu Bulbule	Mordem college ganeskhind	7666862946	Bulbule
25)	Madhuri Sunil Darekar	Modern college Ganeshkhind	8975727494	Darekar
26)	Gauri Rajkumar Karkar	Modern college Ganeshkhind	9763867791	Gauri Karkar
27)	Vaijayanta Gulab Dukare	Modern college Ganeshkhind	8805568617	Dukare
28)	Aditi Balasaheb Kale	Modern college Ganeshkhind	8275211888	Kale

29.	Sonali Suresh Pawar	Modern collrage Ganeshkhind	8805804794	Sonali
30.	Runali Ravindra Jagdale.	Modern Collrage. Ganeshkhind	7985837505	Jagdale
31	Vaishnavi Hanumant Kambe	Modeen College Ganeshkhind	8329766210	
32	Saniya Vitthal Gaikwad	Modeen College Ganeshkhand	7030782198	Gaikwad
33)	Ajay Dattatray Belhekar	Modern College Ganeshkhind	9890260999	
34)	chilawante Bhagyashri Baliram	modern college Ganeshkhind	7385402320	
35)	Bhagyashree Suresh Sonawane.	modern College Ganeshkhind.	7219540088.	Sonawane.
36)	Urmila Prabhrao Magar	Modern College Ganeshkind	9325039176	Umagar
37	Jumgam Riba	Modern college Ganeshkhind	9362865601	Jumgam
38.	Welty Debbarma.	Modern College Ganeshkhind	9366968625	Welty D/B.
39.	Renati Nagappan	Modern College Ganeshkhind	8261972683	Renati
40	Mansi Kamble	Modern College Ganeshkhind	7385891720	Mkb

41	Tanuja charan Banekar	Modern college Ganeshkhind	9146677381	Tanuja
42	Amar Parmeshwar Tupe	Modern college Ganeshkind	9834972955	Amar
	रणजित इंदाणित हटे	— // —	75177287	
44	Abhishek Balu Jadhav	Modern College Ganeshk-hind	7780069341	
45	Pritam Prakash Gavade	— // —	9552605039	
46	Meghu sopan sathe.	modern college ganesh	8956172963	M.S. sathe.
47	Muskan Firoj Khanjade	Modern college ganeshkhind	8767832740	
48	Nikalje Prerna Ravindra	— // —	7378821851	P.R. Nikalje
49	Nikalje Pradnya Manoj	Modern college ganeshkind	9011718327	P.M. Nikalje
50	Yogini Harichandra Kadrung.	— // —	8010674823	Kadrung.
60	Kajal Rohidas Damse	— // —	7666016318	Damse
61.	Biru I. Alangisir	— // —	9307631977	

62	Saurabh D. Pawar	Marathi college	8788[illegible]	S.D. Pawar
63	Ghale Atharv Gajanan	〃	7040334622	A. G.
64	Prabuddha Dilipkumar gaikwad	〃	9960064216	
65	Tejas Dnyaneshwar Kedar	〃	9022607106	Kedar
66	Omkar Indrabhan Shinde	Marathi College	7519078527	Shinde
67	Rohit Ashok Mane	〃	7276705015	
68	Jamadar Jeevan sudhakar	〃	9860045083	
69	Namdev Bhimrao Gangasagare	〃	8446575266	
70	Kakade Ganesh Rameshwar	〃	9921956404	
71	Shambhuraje D. Phuge	〃	7040846104	
72	Swapnil Khandale	〃	7875963091	
73	Mahesh Ambigar	〃	8788172486	M.M Ambigar

74.	Sahil Eknath Jadhav	—"—	9552882737	Sahil
75.	AHSHAD ANAND BHALERAO	—"—	7998702421	[illegible]
76.	Srijit Dattatray Radlinge	—"—	7666891862	[illegible]
77	Kaustubh Kau Dudhal	"—	902258 7507	[illegible]
78	Priyanka Ravi chavan	—"—	9890006607	[illegible]
79	Harsh sisodiya	—"—	8856978952	Harsh
80	Vaishnavi Rajesh Choudhary	="=	9370365460	[illegible]
81	Lumen Reang	="=	9284835959	[illegible]
82	Lazarush Jamatia	—"—	7085338085	Lazar
83	Pratibha T. Shejwal.	="=	9175840513	Shejwal
84	Kale Saraswati . P	—"—	9322880644	[illegible]
85	Birajdar sainath R.	—"—	9370150950	[illegible]

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करारनामा

करारनामा आज वार बुधवार दि. ११/१०/२०१७ या दिवशी

कुलदिप स्क्रॅप मटेरीयल MPCB REG NO= BO/RO (HQ) /HWE-Waste collection center/२०१६/K/B-५५७

पत्ता – स. नं. ५०, वाघजाई नगर, प्लॉट नं. ४७ आंबेगाव खुर्द, पुणे - ४११०४६.

तर्फे प्रोप्रा

श्री अशोक सिताराम भारस्कर

वय- २६ वर्षे धंदा-व्यवसाय

रा. दा नं६६, संतोष नगर, कात्रज ता हवेली, जि पुणे लिहून घेणार

(ज्यांचा उल्लेख या दस्तामध्ये येथून पुढे सोईसाठी व संक्षेपासाठी लिहून घेणार म्हणून करण्यात येईल त्याचप्रमाणे सदरचा दस्त हा त्यांचे कायदेशीर वलीवारसदार, कायदेशीर प्रतिनीधी, कुलमुखत्यारधारक, अधिकारपत्रधारक, उत्तराधिकारी, नॉमिनीज इत्यादीवर बंधनकारक आहे व राहील)

यांसी

प्राचार्य

मॉडर्न कॉलेज ऑफ आर्ट्स, सायन्स अण्ड कॉमर्स,

गणेशखिंड रोड, युनिव्हर्सिटी सर्कल पुणे

प्राचार्य

डॉ. संजय सोपान खरात

वय ४९ वर्षे, प्राचार्य लिहून देणार

(ज्यांचा उल्लेख या दस्तामध्ये येथून पुढे सोईसाठी संक्षेपासाठी लिहून देणार म्हणून करण्यात येईल त्याचप्रमाणे सदरचा दस्त हा त्यांचे कायदेशीर वलीवारसदार, कायदेशीर प्रतिनीधी, कुलमुखत्यारधारक, अधिकारपत्रधारक, उत्तराधिकारी, नॉमिनीज इत्यादीवर बंधनकारक आहे व राहील)

कारणे करारनामा लिहून ठेवत आहोत कि,

१. वर नमुद लिहून घेणार म्हणजेच महाराष्ट्र पोल्युशन कंट्रोल बोर्ड चे नियमानुसार नोंदणीकृत असलेली कुलदिप स्क्रॅप मटेरियल ही प्रोप्रायटरी संस्था असून सदरील

संस्थेचा मुख्य उद्देश ई स्क्रॅप चे मटेरियल घेवुन त्याचे रीसायकलिंग करणे तसेच इतर निकामी झालेल्या इलेक्ट्रीक गृहपयोगी वस्तुंची खरेदी करून त्याची पर्यावरण संरक्षण कायदा १९८६ तरतुदीनुसार व नियमानुसार रिसायकलिंग करणे अशा स्वरुपाचा आहे.

२. सदरील कुलदिप स्क्रॅप मटेरीयल या संस्थेचा कामाच्या बाबतीत लिहून देणार या महाविद्यालयास माहिती मिळाली असता सदर लिहून देणार यांनी लिहून घेणार यांचे कडे महाविद्यालयात विविध कामात वापरात असलेल्या सर्व प्रकारचे इलेक्ट्रॉनिक्स व इलेक्ट्रिकल वस्तु निकामी झाल्यानंतर इतरत्र पडुन राहतात, सदरील निकामी झालेल्या सर्व प्रकारच्या इलेक्ट्रॉनिक वस्तु सदर महाविद्यालयात पडुन राहील्याने कामकाजात अडीअडचणी निर्माण होतात त्यासाठी लिहून देणार यांनी सदरील सर्व इलेक्ट्रॉनिक वस्तुंचा तयार होणारा कचरा निकामी झालेल्या वस्तुंचे भाग अशा सर्व वस्तुंचे रिसायकलींग करणे कामी व अशा वस्तु खालील परिशिष्टात नमुद केलेल्या दरात आमचे कडुन वेळोवेळी खरेदी करणे कामी सदरील करारनामा आज रोजी पासुन ५ वर्षे कालावधीकरीता करीत आहोत

३. सदर लिहुन देणार यांचे ठिकाणी निर्माण होणारा सर्व प्रकारच्या इलेक्ट्रॉनिक व इलेक्ट्रीकल कचरा म्हणजे ई-वेस्ट लिहुन घेणार यांना खालील परिशिष्टात नमुद झालेल्या दरात विक्रि करावयाचे लिहून देणार यांनी मान्य व कबुल केलेले आहे. तसेच लिहून घेणार यांनीही अशा सर्व प्रकारच्या ई-वेस्ट लिहून देणार यांचे कडून वेळोवेळी खरेदी करावे व सदरील करारात नमुद दराने प्रत्येक वेळी लिहून देणार यांचे खाते नंबर वर चेक /डिडि अन्वये खरेदी केलेल्या सर्व ई-वेस्ट ची रक्कम देण्याची आहे.

४. सदरील लिहुन देणार यांचे कडे तयार होणारे ई-वेस्ट व इतर इलेक्ट्रॉनिक वस्तुचा कचरा, निकामी वस्तु इत्यादी परिशिष्टात नमुद केल्याप्रमाणे सर्व वस्तुंची लिहून घेणार यांना विक्रि केल्यानंतर सदरील वस्तुंच्या मोबदल्यात लिहून देणार यांना येणारी रक्कम लिहुन देणार

यांचे नावे/ लिहून देणार यांचेकडे विना विलंब लिहुन घेणार यांनी जमा करावयाची आहे. सदरील संपुर्ण रक्कम मिळाल्याबाबतची पोच पावती लिहून घेणार यांस ११/१०/२०१७ पासून दि. ११/१०/२०२२ अशी राहील. सदरील कालावधीमध्ये परिशिष्टात नमुद केलेल्या सर्व ई-वेस्ट वस्तुंची लिहून घेणार यांना विक्री करायचे बंधन लिहून देणार यांचेवर राहील सदरील कालावधीत इतर ति-हाईत वस्तुंची व वस्तुंच्या कोणत्याही कसल्याही भागाची विक्रीव्यवहार देणार यांनी करावयाची नाही.

५. सदरील लिहून देणार यांचेकडे वेळोवेळी तयार होणा-या ई- वेस्ट ची लिहुन घेणार यांना विक्रि केल्यानंतर, सदरील सर्व ई – वेस्ट लिहुन देणार यांचे पत्त्यावरून म्हणजेच वस्तू ज्या ठिकाणी आहे त्या ठिकाणाहून घेऊन जाण्याची तसेच सदरील सर्व वेस्ट, कचरा काळजीपूर्वक हाताळून लिहून देणार यांचे इतर वस्तूंना कोणतीही इजा न करता घेऊन जाण्याची सर्व जबाबदारी लिहून घेणार यांची राहील.

६. लिहुन देणार यांचेकडून ई – वेस्ट जमा करून खरेदी करून सर्व वेस्ट गाडीमध्ये भरून घेण्याची व सदरील सर्व कामकाज करावयासाठी कामगारांची निवड लिहून घेणार यांना करावयाची असून त्याकामी येणारा सर्व खर्च म्हणजेच कामगार पगार, टेम्पो भाडे इतर सर्व खर्च लिहून घेणार यांनी करावयाचा आहे त्याची तोशिष लिहून देणार यांना लागु नाही.

७. सदरील कराराच्या परिशिष्टात नमूद असलेला दर लिहून देणार यांना मान्य व कबूल आहे त्यास त्यांची कोणतीही हरकत नाही व सदरील दरात करार संपुष्टात येईपर्यंत म्हणजेच ठरलेल्या ५ वर्ष मुदतीत कोणताही बदल होणार नाही.

८. सदरील कराराची मुदत संपुष्टात आल्यावर सदर करार रद्द समजण्यात येईल आवश्यकता भासल्यास लिहून देणार व लिहून घेणार यांनी सदरील कराराची मुदत वाढवायची आहे. यदाकदाचित सदरील कराराची मुदत वाढविणे शक्य न झाल्यास पुन्हा करार नोंदणीचे वेळी

म्हणजेच ई – वेष्ट चे कॉन्ट्रक्ट देतेवेळी लिहून देणार यांना लिहून घेणार यांना प्राधान्य द्यायचे आहे.

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नाव : Mrs. Salunke Vaishali S.

पत्ता : Dept. of Electronics
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