ISSUE XI

DOMBIVLI SHIKSHAN PRASARAK MANDAL's
K.V.PENDHARKAR COLLEGE OF ARTS, SCIENCE AND COMMERCE, DOMBIVALI (E)
(AUTONOMOUS)

DEPARTMENT OF BIOTECHNOLOGY

BIOSCENE 2023-2024

EXPLORING LIFE UNDERNEATH THE SEA

BIOSCENE 2023-2024

EXPLORING LIFE UNDERNEATH THE SEA

ISSUE XI

Published by,

Department of Biotechnology,

DSPM's K.V. Pendharkar College (Autonomous), Dombivli (E)

INDEX

EDITORIAL

As I write this editorial for the eleventh issue of BIOSCENE, our departmental magazine, I feel grateful and proud. This year's theme, ***"Exploring Life Underneath the Sea,"*** has inspired a captivating collection of articles and creative works.

Established in 2003-2004 under the visionary leadership of Dr. R.G. Bagool, our Department of Biotechnology has grown significantly. Currently, under the guidance of Ms. Sandeeptha Rathindran, we offer postgraduate and graduate courses, nurturing students to become accomplished biotechnologists and responsible individuals equipped to tackle global challenges.

As educators, we strive to foster holistic development through diverse activities. Our department encourages students to explore their potential, and BIOSCENE serves as a platform for showcasing their talents.

This magazine is a vibrant bouquet of detailed reports on departmental activities, student-written articles, research projects, artwork, achievements, etc.

I extend heartfelt thanks to our students, faculty members, and Dombivli Shikshan Prasarak Mandal's K.V. Pendharkar College management for their unwavering support. I hope you find BIOSCENE 2023-2024 an engaging and informative read.

ACTIVITY REPORTS

Department of Biotechnology
Activity Report 2023-2024 (Term-I)

- **Guru Purnima day** activity was on 3rd of July, 2023. Theme was 'Arts meet Biotechnology', number of beneficiaries – 48 students. Three students each from second- and third-year classes secured prizes in this skill enhancement activity.

- **Advanced Learner & Slow learners' group** was created to enrich the students' knowledge in the subject and to enhance their learning skills. A total of 18 students were grouped under Advanced Learners & Slow learners from S.Y. Biotechnology and T.Y. Biotechnology. Students were assigned with various activities like assignment, presentations & flowchart making in the academic year 2023-2024.

- An **Expert lecture** on "Book Review – Emperor of all Maladies by Siddharth Mukherjee" was arranged for T. Y. students on 18th July 2023. Dr. Amala Patwardhan, Librarian narrated the technique of writing review on a book in the session. All together 26 students attended the lecture.

- **T.Y Parent Meeting** was conducted on 15th July 2023. 16 Parents with students attended the meeting. **S.Y Parent Meeting** was conducted on 21st July, 2023, 19 Parents attended the meeting out of 30.

- An **Open Book Day** was organized for students of first, second and third year on 8th August, 2024. This was organized in collaboration with college library to make students familiar with reference books in biotechnology. The no. of beneficiaries are as follows: FY – 36, SY – 26, TY - 21

- **F.Y Induction Programme** for students was conducted on 16th August 2023. The students were informed about the college, subjects offered under NEP 2020, academic plan with semester wise examination, discipline and attendance, MKCL courses and Open electives, etc.Orientation lecture course, Biotech course details, academic calendar and examination pattern. Number of students present -38.

- **Orientation lecture series and practical** were conducted for F.Y Biotechnology students from 01/08/23 to 31/08/23 to familiarize student about the basic concepts & applications in biotechnology, microbiology, biochemistry, & life sciences.

- Department activity **PSI-CRAZE** was held on 18th and 21st August, 2023. The theme for the event was FIRE and ICE which was an interdepartmental event. Different competitions, fun games and cocurricular activities were planned for students of degree college. The no. of beneficiaries is 95.

- A **Gallery Walk** activity was planned for the students of second year biotechnology. This was organized to make students familiarized with some posters topic to encourage students for referencing and reading. The total of 31 students attended this activity.

- **Teachers Day activity** was conducted on 5th September, 2022. Students from T.Y. Biotech were encouraged to conduct lectures & practical on the same day with In-charge teachers. Total enthusiastic students attended from S.Y, T.Y and F.Y Classes were 66.

Department of Biotechnology
Activity Report 2023-2024 (Term-II)

- **ACTREC Open day visit** scheduled on 30th November, 2023 was organized for T.Y students. The students got opportunity to visit Animal house, Biochemistry & Microbiology, Molecular biology Laboratories and Instrument room.

- A visit to NMIMS Institute of Vile Parle Open Day was organized for the group of Third year B.Sc. and First year M.Sc. Biotechnology students.

- **Parent-Teacher meeting** was organized in the month of 3rd February, 2024 informing the parents regarding Industrial visit and study tour to Baroda from 14th – 17th February, 2024.

- The skill development cocurricular course activity in **Certificate Course of STP - Sewage Treatment Plant** was implemented for **FY Biotechnology** students. This was the fourth batch and total of 36 students enrolled for this course.

- An industrial visit to **LifeSenz Cancer Research Laboratory** was planned on 6th March, 2024 for the students of first year M.Sc. Biotechnology. This visit made students understand different detection, diagnosis methods of cancer and their applications.

- Research paper presentation in One Day National Conference was organized in DSPM'S K.V.Pendharkar college: Participation of **T.Y. and M.Sc. Part I Biotechnology students** in National conference on Empowering tomorrow's innovators navigating-Entrepreneurship in the Modern Era.
  No. of students participated: 18, No. of scientific publications by faculty- 11

- A **Study tour to Gujrat, Baroda** was organized on 15th February to 17th February, 2024 for S.Y. and T.Y. Biotechnology students. A total of 36 students were accompanied by 2 Teachers.

- **Remedial lectures** were conducted for ATKT (Theory and Practical) students of all three classes on the following dates:
  Total Number of remedial lectures engaged by the departmental staff: **05 on 15th September, 2023**
  Total Number of remedial lectures engaged by the departmental staff: **09 from 1st February to 17th February,2024**

ARTICLES BY STUDENTS

EXPLORING LIFE UNDERNEATH THE SEA

The ocean's depths hold a captivating mystery, teeming with life far stranger and more Wondrous than anything found on land. Exploring this undersea realm unveils a hidden world Where sunlight fades, replaced by bioluminescent creatures that paint the darkness with an Ethereal glow.

Scientists use specially designed submersibles and remotely operated vehicles (ROVs) to Navigate the crushing pressure and navigate the alien landscape of the deep sea. These Technological marvels allow us to witness the bizarre adaptations that enable creatures to thrive in an environment so hostile to us.

From the anglerfish, with its bioluminescent lure that dangles like a morbid fishing rod, to the Colossal squid, whose tentacles stretch out longer than a school bus, the deep sea is a Showcase of evolution's creativity.

Exploring the life under the sea is not just about encountering the extraordinary; it's about Understanding the vital role this ecosystem plays in the health of our planet. The ocean depths Are a vast reservoir of carbon dioxide, helping to regulate Earth's climate.

By studying these unique environments, we gain a deeper appreciation for the ocean's delicate Balance and the importance of protecting this precious resource.

- **By S.Y. Biotechnology Student,**
- **Sahil Das**

WHISPERS OF THE TIDES: THE JOURNEY OF ROSHNI

In wilderness, she finds her grace,
A girl named Roshni, in her own space.
Silent and introspective, yet full of dreams,
In the world of the sea, her heart beams.

On the beach, where the waves caress,
Roshni finds solace, a sweet gruss.
She walks alone, but not lonely at all,
In the whispering breeze, she stands tall.

With the ocean as her silent friend,
Roshni's escapades never end.
She explores the shores with curious eyes,
In the realm of the sea, where mystery lies.

Seashells and sand dollars, treasures rare,
In her gentle hands, she holds with care.
As she wanders the beach, lost in thought,
In the beauty of nature, she is caught.

Beneath the waves, a world unknown,
Where marine life thrives, in depths alone.
Roshni dives deep, her spirit free,
Amongst coral reefs, she finds her glee.

With each creature she meets, a silent exchange,
In the language of the sea, they arrange.
An introvert, yes, but with a heart so wide,
For the ocean's embrace, she cannot hide.

Oh, Roshni, child of the sea,
In your quiet world, you'll always be.
Exploring the depths, with wonder untold,
A treasure of the ocean, pure gold

- **By F.Y. Biotechnology Student,**
Roshani Chaudhary

OCEANS.....

"The sea is an underwater museum still awaiting it's visitors".

By:- Aditya. Singh

Where early life evolved & where nearly 80% of animals still live. The ocean is a fluid & unpredictable world & all those that live here are at its mercy. Our planet's oceans cover 70% of its surface & provide an incredible 99% of its habitable space. This maybe an alien world to us but it's home to an extraordinary range of animals, from the biggest to the strangest creatures in our world, even for the most marine adapted life isn't easy. Survival at sea is a completely different game to survival on land. Especially when the rules keep on changing.

To reach one of the most hostile environments on Earth, you must descend thousands of feet beyond the Sun's reach down into the ocean's depths. The pressure here would crush you like a soda can. There is life just not as we know it. 75% of animals make their own light, eyes are super-sized to catch what tiny luminescence there is & soft bodies dominate here. This alien environment is full of surprises. It even snows down here. Flakes of organic matter fall for weeks towards the sea floor. Along the way, they fuel an ecosystem of microscopic animals & graceful giants. Right from the very beginning the ocean has been a cradle of life on our planet & the many creatures that still live here are really a legacy of that irrepressible will to succeed in a turbulent world. No matter what the ocean has thrown at them somehow they've managed to endure.

"If you think the ocean isn't important imagine Earth without it. Mars comes to mind. No ocean, no life support system".

- **By F.Y. Biotechnology Student, Aditya Singh**

- **By F.Y. Biotechnology Student,**
Shravani Patil

T.Y. B.Sc. & M.Sc. BIOTECHNOLOGY RESEARCH PROJECTS FOR NATIONAL CONFERENCE UNDER GUIDANCE OF FACULTY MEMBERS

14. From Waste to Worth: Biodegradation Insights into Textile dyes from Industrial Effluent using Microbial Consortia

Darshana Salunkhe
Dombivli Shikshan Prasarak Mandal's, K.V.Pendharkar College of Arts, Science and Commerce, (Autonomous) Dombivli (E)
Riteeka Gaikar
Dombivli Shikshan Prasarak Mandal's, K.V.Pendharkar College of Arts, Science and Commerce, (Autonomous) Dombivli (E)
Suman Satyarum
Dombivli Shikshan Prasarak Mandal's, K.V.Pendharkar College of Arts, Science and Commerce, (Autonomous) Dombivli (E)

Abstract

The effluents from textile industries without proper treatment contains a remarkable amount of synthetic dyes which are harmful to the environment and a big challenge globally to degrade it with a eco-friendly way. In this study 4 common textile dyes used were collected from local textile industry- Dye-1(Red) Dye-2(Pink) Dye-3(Yellow)Dye-4(Blue). The research work deals with the isolation of three bacterial species from effluent sample and their consortium for the biodegradation ability of textile dyes. The isolates were identified (Bacillus, Pseudomonas, Aspergillus). Degradation was confirmed by determining the tolerance limit of organisms using agar dilution method and measuring optical density of the decolorized dye. Physicochemical parameters are also studied. This study reveals that these bacteria have degradation potential and research results will help to set up dye removal eco-friendly methods to expose the dye effluents to environment in future.

Keywords: Biodegradation, Textile dye's , Eco-friendly

Introduction

Textile industry is one of the largest industries in India providing employment for more than 35 million people in the entire country. Around 14% of the world's production of textile fibers and yarns were contributed from India. Textile industries accounts for 30% of the total exports and 14% of the total industrial production, thus playing an important role in deciding the national economy. The textile industry is interdependent to the dyestuff sector. Nearly 70% of

the dyestuff produced is consumed by the textile industry. (Shobina Kannan et.al.2022). Industrial waste water effluent that contains dye is a life threatening problem. The color of the dye is due to the presence of the chromophore group, wherein the auxochrome group helps the dye in imparting the color on the fabric. Most of the residual dyes are highly toxic by carcinogen posing a potential threat to all living organisms. (Gupta.S et.al.2020).

The activity and flexibility of microorganisms determine the effectiveness of the treatment of the dyestuff. Adsorbents can include bacteria, microalgae, and fungi, and the adsorption does not degrade the dye into fragments. In contrast to biosorption, the original dye structure is disrupted in biodegradation, often entirely decomposed. Thus, biodegradation is the more practical option (Radia Jamee et.al. 2019).

Materials and methods

I. Sample & Dye collection

The effluent sample was collected from the discharge point of a local textile industry of MIDC region in Dombivli. Also, four different dyes were collected from the same textile industry which were named as- Dye 1-(Red) Dye 2- (Pink) Dye 3- (Yellow) and Dye 4- (Blue).

II. Study of various physicochemical parameters

1. pH: Small pH strip was placed on clean and dry surface with a forcep and small volume of sample was added on it with the help of dropper. Change in pH strip was observed and pH was determined by comparing the color change with the various ranges of pH strips using reference chart (Dr.A.Ezhilarasu et.al*.2016)
2. Color: By observing the sample the color of the sample was noted.
3. Temparature: Thermometer was placed in the beaker containing sample and reading was noted (Dr.A.Ezhilarasu*, 2016).
4. Turbidity: Turbidity of the effluent sample was checked by tubidimetric method of which the optical density was measured at 420nm.(Trivedy RK,Goel PK et.al. 1984)(refer table-1)
5. TDS: Add a known volume of sample in a clean and dry crucible and heat the crucible with sample in oven at 105°C for over 24 hours TDS(mg/L)=(A-B)x1000/Sample volume where A= weight of crucible+Sample; B= weight of crucible+residue after 24 hours at 105°C(Trivedy RK et.al.1984)

III. Isolation of microorganisms from textile effluent sample

A loopful of effluent sample was streaked on St.Nutrient agar plate, St.MacConkey's Agar plate St.Sabouraud's Agar plate, St.Cetrimide Agar plate respectively and incubated at

37°C for 24 hours.(Kumar.s et.al. 2016). The above plates were used as master culture and stored in refrigerator at 4°C. A microbial consortia of the islotes streaked on the above plates was inoculated in 10ml St. Saline solution.

IV. Screening of bacterial isolates using Agar dilution method

Table no. 2

These plates were then allowed to solidify for a while. After solidification a consortium of bacterial isolates were streaked onto these plates and incubated at 37°C to check the tolerance level of bacterial isolates in the dye. (refer table-2).

Sr.No	Dyes	0.5%	1.0%	3.0%
1	Dye 1(Red)	0.025g of dye+20 ml Nutrient agar broth	0.05g of dye+20 ml Nutrient agar broth	0.15g of dye+20 ml Nutrient agar broth
2	Dye 2(Pink)	0.025g of dye+20 ml Nutrient agar broth	0.05g of dye+20 ml Nutrient agar broth	0.15g of dye+20 ml Nutrient agar broth
3	Dye 3(Yellow)	0.025g of dye+20 ml Nutrient agar broth	0.05g of dye+20 ml Nutrient agar broth	0.15g of dye+20 ml Nutrient agar broth
4	Dye 4(Blue)	0.025g of dye+20 ml Nutrient agar broth	0.05g of dye+20 ml Nutrient agar broth	0.15g of dye+20 ml Nutrient agar broth

V. Screening of dye decolorization using broth dilution method: Stokes Method

Concentrations	Dye 1(Red)	Dye 2(Pink)	Dye 3(Yellow)	Dye 4(Blue)
0.5%	0.025g dye +4.875ml Nutrient broth + 1 ml Culture	0.025g dye +4.875ml Nutrient broth + 1 ml Culture	0.025g dye +4.875ml Nutrient broth + 1 ml Culture	0.025g dye +4.875ml Nutrient broth + 1 ml Culture
1.0%	0.05g dye +4.85ml Nutrient broth + 1 ml Culture	0.05g dye +4.85ml Nutrient broth + 1 ml Culture	0.05g dye +4.85ml Nutrient broth + 1 ml Culture	0.05g dye +4.85ml Nutrient broth +1 ml Culture
3.0%	0.15g dye +4.75ml Nutrient broth + 1 ml Culture	0.15g dye +4.75ml Nutrient broth + 1 ml Culture	0.15g dye +4.75ml Nutrient broth + 1 ml Culture	0.15g dye +4.75ml Nutrient broth + 1 ml Culture

Postive control	4.9ml Nutrient broth+ 1ml Culture	4.9ml Nutrient broth+ 1ml Culture	4.9ml Nutrient broth+ 1ml Culture	4.9ml Nutrient broth+ 1ml Culture
Negative control	0.025g dye +4.975ml Nutrient broth	0.025g dye +4.975ml Nutrient broth	0.025g dye +4.975ml Nutrient broth	0.025g dye +4.975ml Nutrient broth

Table no-3

These tubes were then incubated at 37°C for 3 weeks and the Optical density was measured colorimeterically at 530 nm (refer table-3) also the decolorizing percentage was deduced.

The decolorization percentage of the dye was deduced as-

Decolorization (%) = (Initial absorbance −Final absorbance) / (Initial absorbance) x 100 (Shobina Kannan et.al.2022).

VI. Gram Staining

Gram staining was performed using the following reagents (crystal violet, grams iodine, alcohol, saffranin) to identify the isolated bacterial species by observing under microscope at 100X objective lens.

Results and Discussion

I.Sample and Dye collection: The effluent sample and dye collected from the local textile industry were brought to the laboratory and stored at room temperature.

II.Study of various physicochemical parameters-

1. pH: The pH of Effluent sample was measured using pH strips and the pH of Effluent sample was found to be 3.0 which is acidic.
2. Color: The color of the effluent sample was observed to be brownish in color.
3. Temperature: The temperature of the effluent sample was measured using a thermometer and It was found to be 25°C.
4. Turbidity: The turbidity for the effluent sample was determined by graphical extrapolation method and was found to be 0.14 mg/ml(refer table-4).
5. Total dissolved solids (TDS):

TDS(mg/L)=(A-B)x1000/Sample volume

Calculation- 1.A=53.996 , 2.B=53.952

TDS(mg/L)=(53.996-53.952)x1000/10

=4.4 m/L

Sr. no.	Conc. Of $BaSO_4$ (mg/ml)	O.D at 420 nm
1	Blank	0.00
2	1.0	1.21
3	2.0	1.02
4	3.0	0.46
5	4.0	0.54
6	5.0	0.71
7	6.0	1.51
8	7.0	1.23
9	8.0	1.03
10	9.0	1.09
11	10	1.08
12	Sample	0.14

Table no-4

III. Isolation of microorganisms from textile effluent sample: A consortium of these bacteial isolates were innoculated in 10 ml of the St. Saline suspension which was further used for the degradation of dye (Refer figure-1).

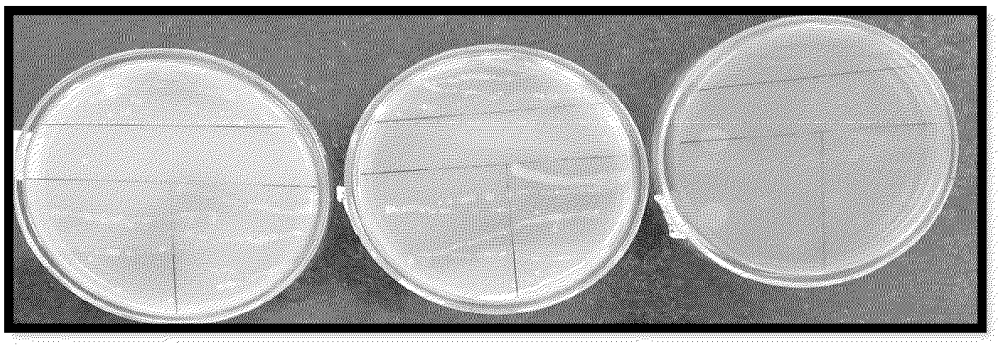


Figure no- 1

IV.Screening of dye using Agar dilution method

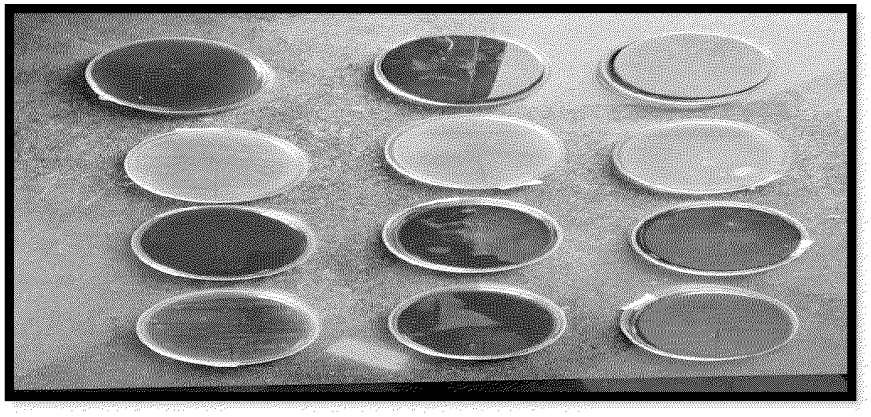


Figure no-2

DYE	0.5%	1%	3%
Dye 1 (Red)	+++	++	+
Dye 2 (Pink)	+++	++	+
Dye 3 (Yellow)	+++	++	+
Dye 4 (Blue)	++	++	+

Table no. -5

This method was performed to check the tolerance of bacterial isolates, about 1% of dye showed tolerance at incubation of 37°C for 24 hours(refer figure-2)&(table-5).

V. Screening of dye decolorization by broth dilution method

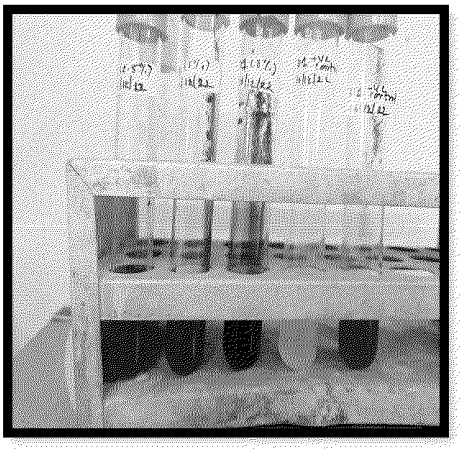


Figure-3(Dye1)

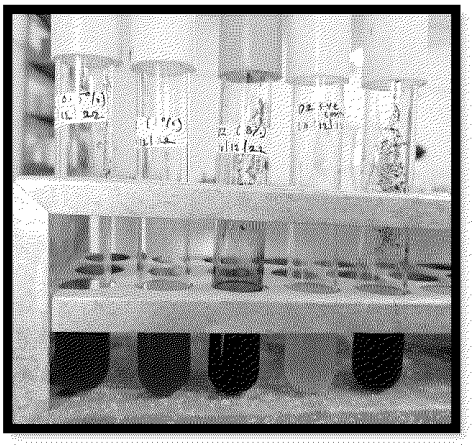


Figure-4(Dye-2)

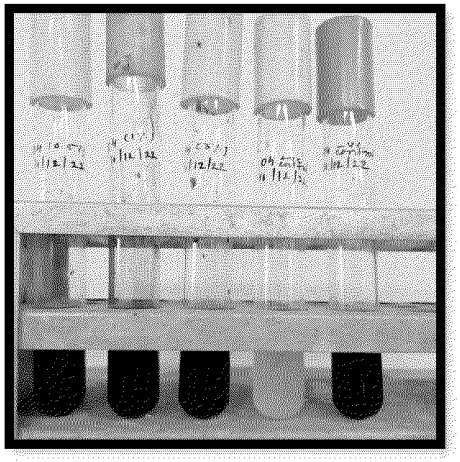


Figure-5(Dye-3)

Figure-6(Dye-4)

Bacteria from textile effluent were subjected to acclimatization with dyes in basal nutrient medium. (Refer figure 3, 4, 5, 6). The absorbance of the decolorized dye for measured colorimeterically at 530nm (refer table-6).

Concentrations	Dye-1(Red)	Dye-2(Pink)	Dye-3(Yellow)	Dye-4(Blue)
0.5%	2.48	0.65	0.40	1.48
1.0%	2.70	2.01	0.47	2.56
3.0%	3.76	2.90	0.76	2.81
Positive control	2.04	0.80	0.42	1.52

The decolorization percentage was deduced

DYE	0.5%	1%	3%
DYE 1 (RED)	70%	76%	71%
DYE 2 (PINK)	78%	79%	70%
DYE 3 (YELLOW)	85%	75%	78%
DYE 4 (BLUE)	70%	69%	50%

Table no-7

Broth dilution method was carried out for acclimatization and decolorization of dye. Concentration of (1%) showed about 75% decolorization of the dye within 3 weeks of incubation at 37°C (refer table-7).

Gram Staining –

Gram Staining was performed and 3 different Bacterial islotes (Bacillus, Pseudomonas, Aspergillus) were identified using Bergey's Manual of Systematic Bacteriology.

Conclusion

The present study was focused on biodegradation of textile dye effluents and decolorization assay. From dye degradation assay it can be concluded that the microbes isolated from the effluent water sample have the ability to degrade the dyes. The physicochemical parameters for water sample has been studied. Three bacterial isolates (Bacillus, Pseudomonas, Aspergillus) were isolated and screened using selective media and gram nature, which were further used for the degradation of dye. Screening of bacterial isolates was done using agar dilution method to check the tolerance of bacterial isolates, about 1% of dye showed tolerance. Bacteria from textile effluent were subjected to acclimatization with dyes in basal nutrient medium. Broth dilution method was carried out for acclimatization and decolorization of dye. Concentration of (1%) showed about 75% decolorization of the dye within 3 weeks of incubation

at 37°C. Thus they can be used as degrading agents to overcome the removal problem of carcinogenic and hazardous dyes from the discharge of various textile dye industries. The available evidence suggests that dye structure affects decolorization rates.At future studies, the characterization, optimization and molecular investigation of the dyestuff degradation by the isolate also can provide important info during this field to solve the arising problem. We will able to conjointly develop molecular biology technique and commercially can produce such enzyme to protect environment from the pollution.

References

1. Akhtar.N et.al. (2014) , A study on bacterial decolorization of crystal violet dye by consortium periringes, Pseudomonas aeruginosa and Proteus vulgaris. International journal of pharmacy and Biological science (pg 89-96).
2. Dr. A. Ezhilarasu*, Textile industry Dye degrading by bacterial strain Bacillus sp ,International Journal of Advanced Research in Biological Sciences , ISSN: 2348-8069 Volume 3 , Issue 3 , March – 2016.
3. H.S.El-Sheshtawy and M.Abdelkreem, Biodegradation of textile dye using consortium of bacterial strains isolated from industrial dye effluent , 2020.
4. Kumar.s and Kumar.A , Isolation and Characterization of Microbial Strains from Textile Industry Effluents of Bhilwara, India: Analysis with BioremediationJournal of Chemical and Pharmaceutical Research 8(4):143-150 , May 2016.
6. Radia Jamee and Romana Siddique, Biodegradation of Synthetic Dyes of Textile Effluent by Microorganisms: An Environmentally and Economically Sustainable Approach, Eur J Microbiol Immunol (Bp). 2019 Dec 25, pg (114–118).
7. Saxena, A. and Gupta, S, "Bioefficacies of microbes for mitigation of Azo dyes in textile industry effluent: A review," BioRes. 15(4), 9858-9881. (2020).
8. ShobinaKannan,Jegathambal Palanichamy,*T.Sugitha,C.Mayilsa, Bioremediation of textile dyeing industry effluent from small scale industries using a microbial consortium of Bacillus sp., Escherichia coli,and Aspergillus niger,Journal of Applied Biology & Biotechnology Vol. 10(Suppl 2), pp. 100-106, June, 2022.
9. Trivedy RK, Goel PK, Chemical and biological methods for water pollution studies, Environmental publications, 1984.
10. Wiegand I, Hilpert K, Hancock RE , Agar and broth dilution methods to determine the minimal inhibitory concentration (MIC) of antimicrobial substances. Nat Protoc; 3(2):163-75. doi: 10.1038/nprot.2007.521. PMID: 18274517, 2008.

15. Development and Evaluation of Cauliflower-Based Seasoning Powder: A Culinary Innovation

Pooja Mahalingam
Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science and Arts (Autonomous), Dombivli.
Sneha Pande
Assistant Professor, Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science and Arts (Autonomous), Dombivli.

Abstract

This research focuses on the creation and analysis of a unique seasoning blend composed of cauliflower, roasted cumin powder, pepper, salt, maltodextrin, maize starch, and aerosil. The study involves comprehensive testing to assess key parameters such as salt content (%), acidity (%), moisture (%), bulk density (g/ml), and taste evaluation. The experimentation aims to provide valuable insights into the physical properties, and sensory attributes of the seasoning blend. The results obtained from these tests contribute to the understanding of the product's potential as a flavorful and health-conscious alternative in the culinary domain. The research methodology and findings are presented in detail to facilitate scientific discourse and encourage further exploration in the realm of innovative seasoning development.

Keywords: Salt content (%), bulk density (g/ml), health conscious, culinary, physical parameters, physicochemical parameters.

Introduction

The culinary landscape is witnessing a growing demand for innovative and health-conscious seasoning alternatives. Seasoning powders are combinations of various compounds aimed at elevating the taste and flavor of prepared meals to which they are incorporated.

Cauliflower is mostly disliked my people due to its smell and taste, but it has many antioxidant, healthy weight loss, and many more properties. Hence, using cauliflower as a seasoning is beneficial and it's very good for health.

Cauliflower, a vegetable belonging to the Brassicaceae family, also known as Cruciferae, is scientifically named Brassica oleracea var. botrytis. The characteristic shared by plants in this family is the resemblance of their four-petaled flowers to a Greek cross, often referred to as crucifers or cruciferous vegetables. Its scientific name, Brassica oleracea var. botrytis, stems

from the classical Latin term for Wild Cabbage (Quattrocchi, 349). The term "cauliflower" itself is derived from the Latin words caulis, meaning "stalk," and floris, meaning "flower." Contrary to expectations, cauliflower is, in fact, a flower, with the edible part being the head of underdeveloped, tender flower stems and buds.

In response to this, our research delves into the development and evaluation of a distinctive seasoning blend crafted from a combination of cauliflower, roasted cumin powder, pepper, salt, maltodextrin, maize starch, and aerosil. This study addresses the need for flavorful yet nutritious seasoning options, considering the rising awareness of dietary choices and health-conscious consumption.

The inclusion of cauliflower, known for its versatility and nutritional benefits, serves as a unique base for the seasoning. Roasted cumin powder and pepper contribute distinctive flavors, while salt, maltodextrin, maize starch, and aerosil play essential roles in texture, stability, and mouthfeel. To ascertain the quality and characteristics of the seasoning blend, our research conducts a series of tests, including the determination of salt content, acidity, moisture levels, bulk density, and taste evaluation.

By focusing on these parameters, we aim to provide a comprehensive understanding of the seasoning's nutritional profile, physical properties, and overall sensory appeal. This investigation holds promise not only for culinary enthusiasts seeking novel flavors but also for individuals conscious of the nutritional content of their food choices. The findings presented in this study contribute to the broader discourse on developing innovative and health-conscious seasoning options in the realm of contemporary gastronomy.

Applications

- Seasoning dusting:
  Base + Heat + hot oil + 4% to 6% seasoning powder
- Soup:
  Boiled hot water + 5% seasoning powder

Materials and methodology

We made a seasoning blend or you can also use it as a taster enhancer in veggie soups also, you can use it as legit soup by diluting it and we have used the below components in it in fixed concentrations:

1. Cauliflower powder
2. Roasted cumin powder
3. Salt

4. Pepper
5. Paprika
6. Maltodextrin
7. Maize starch
8. Powdered sugar
9. Aerosi

The methodology used is as below

Firstly, the cauliflower powder is made which is the key ingredient of this mixture, the cauliflower is blanched and then oven dried at 90°C for 45 around minutes but keeping it under observation.

Once it was completely dry it was ground it into a powder and then also kept some coarse particles for a little crunch. It can be preserved for around 6 months.

Then the above ingredients were added in set concentrations.

The following parameters were studied:

- Physical parameters:
- Colour
- Odour
- Texture
- Taste

Physicochemical parameters:

- Salt content (%)
- Acidity (%)
- Moisture (%)
- Bulk density (g/ml)

Observations

Physical parameters	**Observations**
Colour	Buff with tiny black specs
Texture	Powder free of lumps with no visible extraneous matter.
Odour	Powder free of lumps with no visible extraneous matter.
Taste	Umami, spicy.

to quality control, considerations for future microbial parameter assessments were acknowledged.

This forward-thinking approach reflects a dedication to maintaining and improving the premix's safety and quality standards, ensuring it remains a trusted and innovative addition to culinary creations.

Another future aspect is a lot of part of the cauliflower that is the stem is wasted, in order to use it up we can use the stem too while making the cauliflower powder.

Bibliography

1. https://core.ac.uk/reader/25485260
2. https://apps.chhs.colostate.edu/preservesmart/produce/drying/cauliflower/#:~:text=Arrange%20blanched%20cauliflower%20in%20single,closely%20as%20drying%20nears%20completion
3. Physical Properties of Vegetable Food Seasoning Powders Jasmina Tahmaz(B), et.al. Faculty of Agriculture and Food Sciences, University of Sarajevo, Zmaja od Bosne 8,71000 Sarajevo, Bosnia and Herzegovina (2022)
4. Study Into Formation of Nutritional Value of Cauliflower Depending on The Agri-Biological Factors L. Pusik, V. Pusik, N. Lyubymova, V. Bondarenko, L. Gaevaya, O. Sergienko, O. Romanov, L. Gryn, L. Kononenko, 2018
5. Optimizing Production Process of Seasoning Powder Made From Fermented Fish Products Meta Mahendradatta*, Abu Bakar Tawali, Februadi Bastian, Mulyati Tahir Food Science and Technology Study Program Department of Agricultural Technology, Faculty of Agriculture Hasanuddin University, Makassar 90245, Cabbage, Cauliflower and Kale
6. Alana Pudalov, 08 and Jinquan Liang, 08 for the 1812 Garden Research Project of the Food For Thought class with Professor David Gapp and Professor Frank Sciacca.
7. http://www.biodatabase.de/Cauliflower
   http://www.dolesuperkids.com/html/kids/Nutrition%20Database/Encyclopedia/Encyclopedia_New/Cauliflower/index.html

16. Nata De Coco Reinvented: Harnessing Acetobacter Xylinum From Rotten Fruits For A Novel Sports Drink Formulation

Navneet Mehta
Dhanashri Mandra
Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science & Commerce (Autonomous), Opposite MIDC Office, Dombivli (E), (Maharashtra)
Divya More
Assistant Professor, Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science & Commerce (Autonomous), Opposite MIDC Office, Dombivli (E), (Maharashtra)

Abstract

Nata - de - Coco is a translucent, jelly-like, low-calorie, low-fat food high in fibre and rich in vitamins and minerals produced by fermentation of coconut water using acetic acid bacteria, particularly Acetobacter xylinum. It promotes digestive health, aids in controlling blood sugar levels, supports weight loss, and may contribute to boosting the immune system. The study aims to isolate Acetobacter xylinum from rotten apple and grape and to make nata de coco suspended sports drink. Sports drinks are beverages designed to rehydrate and replenish electrolytes, carbohydrates, and other nutrients lost during physical activity. The assessment of the developed product involves both sensory and nutrient evaluations. The sensory evaluation and quantification of sample attributes employs 9 – point hedonic scale, where subjects express their perceptions of all samples, including the standard product and filled the forms according to hedonic 9 points.

Key Words: Nata – de – Coco, Acetobacter xylinum, Sensory Evaluation, Hedonic scale

Introduction

Nata – de – Coco was initially introduced in the Philippines in 1973 to repurpose coconut water waste and transform it into a jelly-like substance [6]. It is a bacterial cellulose product and a popular dessert in Thailand and Southeast Asian countries. The production process involves fermentation of coconut water by Acetobacter xylinum, resulting in the formation of this chewy and translucent delicacy. It is commonly used in a variety of desserts, contributing its unique texture and taste to culinary creations in the region [2]. Distinctive composition and unique

characteristics of bacterial cellulose present possesses high purity, lacks lignin, pectin, and hemicelluloses that are commonly present in plant cellulose [5].

Acetobacter xylinum is a gram-negative soil bacterium widely distributed in nature and frequently encountered contaminant in the industrial production of vinegar by Acetobacter Aceti. It has also been isolated from the rotting fruits and used for synthesis and secretion of cellulose during its metabolism. [8] Nata – de – Coco, predominantly composed of cellulose - an insoluble fibre, offers numerous health benefits like plays a crucial role in promoting regular bowel movements, cancer, and diabetes, reducing the risk of heart disease, and lowering cholesterol levels in the blood. This nutritious food has the potential to serve as a functional food, with the added advantage of being easily produced in communities by repurposing organic waste resources.[6]

Functional foods are intentionally designed, processed and integrated into the daily diet with the purpose of offering specific health benefits and positively impact an athlete's physical capabilities and overall performance [4]. Sports drink beverage specifically formulated to aid hydration and replenish electrolytes, carbohydrates, and other nutrients lost during physical activity, particularly intense or prolonged exercise. These drinks typically contain water, sugars, electrolytes (such as sodium, potassium, and chloride), and may also include flavourings. Dietary fibre plays a crucial role in the human digestive process, evading complete hydrolysis, digestion, and absorption in the small intestine. It increases faecal bulk, contributing to regular bowel movements and aiding in the prevention of constipation. fibre has notable effects on blood glucose levels. It helps reduce postprandial (after-meal) blood glucose levels, which, in turn, can lead to a decreased insulin response. This is particularly significant for individuals with diabetes or those aiming to manage their blood sugar levels [9]. Thus, main aim of the research was to produce formulation of nata de coco containing sports drink. the nata de coco was produced from Acetobacter xylinum which was isolated from rotten grape and apple.

Materials and Methods

1. Sample Collection and Isolation of Acetobacter xylinum

The rotten samples of grape and apple were collected locally. These are used to isolate Acetobacter xylinum by serial dilution and pour plate technique. Inoculated on Hestrin Scharmm (HS) agar medium and incubated for 24-48 hours and room temperature.

2. Morphological, Biochemical Characterization:

Morphological characterization & identification by gram staining was performed. Physiological tests encompassing different properties were

3. Production of Nata – de – Coco: studied includes catalase test, acetic acid production test, ethanol over-oxidation test, cellulose production test, motility study, etc. The starter culture maintained on HS medium was prepared and mixed with sterile coconut water. This mixture covered with clean and dry cloth followed by incubation at room temperature for 12–15 days for production of Nata – de – Coco sheets.

4. Analysis of Nata – de – Coco:

The Water holding capacity, moisture content, pH, thickness was measured using vernier calliper and nutritional analysis was carried out [3,1]. Nutritional analysis included determination of carbohydrate, sugar, protein and fat.

5. Sports drink formulation and Sensory Evaluation:

The appropriate composition for sports drink was prepared by measuring acidity and pH of the solution. Sensory evaluation based on 9-point hedonic scale was conducted on certain group of people. The factors studied were taste, colour, texture and odour and overall acceptability.[10]

Observation and Results

1. Isolation of Acetobacter xylinum

The growth in the form of well isolated colonies was seen on Hestrin Scharmm (HS) medium.

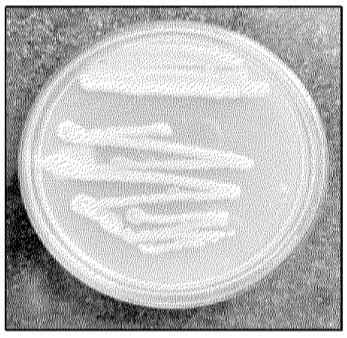


Figure 1: Growth of Acetobacter xylinum on Hestrin Scharmm (HS) medium.

2. Morphological, Biochemical Characterization: Acetobacter xylinum belongs to Acetobacter Genus which is a genus of Gram-negative bacteria. The morphological characteristics details for both the sample are as follows:

Sr. No.	Colony Characteristics	Grapes	Apples
1.	Size	2 – 3 nm	2 – 3 nm
2.	Colour	Cream	Cream
3.	Margin	Entire	Entire
4.	Elevation	Raised	Raised
5.	Opacity	Opaque	Opaque
6.	Surface	Smooth and Mucoid	Smooth and Mucoid
7.	Motility	Motile	Motile
8.	Shape	Rod	Rod
9.	Spore	Negative	Negative
10.	Gram Nature	Negative	Negative

Table 1: Morphological Characteristics of sample

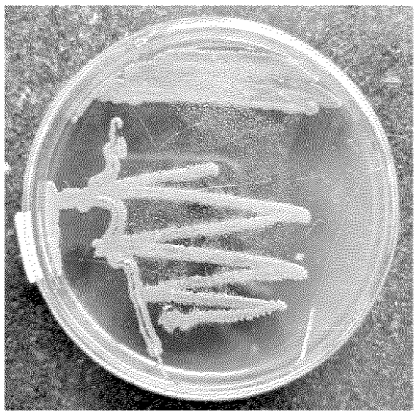


Figure 2: Ethanol Over Production on Carr Medium

Sr. No.	Biochemical Test	Result
1.	Ethanol Over Production	+
2.	Acetic Acid Production	-
3.	Catalase Test	+
4.	Oxidase Test	-
5.	Bacterial Cellulose Production	+
6.	Glucose, Sucrose, Lactose, Mannitol, Maltose Fermentation	+

Table 2: Biochemical Characteristics of sample

3. Production of Nata – de – Coco

Nata - de – Coco was produced with use of starter culture, Acetobacter xylinum containing sugar used as carbon source, ammonium sulphate as nitrogen source and acetic acid

used for maintaining acidity of the medium. The visible formation of nata – de- coco translucent bacterial cellulose sheet in coconut water medium starts at 15th day.

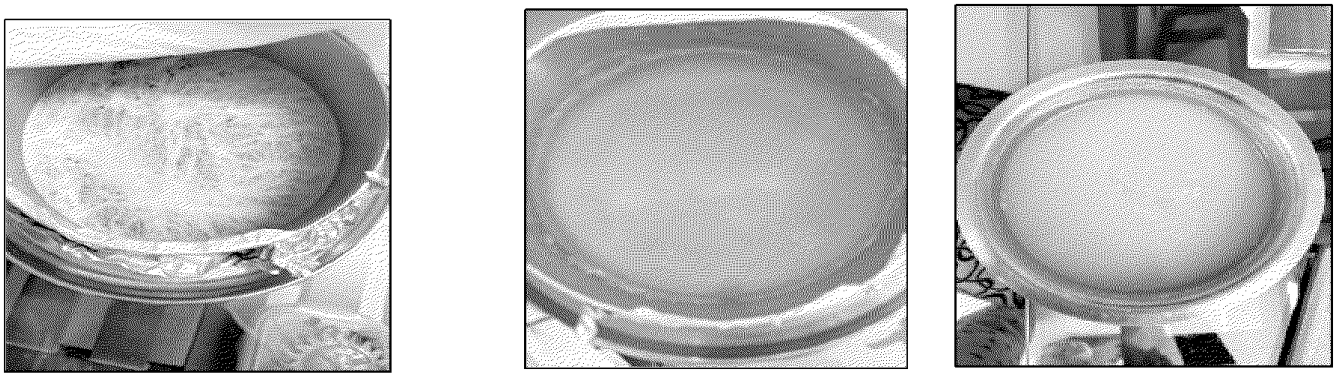


Figure 3: Nata - de – Coco Day 1, 7 and 15

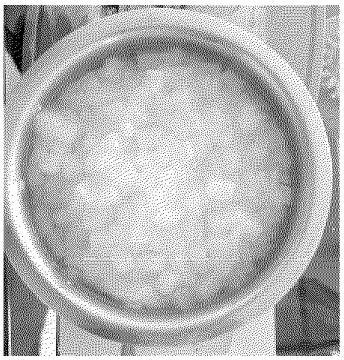


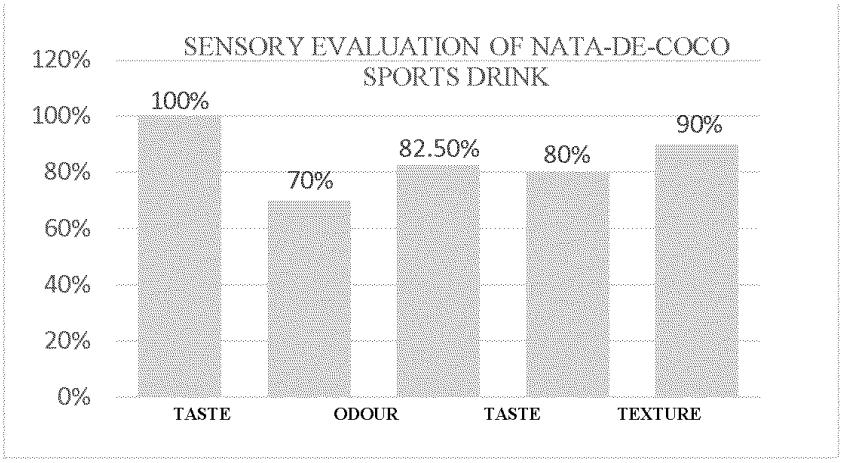
Figure 4: Nata - de – Coco Cubes

4. Analysis of Nata – de – Coco

The moisture content and water holding capacity was found to be around 96% and 84% respectively. The pH of the nata de coco after isolation was 4 and after washing and boiling couple of times it was increased to 5.5. The thickness of cubes varied but it was around 0.9 to 1 cm. The nutritional analysis was carried out and it was found out to be sugar 15g/ 100g, protein 0.04 g/100 g, fats 0.16 g/100g.

5. Sports drink formulation and Sensory Evaluation

The formulated drink was tested for different physiochemical parameters. The pH was determined to be around 3 which is acidic. Usually, the commercially sports drink have pH of around 2.9, acidity was found be around 0.2 to 0.25%.



Graph 1: Sensory Evaluation of Nata – de – Coco Sports drink

Sensory evaluation was performed which should the acceptance in terms of colour was 100%, odour was 70%, taste was 82.5%, Texture was 80.5%, and 90% showed over all acceptability

Conclusion

Isolation of Acetobacter xylinum was performed successfully on Hestrin Scharmm (HS) medium.

The morphological characterization was done indicating the species belonging to Acetobacter genus. Further biochemical tests are performed for identification of species. Catalase and bacterial cellulose tests are positive for the isolated species. Ethanol over production on Carr medium was studied indicating positive response of isolated Acetobacter xylinum along with fermentation of different sugars.

The starter culture of Acetobacter xylinum used further for production of Nata – de – Coco mixed Coconut water composition which serve for sports drink formulation. At the 15th day Nata – de – Coco translucent jelly was formed successfully. This indicates the potential of isolated culture to be used as starter culture for production of sports drink formulation.

The physical and nutritional analysis of nata – de – coco was done and all the values are falling within expected ranges.

With the advent of increasing need for nutritious energy drink containing all essential electrolytes, vitamins, minerals, etc. Nata – de – Coco was used in application for formulation of sports drink. Appropriate formulation of sports drink was prepared containing all necessary constituents.

Furthermore, sensory evaluation survey was conducted for the prepared Nata – de – Coco based sports drink formulations. Different parameters like odour, colour, taste, texture was studied and analysed. The acceptability rate for the drink was found out to be 90%.

From above studies and analysis, it can be concluded that the produced Nata – de – Coco can be a substitute for commercially available sports energy drink. It also has added advantage of prepared with biological origin, optimum nutritional availability and cost effectiveness.

References

1. H Nimitkeatkai et al 2020 IOP Conf. Ser.: Earth Environ. Sci
2. H Nimitkeatkai et al. Characterization of Bacterial Cellulose (Nata de coco) from Lychee. 2020 IOP Conf. Ser.: Earth Environ. Sci.
3. Karen Reiner. Carbohydrate Fermentation Protocol. American society for microbiology.
4. R. J. Maughan. The sports drink as a functional food: formulations for successful performance. Proceedings of the Nutrition Society.
5. Tajnuba Sharmin et al. Development of Nata De Coco and Strawberry Flavored Nata De Coco Drink and Comparative Quality Evaluation. Science Heritage Journal.
6. Trina Ekawati Tallei et al. Nata as a source of dietary fiber with numerous health benefits. J Adv Biotechnology Exp Ther.
7. Vanessa Cassoni et al. Prospecting Of Culturable Acetic Acid Bacteria From Fermented Fruits. Journal of Biotechnology and Biodiversity.
8. White DG et al. Prospects for the commercialization of the biosynthesis of microbial cellulose. In: Schuerech C (ed) Cellulose and wood-chemistry and technology. Wiley, New York.
9. Yifeng Zhang et al. Insoluble dietary fiber from five commercially cultivated edible mushrooms: Structural, physiochemical and functional properties. Food Bioscience.

17. Biogenic Synthesis of Bioethanol from Agricultural Waste and Analyzing its Potential as an Alternative to Fuel

Anagha Kadam
Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science & Commerce (Autonomous), Opposite MIDC Office, Dombivli (E), Maharashtra.
Tanaya Kalebag
Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science & Commerce (Autonomous), Opposite MIDC Office, Dombivli (E), Maharashtra
Divya More
Assistant Professor, Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science & Commerce (Autonomous), Opposite MIDC Office, Dombivli (E), Maharashtra

Abstract

Bioethanol is a renewable resource produced from low-cost fermented cellulosic biomass. This comparative study aims to produce bioethanol from corn cob, sugarcane bagasse, sugarcane leaves, and wheat husks using a fermentation process. Bioethanol was successfully produced using these biomasses through pre-treatment, and acid hydrolysis. The fermentation is carried out by yeast Saccharomyces cerevisiae followed by Distillation at 78 °C. The pH, Refractive index, Solubility and Sugar concentrations were determined by Dinitro salicylic acid (DNSA) method. Total carbohydrates were determined by the Anthrone test. The ethanol concentration and specific gravity were measured by Refractometer. Detection of ethanol was done by the Iodoform test and estimation by the Dichromate method. The extracted bioethanol was put to test in various applications like Flammable gel which can be renewable and can help reduce the usage of LPG for different chemical reactions.

Keywords: Bioethanol, Distillation, Refractometer, Flammable Gel.

Introduction

The principle fuel used as a petrol substitute for road transport vehicles is bioethanol. The sugar fermentation process mainly produces Bioethanol fuel, although the chemical process of reacting ethylene with steam can also manufacture it. The main sources of sugar required to produce ethanol come from fuel or energy crops. These crops are grown specifically for energy

use and include corn, maize and wheat crops, waste straw, willow and popular trees, sawdust, reed canary grass, cord grasses, artichoke, and sorghum plants (Bano S.et.al). There is also ongoing research and development into the use of municipal solid wastes to produce ethanol fuel. .Ethanol or ethyl alcohol (C_2H_5OH) is a clear colourless liquid; it is biodegradable, low in toxicity and causes little environmental pollution if spilt. Ethanol burns to produce carbon dioxide and water. Ethanol is a high-octane fuel and has replaced lead as an octane enhancer in petrol. By blending ethanol with gasoline we can also oxygenate the fuel mixture so it burns more completely and reduces polluting emissions. The most common blend is 10% ethanol and 90% petrol (E10). Vehicle engines require no modifications to run on E10 and vehicle warranties are unaffected also. Only flexible fuel vehicles can run on up to 85% ethanol and 15% petrol blends. Bioethanol is a sustainable fuel that can be used to partially replace fossil fuels. To be viable, waste plant materials must be turned to fuel as a long-term alternative to fossil fuels. As a result, renewable energy resources derived from non-edible agricultural materials such as millet husks, Corn cob are required to replace fossil fuels. This is because plant feedstock fuel emits fewer greenhouse gases than fossil fuels, making it better for the environment and reducing global warming. As a result, the production of biofuels from agricultural leftovers has received increased attention.

Materials and Methods

1. Sample Collection

Samples were washed thoroughly with tap water, air-dried for 2 days, and ground till fine particles were obtained.

2. Pre-Treatment and Sample Hydrolysis

Samples were treated with 5% Sodium Hydroxide for 2 hours at Room Temperature. The pre-treated samples were further treated with Conc. H_2SO_4 stirred well and kept at 35 °C for 40 minutes to 1 hour. (Bano S.et.al)

3. Fermentation and Distillation

The samples were kept at 30°C for 50-70 hours for desirable growth of Saccharomyces cerevisiae. Distillation was carried out using standard distillation apparatus. The boiling point of each sample was maintained up to 100°C.

4. Estimation of Alcohol Content and Biochemical Test

Qualitative tests for Sugar, Carbohydrate, Glucose, pH, and Refractive index were checked after distillation. The amount of ethanol estimated by Cole's ferrous cyanate method.

5. Synthesis of Bioethanol Flammable Gel and Its Potential:

Take 400 ml Distilled water in a beaker and add 2gms of Carbopol stir mix well and let it set for 1 hour. Dropwise add 10% NaOH till the mixture turns into gel, add prepared Bioethanol and let it set. (Putra S.et.al)

6. Stability, Flame and Colour Ignition Time Test for Bioethanol Flammable Gel

Bioethanol gel was taken into porcelain dish and then burned. The colour and flame of bioethanol gel combustion was observed and recorded. Bioethanol gel was put into a porcelain dish and its ignition time was recorded.

Observations and Results

Biogenic synthesis of Bioethanol was done by Chemical hydrolysis and distillation process. The aim of this study is to produce bioethanol from Sugarcane bagasse, and wheat husks using fermentation process and to determine which biomass is an optimum raw source for production of Bioethanol.

Figure 1: Fermented product after hydrolysis

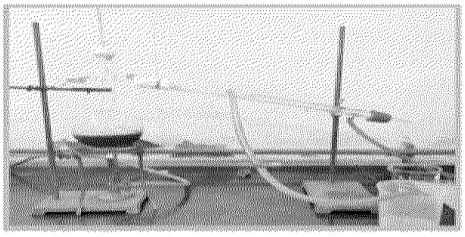


Figure 2: Distillation of Biomass

Bioethanol was successfully produced using these biomasses through pre-treatment where samples were treated with NaOH for 2 hours. After acid hydrolysis with Concentrated Sulfuric acid for 1 hour, the fermentation is carried out by yeast Saccharomyces cerevisiae followed by Distillation at 78 °C. Four samples were tested for pH.

Figure 3: Fermented samples after distillation

Biochemical Tests

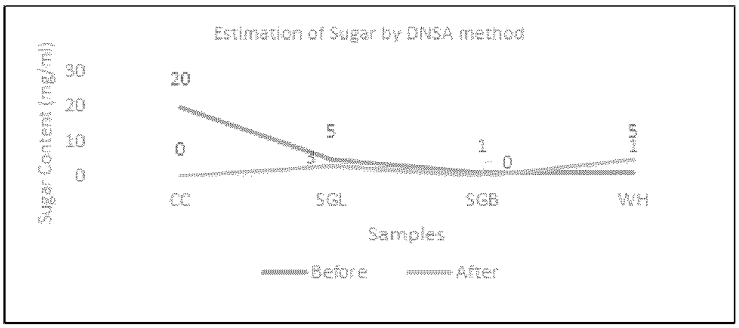
Detection of ethanol was done by Iodoform test. Amount of Sugar was determined by Benedict's test, the intensity of colour were analysed and it was observed that Wheat husk and Sugarcane Bagasse had optimum level of sugars present.

Total carbohydrates were determined by Anthrone test. Wheat husk and Sugarcane Bagasse both of the samples had carbohydrates present in them it was observed by dark colour precipitate.

Sr. no.	Sample	Anthrone Test	Iodoform Test
1	Corn cob(CC)	+	+
2	Sugarcane Leaves(SGL)	+	+
3	Sugarcane Bagasse(SGB)	+	+
4	Wheat Husk(WH)	+	+
KEYS: Positive + ; Negative -			

Table 1: Qualitative test for Carbohydrates and Ethanol

Sugar concentrations were determined by Dinitro salicylic acid (DNSA) Colorimetric method and it was found that Wheat husk had maximum colour intensity.



Graph 1: Estimation of sugars by DNSA method

A Flammable gel was made using the obtained Bioethanol. The gel was prepared using Carbopol and distilled water in appropriate parts and further mixed with the Bioethanol.

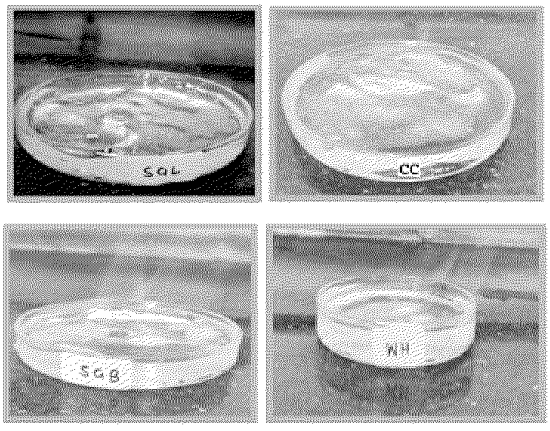


Figure 4: Biothaol based flammable gel

Carbomers are thickening agents that help control the viscosity and flow of cosmetic products. They also help distribute and suspend insoluble solids into liquid, and prevent the oil and liquid parts of a solution from separating. They have the ability to absorb and retain water, and can swell up to 1000 times their original volume when dispersed in water. Generally, this class of ingredients is used in gel-like formulations because it forms a colloidal, mucilage-like consistency when mixed in water.

Ignition time and flame test were performed to the analyse the effect produced after igniting.

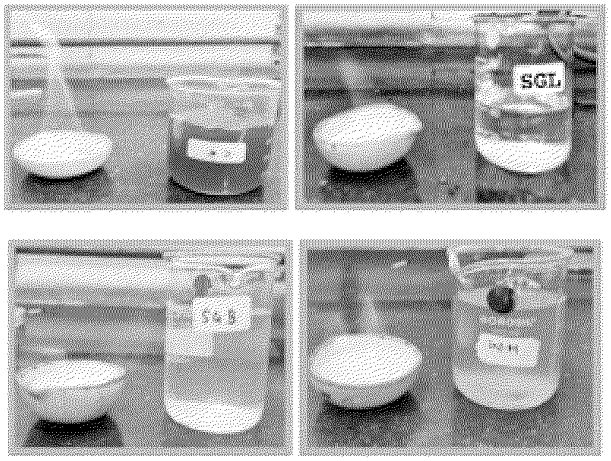


Figure 5: Flame stability and colour test

Flame colour meaning can be indicative of temperature, type of fuel or the completeness of combustion.

Sample	Flame colour	Ignition time
CC	Yellow	2.40 mins
SGL	Blue	2.30 mins
SGB	Blue	1.33 mins
WH	Yellow	1.59 mins

Table 2: Ignition test for Bioethanol Gel

It was observed that Wheat husk i.e.,2 minutes ignited for longer duration than Sugarcane Bagasse. A Yellowish blue flame was observed that indicates complete combustion. Sugarcane ignited for 1.30 minutes and showed a blue coloured flame indicating complete combustion of gases.

A Comparative analysis is made from the obtained data. The extracted bioethanol was put to test in various applications like Flammable gel which can be renewable and can help reduce

usage of LPG for different chemical reactions and production of perfume, to warm food on large scales.

Conclusion

Extracted Bioethanol has been successfully experimented.

Fossil energy sources such as coal, petrol etc. are consumed by the society to produce fuels and chemicals.

These fossil fuels emit GHGs resulting increased global warming and creates environment pollution. Therefore, it is a demand to search an eco-friendly and less costly biofuel. Bioethanol is best option as an alternative fuel. It emits less greenhouse gases and produced from renewable sources. Bioethanol is mainly produced from feedstocks such as sugarcane, sugar beet, rice and corn grain, but the supply of these feedstocks is limited. This limitation will create the food crisis if these feedstocks utilized for bioethanol production. Agriculture waste serves as cheap and abundant biomass for bioethanol production. Agriculture waste can be converted into bioethanol by different pretreatments (physical, chemical, physio-chemical and biological). Biological pretreatments should be used because it is safe, environmentally friendly and less energy consuming as compared to other pretreatments. Pretreated biomass is used for enzymatic hydrolysis followed by fermentation using microbes such as bacteria or yeast. Bioethanol production from agriculture waste will help decrease emission of greenhouse gases, environmental pollution and serve as a sustainable solid waste management strategy

Fossil energy sources such as coal, petrol etc. are consumed by the society to produce fuels and chemicals. These fossil fuels emit GHGs resulting increased global warming and creates environment pollution. Therefore, it is a demand to search an ecofriendly and less costly biofuel. Bioethanol is best option as an alternative fuel.

It emits less greenhouse gases and produced from renewable sources. Bioethanol is mainly produced from feedstocks such as sugarcane, sugar beet, rice and corn grain, but the supply of these feedstocks is limited. This limitation will create the food crisis if these feedstocks utilized for bio-ethanol production.

Agriculture waste serves as cheap and abundant biomass for bioethanol production. Agriculture waste can be converted into bioethanol by different pretreatments (physical, chemical, physio-chemical and biological). Biological pretreatments should be used because it is

safe, environmentally friendly and less energy consuming as compared to other pretreatments. Pretreated biomass is used for enzymatic hydrolysis followed by fermentation using microbes such as bacteria or yeast. Bioethanol production from agriculture waste will help decrease emission of greenhouse gases, environmental pollution and serve as a sustainable solid waste management strategy.

Flame Gel Fuel is an environmentally preferable, clean-burning gel that doesn't leave any messy soot, smoke or ash behind. Gel produced by Bioethanol might have chances for low emission of greenhouse gases.

Flammable gel with Carbopol was set to be used as an alternative fuel. Stable, non-sooty flame was observed for a long duration indicating its potential as Biofuel. A blue fame was observed for both the samples, which indicates complete burning. Bioethanol gel is non-carcinogenic and non-corrosive.

Reference

1. Bano S.et.al, Bioethanol production from rice and wheat husks after acid hydrolysis and yeast fermentation, World Journal of Pharmaceutical research
2. Braide W.et.al., Production of Bioethanol from Agricultural waste, Journal of Fundamental and Applied Sciences
3. Lamido S.et.al, Effect of Process Parameter on the Production of Bioethanol from Corn cob and Rice husk, International Journal of Development research
4. Putra S.et.al, Production of Bioethanol gel from Sugarcane with Carbopol as Alternative Fuel, Chemistry department
5. Saha S.et.al, Production of Bioethanol from Agricultural waste utilizing Fermentation of Saccharomyces cerevisiae, Journal of Bangladesh Agricultural University
6. Wong.Y.C.et.al, Bioethanol production from Sugarcane bagasse using Fermentation Process, Oriental Journal of Chemistry

18. Formulation and Evaluation of Face Pack Prepared using Wheat Flour and Rice Flour

Shilpa Pathak
Department of Biotechnology, DSPM'S K.V. Pendharkar College of Arts, Science & Commerce Dombivli (East), Thane.
Dipali Rane
Department of Biotechnology, DSPM'S K.V. Pendharkar College of Arts, Science & Commerce Dombivli (East), Thane.
Suman Satyarum
Department of Biotechnology, DSPM'S K.V. Pendharkar College of Arts, Science & Commerce Dombivli (East), Thane.

Abstract

The objective of this work is to formulate and evaluate face pack using natural ingredients. With the varying concentrations, different formulations containing ingredients such as wheat flour, Multani mitti, turmeric, chia seed, rice flour, rose water were collected from local market. The ingredient have been reported in this research paper having good anti – inflammatory, anti – oxidants and anti – microbial activity. Both prepared formulations were evaluated by different parameters like organoleptic properties and physical-chemical parameters and stability along with irritancy test and microbial load. Among all formulation, was found to be good in physical parameters, free from skin irritation and maintained its consistency even after stability storage conditions and also having microbiological stability. The face pack were prepared and evaluated for various parameters like color, appearance, pH, consistency, wash ability, antimicrobial activity, Skin test. The result of the test was found to be significant, having good smoothing effect on skin and found effective against Gram positive *staphylococcus aureus*. Natural face packs are used to stimulate blood circulation, rejuvenates them muscle and help to maintain the elasticity of the skin and removes dirt from skin pores.

Keywords: Face Pack, Natural, Formulation, Evaluation.

Introduction

Cosmetics are described as products used for the motive of cleaning, elegance or altering one's look. The natural face pack act with the aid of improving blood movement inside the veins

of pores and skin but the effect of facial face packs generally brief, so for regular glow it should be used 2-3 times every week [1,2]. These preparations are applied to the face as pastes or liquids, then left to dry and solidify to form a film that tightens, cleanses the skin. Typically, they are applied to the skin for fifteen to thirty minutes in order to completely evaporate the water [3]. Nowadays, acne, blackheads, pimples, dark circles are common among young people. According to Ayurveda, skin problems are usually caused by impurity of blood. Present Research deals with the formulation and Evaluation of natural face pack for glowing and acne free skin at home by using rice flour and wheat flour along with other natural materials i.e., Multani mitti, turmeric, chia seeds, coconut oil [4,5].

Wheat is a versatile product in the skincare industry. Wheat protein is packed with beneficial components, including vitamins E, B, and A, as well as certain essential fats and minerals [6]. Rice is rich in Vitamin A, C, E, flavonoid compounds. In addition, it contains ferulic acid and allantoin, all of which are necessary for skin function [7, 8].

Multani mitti helps skin by different ways like removing blackheads and whiteheads, smoothing sunburns, improving blood circulation, complexion, reducing acne and blemishes and gives a glowing effect to a skin as they contain healthy nutrients. [9].

Turmeric is widely known for its potential skin benefits, and it has been used traditionally for skincare in various cultures [10]. Chia could be a good source of gel. Chia seeds are loaded with the benefits of Omega 3 fatty acids and antioxidants that help in keeping the skin bright, young and beautiful [11,12].

Materials and Methods

All the natural materials used in the present study i.e., wheat flour (Triticum Aestivum), rice flour (Oryza sativa), Multani mitti (Calcium bentonite), turmeric (Curuma longa), and chia seed (Salvia hispanica) were purchased from local market.

Materials

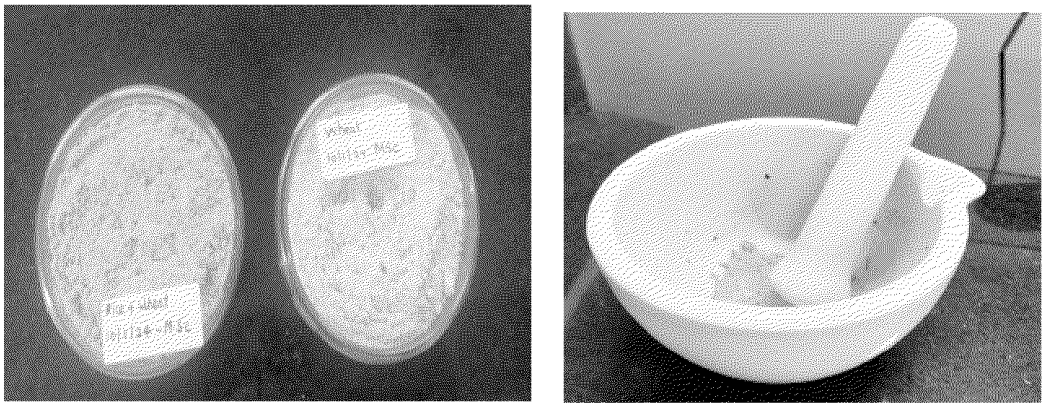
- **Sample** – Wheat flour, Rice flour, turmeric, chia seed, Multani mitti
- **Media: -** Sterile Muellar and Hinton agar
- **Culture: -** 24 hours old culture of *staphylococcus aureus, Candida albicans, Escherichia coli*

Equipments

1. Mortar pestle
2. Hot air oven
3. Weighing balance
4. Autoclave

Table 1: Formula and Material

Sr. No.	Ingredient F1	Ingredient F2	Quantity Given	Quantity taken	Uses
1.	Wheat flour	Rice flour + Wheat flour	40gm	20gm	Wheat flour has many benefits, it absorbs excess oil from the skin.
					Rice is rich in Vitamin A, C, E, flavonoids. Rice flour is good for all type of skin.
2.	Chia seed	Chia seed	5.0gm	2.5gm	It can be used as thickening agent
3.	Multani mitti	Turmeric	3.0gm	1.5gm	Fights acene and pimple removes excess oil, deep cleanses skin removes dirt.
					Antibacterial, antifungal, also adds glove to skin.
4.	Coconut oil	Coconut oil	2.0ml	1.0ml	Moisturizing dry skin.



IMG .1. Formulation of Face pack powder

Methods

1. Formulation

All required natural powder for the face pack preparation were accurately weighed individually using digital balance. Two different formulations were prepared with varying

concentration of all ingredient named as F1 and F2 concentration of each ingredient was mentioned in table 1. The accurate quantity ingredients were weighed and ground into fine powder by using motor and pestle. Then all ingredients were mixed geometrically by dilution method for uniform mixing. Then the prepared face pack was packed into a self-sealable polyethylene bag, labelled and used for further evaluation of various parameters. The formulated face pack was stored in an air tight container.

2. Organoleptic Evaluation

The organoleptic parameters include its nature, color, odor, feel and consistency which were evaluated manually for its nature, odor, feel and consistency which were evaluated manually for its physical properties [13].

a. Stability study

By keeping the created formulation at various temperatures for a month, stability testing was done on it. The packed glass vials of formulation were tested for physical characteristics such as color, odour, pH, consistency, and feel while being stored at different temperatures such as room temperature and 37°c [13].

b. Phytochemical Screening

The aqueous extract of the natural face pack was evaluated for the presence of different phytoconstituents as per the standard procedure.[13].

c. pH:

pH of 1% aqueous solution of the formulation was measured by using a calibrated digital pH meter and pH paper [13]**.**

d. Wash Ability

This is the common method for checking the wash ability of the formulation. The formulation was applied on the skin and then ease and extent of washing with water were checked manually by using 1 litter of water is used to remove all content of the formulation were applied on the surface [13].

E. Tapped Density

Initial powder volume or mass, the measuring cylinder or vessel is mechanically tapped for 1 min and volume or mass readings are taken until little further volume or mass change was observed [13].

3. Irritancy test (Skin)

Take prepared face pack powder in a bowl and add rose water to mix. Mix well and apply over the facial skin. Cover the acne and blemishes spots too. Kept as it is for complete drying for 20 min and then wash with cold water. The pack should be used once a week. It needs to be spread evenly all over the face. Mark a 1-square-centimeter spot on the left dorsal Surface. A specific number of prepared face packs were applied to the designated area, and the application time was recorded. Irritability, erythema, and edema were assessed and reported if present at regular intervals lasting up to 24 hours. [12].

4. Microbial Assay

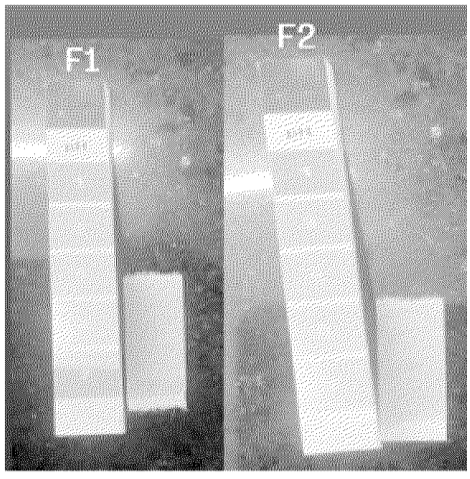
The antibacterial activities of all five formulation were determined by modified agar well diffusion method. In this method, Muellar and Hinton agar plates were seeded with 24 hrs old culture of *Escherichia coli, Candida albicans* and *Staphylococcus aureus*. The agar plates were allowed to solidify. The plates were incubated at 37 degree C for 24 hrs. The antibacterial activities were evaluated by measuring the zones of inhibition [13].

Result and Discussion

1. Organoleptic Evaluation

The organoleptic evaluation was performed for both the face pack F1 and F2, to check the physical parameters like pH, temperature, nature, color, odour, consistency, tap density and other and from those following results were observed as given in Table2. Since all the physical parameters are significant the wheat and Multani pack (F1) and wheat and rice pack (F2) can be further used for skin test. Relate work was carried out by Miss. Telange-Patil P.V in 2022 using rice & orange peel (13).

Sr. No	Parameter	Observation	
		F1	F2
1.	Color	Cremish white	Dark yellow
2.	Odour	No small	Pleasant turmeric
3.	Ph		
4.	Temperature		



IMG .2. PH Test

5.	Tap density		
6.	Consistency	Thick	Thick
7.	Nature	Smooth texture and variability due to different ingredient	Coarse texture variability due to different ingredient

1.

2. Irritancy Test (Skin)

The table below displays the results of the irritancy test. During irritancy trials, the formulation displayed absence of irritation, redness, and edema. This formulation is skin-safe for usage.

Table 3. Irritancy Test (Skin)

Irritation	No
Edema	No
Swelling	No
Redness	No

3. Microbial Assay

Antimicrobial assay of prepared formulation was determined by ditch plate method using Muellar and Hinton agar after incubation of 24 hours at 37^{O}c following result were observed.

Name of the organisms	**Result**
Staphylococcus aureus	Inhibition
Escherichia coli	No Inhibition
Candida albicans	No Inhibition

For further confirmation the agar well method was carried out, but at 3% concentration no significant zone of inhibition was observed in any of the plate. The result were not significant.

Conclusion

Wheat and rice are the most important multipurpose ingredients used in cosmetics because both has multiple uses on skin. From the present work we found good properties for the wheat and Multani mitti pack and wheat and rice pack such as pH, consistency, nature, color and other organoleptic test were in the acceptable range. Skin irritancy test was also significant. shelf life and stability need to check further. Optimization studies are required with increased

concentration of formulation for effective use of both face pack. Now as recent trends since demand for herbal and natural products is increasing. This face pack is good for commercial use.

References

1. Somwanshi, Sachin & Kudale, Kiran & Dolas, Ramdas & Kotade, Kiran. (2017). FORMULATION AND EVALUATION OF COSMETIC HERBAL FACE PACK FOR GLOWING SKIN. International Journal of Research in Ayurveda & Pharmacy. 8. 199-203. 10.7897/2277-4343.083199.
2. Sachin Bhagwat Aglawe*, Amol Uttamrao Gayke, Suraj Anil Mindhe, Varsha Gajanan Rane. FORMULATION AND EVALUATION OF HERBAL FACE PACK. International Journal of pharmacy and biological sciences, 2018; 8(4): 49-52.
3. Millikan L. E. (2001). Cosmetology, cosmetics, cosmeceuticals: definitions and regulations. Clinics in dermatology, 19(4), 371–374. https://doi.org/10.1016/s0738-081x(01)00195-x
4. Barsagde, P. Patil, P. Umekar, M. 2020. A formulation of face pack and hair products of rice water for the use of skin and hair Problem. World journal of pharmacy and pharmaceutical sciences, 9(4):688.
5. Yadav, Pawan. (2011). Nutritional Contents and Medicinal Properties of Wheat: A Review. Life Sciences and Medicine Research. LMSR-22.
6. Barsagade, Prachi & Patil, Pranali & Umekar, Milind. (2021). A FORMULATION OF FACE PACK AND HAIR PRODUCTS OF RICE WATER FOR THE USE OF SKIN AND HAIR PROBLEM. WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES. 9.683-694. 10.20959/wjpps20204-15810.
7. Maspiyah, & Suhartiningsih, & Kusniah, & Naim, (2020). The Physical Properties of By-Product Proportion in Rice Flour-Based Facial Scrub. 10.2991/assehr. k.201014.143.
8. Avhad, Sanket & Dixit, Amol & Akiwate, Jayashri & Aswale, Digvijay & Anbhule, Rahul. (2022). Formulation and Evaluation of Polyherbal Face Pack. Journal of Drug Delivery and Therapeutics. 12. 153-155. 10.22270/jddt. v12i5.5597.
9. Yadav, Roshan & Saha, Hiranmoy & Chanana, Arsh & Singh, Ravinder. (2023). FORMULATION AND EVALUATION OF HERBAL FACE PACK. World Journal of Pharmaceutical Research. 12. 1164. 10.20959/wjpr20232-26991.

19. Encapsulated Agricultural Waste Biomass as a Potential Biosorbent Agent for Heavy Metal and Dye Removal

Pratibha Badal Maharana
Pranali Hanumant Wanve
Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science & Commerce (Autonomous), Dombivli.
Sandeeptha Rathindran
Assistant Professor, Department of Biotechnology, DSPM's K.V. Pendharkar College of Arts, Science & Commerce (Autonomous), Dombivli.

Abstract

Biomass based biosorbent beads prepared from roots of *Anethum graveolens* (Dill), *Trigonella foenum-graecum* (Fenugreek), husks of *Vigna mungo* (Urad dal) and peels of *Ananas comosus* (Pineapple) were investigated for their ability to adsorb heavy metals and dyes from aqueous solution. Heavy metals and dyes are a common contaminant found in the industrial wastewater. In this study, the encapsulated biosorbents were analysed for their adsorption capabilities under parameters of heavy metal and dye concentration and increased contact time of the biosorbents. The results indicated that with increase in contact time of the biosorbent beads with heavy metal and dye solution, there was an increase in percentage removal of heavy metal and dye thus favouring adsorption capability of encapsulated biosorbent beads. The application of biosorbent beads would be economical in remediating environmental pollutants.

Keywords: Biomass, encapsulated biosorbent beads, adsorption, heavy metal and dyes

Introduction

With the onset of industrialization, urbanization and scientific advancements, the use of toxic chemicals containing poisonous heavy metals and dyes have also increased. Heavy metals are defined as metallic elements that have a relatively high density compared to water and that are able to induce toxicity at low level of exposure. Heavy metals occur normally in nature and are also essential to life but can become toxic when accumulated in large quantities in an organism or environment.

Many anthropogenic activities like mining, industrial production processes including foundries, smelters, oil refineries, petrochemical plants, chemical industries, and pesticide production contribute to tremendous release of heavy metals and dyes into the environment. Most commonly used heavy metals that cause a threat to environment and human health include lead, copper, arsenic, zinc, mercury, cadmium, etc. Dyes having high capacity to impart color are actively used in textiles, paper printing, plastic, leather, food, cosmetics, pigment and many other industries. The effluents of these industries cause a serious threat to environment as well as human health if released untreated into water bodies. Water pollution due to heavy metal contamination is one of the major challenge the world is currently facing. This has a direct impact on the aquatic life and risk to human health when the contaminated water ends up mixing with the drinking water. Adverse effects of heavy metal contamination on human health includes low energy levels, anemia, insomnia, diarrhea, nausea, high blood pressure and damage to the functioning of brain, lungs, kidney, liver and other vital organs.

Various physical and chemical methods for pollutant removal have been employed on industrial scale that exploits the properties like adsorption, ion-exchange chromatography, chemical precipitation, electrodialysis, membrane filtration, etc. Recently, there has been a shift towards utilizing agricultural waste biomass as a more eco-friendly, cost-effective, and high efficiency alternative for heavy metal and dye removal. Plant wastes like peels of fruits and vegetables, husks of grains and cereals, and roots have shown the potential to adsorb pollutants like heavy metals and dyes as these agricultural waste biomasses are rich in cellulose, hemicellulose and lignin that can serve as an adsorbent material.

Biosorption is a biological method of accumulating contaminants from waste through metabolically mediated or physicochemical pathways of uptake. It offers several advantages over conventional treatment methods including cost effectiveness, efficiency, minimization of chemical/biological sludge, requirement of additional nutrients, and regeneration of biosorbent with possibility of metal recovery [4]. The present study involves the use of agricultural wastes like Pineapple peels, Black gram (Urad dal) husks, Dill roots and Fenugreek roots as the biomass for preparation of adsorbent material. Alginate is a naturally occurring anionic polymer obtained from brown seaweed, and has been extensively used as a crosslinking agent. Sodium alginate in the presence of calcium ions starts crosslinking in the form of spherical gel beads and this

phenomenon is used to entrap the biomass into the Ca-alginate beads that can be effectively used as an effective and ecofriendly adsorbent material.

Materials and Methods

Biosorbent Preparation

The peels of pineapple, husks of urad dal, roots of dill and fenugreek were washed and rinsed thoroughly under tap water thrice followed by distilled water wash to remove dirt. The samples were then sundried followed by oven drying in hot air oven at 100^0C for 24 hrs. The dried samples were then ground into fine particles with the help of grinder and sieved to get a fine powder of the biomass.

Preparation of Biosorbent Beads

For preparation of biosorbent beads, 6% sodium alginate and 10% calcium chloride solution were prepared. To 6% sodium alginate, defined concentration of biomass was added and mixed. The biomass-sodium alginate mixture was then added dropwise into the chilled 10% $CaCl_2$ solution with the help of a dropper. The beads so formed was kept undisturbed overnight for hardening. The beads were then rinsed with distilled water to remove any traces of $CaCl_2$ and stored for use in biosorption study.

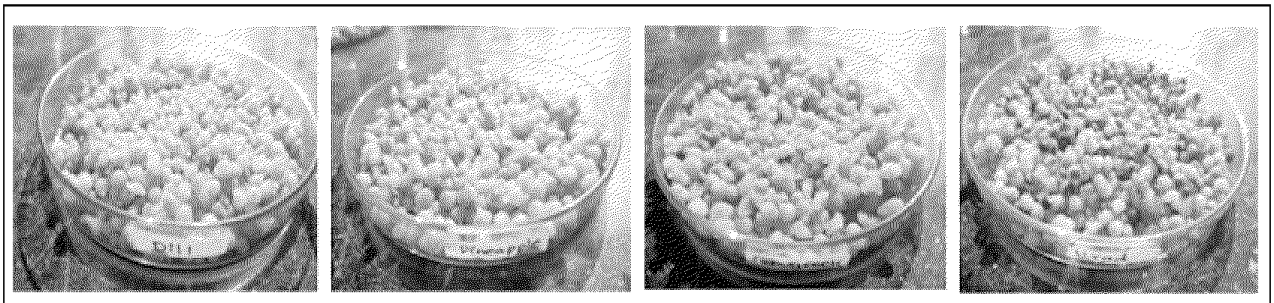


Figure 1. Biosorbent beads prepared from different agricultural biomass

Aqueous Metal and Dye solution preparation

A standard metal solution of 1% Copper sulphate and 0.1% Malachite Green dye solution was prepared and used in biosorption experiment.

Biosorption Experiment

Study of biosorption of heavy metal and dye was performed for all the four encapsulated biomass biosorbent beads. 60ml of each metal and dye solutions were added into 250 ml conical flask having 3g of biosorbent beads of each sample. The flasks were then incubated in orbital shaker at 25^0C set at 80 rpm. The absorbance of each solution with biosorbent beads was recorded after every 1hr of incubation time using UV-VIS spectrophotometer at defined

wavelength for metal and dye solution. The removal percentage of metal and dye from aqueous solutions and adsorption capacity of the prepared biosorbent beads at time 't' were calculated using the equation,

$$\% \text{ Removal} = \frac{(A_o - A_t)}{A_o} \times 100$$

$$Q_t \text{ (mg/g)} = \frac{(A_o - A_t)\, V}{M}$$

where Q_t is the adsorption capacity at time 't', A_o is the initial concentration of metal/dye (mg/L), A_t is the concentration at a given time (mg/L), V is the volume of solution (litre) and M is the mass of biosorbents (g).

Results and Discussion

Effect of Contact Time on Percentage Removal of Heavy Metal and Dye

The effect of contact time on the percentage removal of malachite green dye and heavy metal copper sulphate from the aqueous solution is shown in Figure 1 and Figure 2. Adsorption experiments of different samples were carried out at different time intervals: 60, 120, 180 and 240 mins in a metal solution ($CuSO_4$) and a dye solution (Malachite Green). It was observed that the removal of metal and dye was rapidly achieved within a short period of 60 mins. The results obtained are in accordance with the works of researchers *Nathan et al. 2021; I.E. Agbozu et al. 2014.* Biosorption of Cu ions was attained maximum within 60 mins by Fenugreek biosorbent beads (61.5%) and that by Urad husks beads increased with increase in contact time. Biosorption of Malachite Green was achieved maximum by Urad and Fenugreek biosorbents within 60 mins (90% and 93%, respectively) whereas biosorption by Dill roots beads increased with increasing contact time till 180 mins (92.8%).

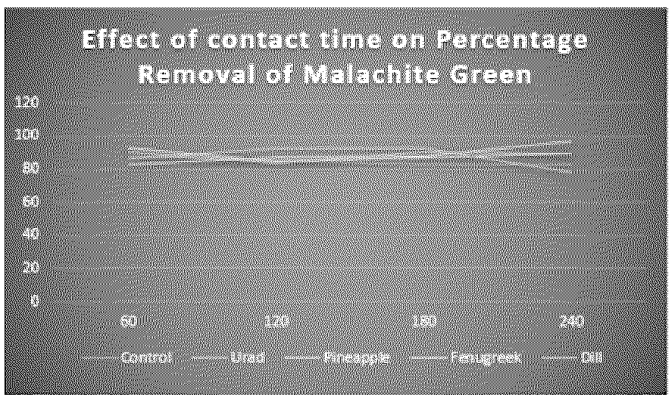


Figure 1. Effect of contact time on percentage removal of dye solution

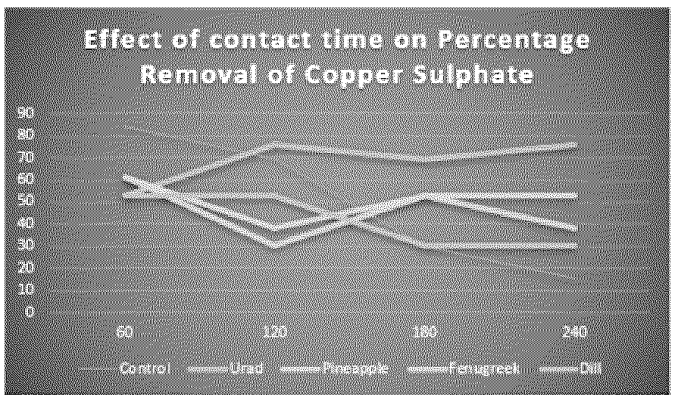


Figure 2. Effect of contact time on percentage removal of metal solution

Study on the Adsorption Capacity of Encapsulated Biosorbents

The effect of contact time on adsorption capacity of different biosorbent beads is shown in Figure 3 and Figure 4. For the samples of Urad, Pineapple and Fenugreek, in the dye solution, it was observed that as the time increased, there is an increase in the adsorption capacity. While in Dill, the maximum adsorption capacity was achieved at 120 mins (20.8 mg/g). In case of metal solution, the maximum adsorption in Pineapple, Fenugreek and Dill sample was achieved at the initial 60 mins (1.6 mg/g, 1.6 mg/g, 1.4 mg/g, respectively) while that in Urad, the adsorption was maximum at 120 mins (1.8 mg/g).

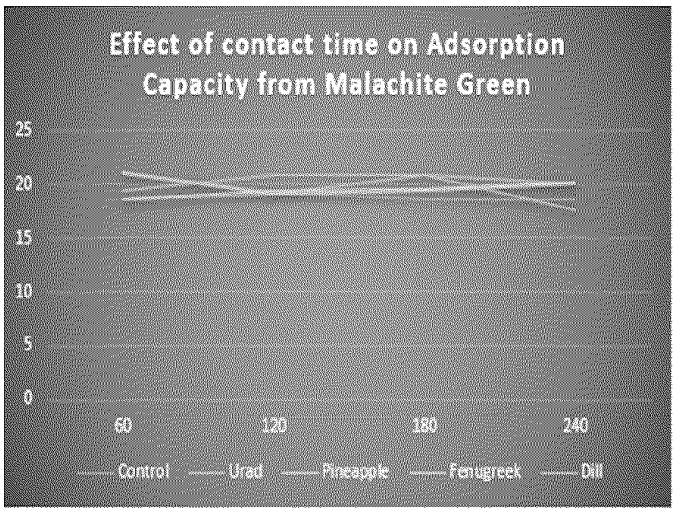


Figure 3. Effect of contact time on adsorption capacity of dye solution

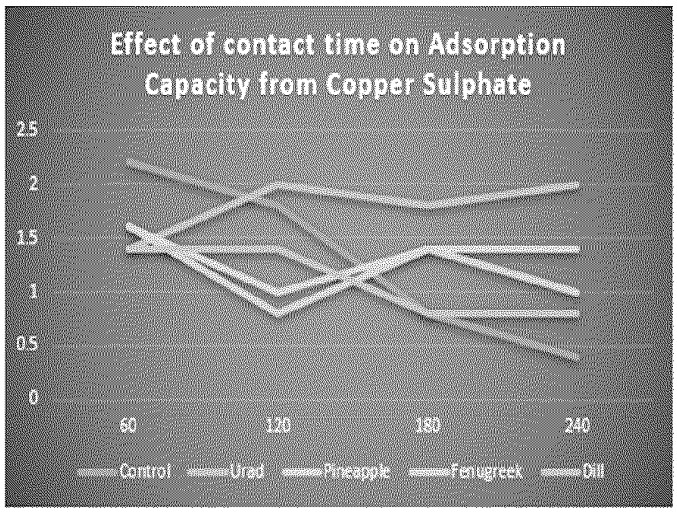


Figure 4. Effect of contact time on adsorption capacity of metal solution

Conclusion

Biomass based biosorbents was prepared by encapsulating biomass in calcium-alginate beads and was used in the removal of heavy metal such as copper and dye such as malachite green from aqueous solution. Based on the findings of this experiment, it can be concluded that out of the four biomass samples under study, the biosorbent prepared from Fenugreek roots was the most efficient for removal of Malachite Green dye with 93% removal efficiency and 21 mg/g adsorption capacity. In case of metal ion removal, Urad dal husks proved to be the most efficient in adsorbing Cu ions from the aqueous solution with 69% removal efficiency and 1.8 mg/g adsorption capacity. Thus, it can be concluded that encapsulating agricultural wastes such as husks, peels and roots in calcium alginate beads can serve as a promising and ecofriendly biosorbent for removal of contaminants from wastes.

References

1. **Abdelfattah Amari, Virendra Kumar Yadav, Sabir Khan Pathan, Bijendra Singh, Haitham Osman, Nisha Choudhary, Khaled Mohamed Khedher, Anup Basnet**, "Remediation of Methyl Red Dye from Aqueous Solutions by Using Biosorbents Developed from Floral Waste", Adsorption Science & Technology, vol. 2023, Article ID 1532660, 17 pages, 2023.
2. **C.L. Chuang a, M. Fan a*, M. Xu a, R.C. Brown a, S. Sung b, B. Saha c, C.P. Huang d**, Adsorption of arsenic(V) by activated carbon prepared from oat hulls, Chemosphere 61 (2005) 478–483.
3. **Guangjun Nie a*, Yipeng Zanga, Wenjin Yue a, Mengmeng Wanga, Aravind Baride b, Aliza Sigdel c, Srinivas Janaswamyc***, Cellulose-based hydrogel beads: Preparation and characterization, Carbohydrate Polymer Technologies and Applications 2 (2021) 100074.
4. **Hima Karnika Alluri, Srinivasa Reddy Ronda*, Vijaya Saradhi Settalluri, Jayakumar Singh. Bondili, Suryanarayana. V and Venkateshwar. P**, Biosorption: An eco-friendly alternative for heavy metal removal, African Journal of Biotechnology Vol. 6 (25), pp. 2924-2931, 28 December, 2007.
5. **I.E. Agbozu* and F.O.Emoruwa**, Batch adsorption of heavy metals (Cu, Pb, Fe, Cr and Cd) from aqueous solutions using coconut husk, African Journal of Environmental Science and Technology, Vol. 8(4), pp.239-246, April 2014.
6. **Leong KOK SENG**, Adsorption of Heavy Metals using Banana Peels in Wastewater Treatment, The Eurasia Proceedings of Science, Technology, Engineering & Mathematics (EPSTEM), 2018 Volume 2, Pages 312-317.
7. **N F Abd Ghapar, R Abu Samah and S Abd Rahman**, Pineapple Peel Waste Adsorbent for Adsorption of Fe (III), IOP Conf. Series: Materials Science and Engineering 991 (2020) 012093.
8. **P. Muthusamy*, S. Murugan**, Removal of Lead Ion Using Maize Cob as a Bioadsorbent, P. Muthusamy et al. Int. Journal of Engineering Research and Application, ISSN: 2248-9622, Vol. 6, Issue 6, (Part -1) June 2016, pp.05-10.

20. Physical, Chemical and Microbial Analysis of Bottled Drinking Water from Different Locations Nearby Mumbai

Riya Bare
Department of Biotechnology, DSPM'S K.V. Pendharkar College of Arts, Commerce & Science (Autonomous), Dombivli.
Seema Dalvi
Assistant professor, Department of Biotechnology, DSPM'S K.V. Pendharkar College of Arts, Commerce & Science (Autonomous), Dombivli.

Abstract

Water Quality Testing is a broad description of various procedures used to analyze water quality. Water testing is just not limited to testing drinking water. It also plays a major role in testing domestic wastewater, industrial effluents, packaged/natural mineral water, ground water, etc. The aim of the present work was to study the quality of bottled drinking water. 12 water samples were collected from Dombivli, Thane, Navi Mumbai and Vashi. The present study includes Physico-chemical and bacteriological characteristics of water. Water samples were analyzed for different parameters like pH, TDS, color, turbidity, odour, hardness, chlorides and alkalinity. The sampling frequency was once every 15 days. From study it was observed that all samples were within limits for physico-chemical parameters except Sample 11. In bacteriological analysis it was observed that Sample 11 was contaminated. Different parameters were analyzed to test the quality of water, to ascertain the safety of water for consumption and establish its portability status.

Keywords: - Water quality, Physiochemical, Bacteriological, Drinking water

Introduction

Water is one of the abundantly available natural resources. Life starts in water, and it's a resource we use every day. All living things, from humans and animals to insects and plants, absolutely need water to stay alive. It's like the universal survival potion for every form of life on Earth. Regularly monitoring water quality has emerged as an essential element in preserving aquatic resources. Lack of access to clean and safe drinking water, as highlighted by the World

Health Organization, is a major cause of around 80% of human disease (Chonde et.al,2014). So, having clean water is like a superpower shield against lots of health problems. Growing urbanization and industrialization show adverse effects on the quality of water which is supplied to different areas and may cause many health problems (Igbeneghu et. Al, 2014). Therefore, the continuous monitoring of water quality is necessary. Assessing water quality aids in detecting contamination and evaluating its overall condition.

pH is important to regulate enzyme systems. Electrical conductivity is a parameter for dissolved ionic substance. Water with hardness above 500 mg/lit may cause scale deposition in the distribution system. Water with a total of 500 mg/lit is considered harmful to human health. Chloride is one of the major constituents found in all-natural water in different concentrations. An elevated concentration of chloride imparts an unfavorable taste to water-based beverages. The higher concentration of salt, especially chloride in water leads to higher electrical conductivity (Pandit 2005 et.al,). If chloride level exceeds 200 mg/lit there is risk of change in taste of water. Total dissolved solid values are useful to determine whether water is suitable for drinking, agriculture or industrial purposes. TDS is obtained mainly due to saltwater contamination and industrial pollution. The higher values of alkalinity indicate the presence of bicarbonate, carbonate and hydroxide in the water body. Adding carbonate to water makes it more alkaline by increasing its alkalinity. As all these parameters can affect human health and are responsible for many diseases (Sasikaran et.al,2012). Certain impurities in our water can cause health problems such as stomach issues, reproductive issues, and problems with the nervous system. Infants, young children, pregnant women, the elderly, and people with weakened immune systems may be especially at risk for illness.

There are three main water quality parameters to measure the quality of water (Biadglegne et. Al,2009)

- Physical water quality parameters include eight principal indicators: electrical conductivity, salinity, total dissolved solids, turbidity, temperature, color, and taste and odor.
- Chemical water quality parameters include pH, acidity, alkalinity, hardness, chlorine, and dissolved oxygen.
- Biological water quality parameters include bacteria, algae, nutrients, and viruses.

Material and methods

Collection of Samples

12 different water samples were collected from different locations. The seal packed bottles of different brands were bought. The sampling was done at 15 days of interval for triplicate results.

Physical and Chemical Parameters

1. pH – Std buffer solution / tablets pH 4, pH 7, pH 9.2.
2. TDS
3. Turbidity
4. Odour - Odour free distilled water, HCL.
5. Color - Chloroplatinate, crystalline cobaltous chloride, conc. HCL.
6. Alkalinity - Mix indicator and 0.02N H_2SO_4.
7. Chloride - Potassium chromate and 0.014N $AgNO_3$.
8. Residual free Chlorine
9. Calcium - 1N NaOH, Murexide indicator, 0.01N EDTA.
10. Magnesium - Hydroxylamine, Triethanolamine, Ammonia buffer, EBT Indicators, 0.01 N EDTA.
11. Nitrite - Sulphonilamide solution, NEDA.
12. Nitrate - Sulphite urea solution, antimony reagent, Chromotropic reagent, conc.H_2SO_4.
13. Sulphate

Microbiological Parameters

1. Escherichia Coli – Chromogenic Coliform Agar (CCA).
2. Coliform Bacteria – Chromogenic Coliform Agar (CCA).
3. Yeast and Mould - Chloramphenicol Yeast Glucose agar.
4. Sulphite reducing anaerobes - Differential reinforced clostridial medium (DRCM).
5. Pseudomonas aeruginosa - Asparagine proline broth.
6. Aerobic Microbial count - Plate count agar (AMC).

Standard values for chemical and microbiological parameters are mentioned in Table 1 and 2.

Table 1: Chemical Parameters with Standard Limit

Sr. No.	Characteristics	Standard value as per BIS	Reference
1	PH value	6.0- 8.5	IS 3025 Part -11
2	Total dissolved solids	500 ppm	IS 3025 Part- 16
3	Turbidity	2 NTU	IS 3025 Part- 10
4	Odour	Agreeable	IS 3025 Part- 5
5	Color	2 Unit	IS 3025 part- 4
6	Alkalinity	200 ppm	IS 3025 part- 23
7	Chloride	200 ppm	IS 3025 part- 32
8	Residual free chlorine	0.2 ppm	IS 3025 Part -26
9	Calcium	75 ppm	IS 3025 part- 40
10	Magnesium	30 ppm	IS 3025 part- 46
11	Nitrite	0.02 ppm	IS 3025 Part- 34
12	Nitrate	45 ppm	IS 3025 Part- 34
13	Sulphate	200 ppm	IS 3025 Part- 24

Table 2: Microbiological Parameters with Standard Limit

Sr. No.	Characteristics	Standard value as per BIS	References
1	Escherichia Coli	Absent per 250 ml	IS 15186
2.	Coliform Bacteria	Absent per 250 ml	IS 5401 Part 1
3.	Sulphite reducing anaerobes	Absent per 50 ml	Annex C of IS 13428
4.	Pseudomonas aeruginosa	Absent per 50 ml	Annex D of IS 13428
5.	Aerobic Microbial count	22°C- 100 cfu/ml 37°C - 20 cfu/ml	IS 5402
6.	Yeast and Mould	Absent per 250 ml	IS 5403

Note: cfu/ml – colony forming unit per ml

Results and Discussion

One bottle of each brand (1 L) was bought from randomly selected grocery stores in Dombivli, Thane, Navi Mumbai and Vashi. A total of 12 brands (such as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12) were analysed. All samples selected for this study were stored at room temperature (25-30°C) and the samples analysed were within 1-6 months of the date of manufacture.

Physico-Chemical Parameters

The observed values for physico-chemical parameters (Table 3) were compared with the standard values (Table 1). In comparison it is found that TDS in sample 11 is very low and for

the same sample calcium content is 0.8 mg/L and magnesium is not present which is not matching the standard limits.

Table 3: Observations for Physico-Chemical Parameters

Sample	1	2	3	4	5	6	7	8	9	10	11	12
pH	6.8	6.9	7.0	6.6	7.1	7.1	7.0	6.8	6.7	6.1	6.3	6.9
TDS	47	48	50	49	42	52	50	45	47	50	21	50
Turbidity	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1
Odour	A	A	A	A	A	A	A	A	A	A	A	A
Color	1	1	1	1	1	1	1	1	1	1	1	1
Alkalinity	26	26	28	25	22	29	28	24	26	28	11	28
Cl	13	13.2	14.1	13.7	11.8	14.4	14.1	12.8	13.2	13.7	1.98	15.2
RFC	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Ca	7.2	6.5	7.0	6.8	6.5	7.3	6.9	6.5	6.6	6.6	0.8	7.1
Mg	1.9	1.8	2.0	1.8	1.6	2.7	1.9	1.7	1.7	2.1	Nil	2.5
Nitrite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
So4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Keys: A – Agreeable **ND** – Not Detected

Microbiological Parameters

The observed results for Microbiological parameters (Fig.1 to 6) were compared with the standard values (Table 3). On comparison it is found that Sample 1 to4t 10 and Sample 12 follows standard limit according to BIS (Bureau of Indian standard) but sample 11 is doesn't follow the standard limits. In Sample 11, there is a presence of Blue-violet colonies; it means growth of E. coli is observed in Sample 11 water (Fig.1). Yeast commonly appears as round white, smooth and elevated colonies. Molds appear in a large range of colors but are easily recognized by their fuzzy or cottony appearance. In sample 11 we observed, fuzzy and cottony appearance means there is presence of mold (Fig.2). All 12 samples are negative for the presence of Sulphite reducing anaerobes and Pseudomonas aeruginosa (Fig. 3 & 4). Aerobic Microbial count 22°C- 100cfu/ml and 37°C - 20 cfu/ml is the standard limit but sample 11 exceeds the limit as we observed white colonies on Total Plate Count media (Fig. 5).

Fig. 1 Observations for Escherichia Coli and Coliform Bacteria (CCA)

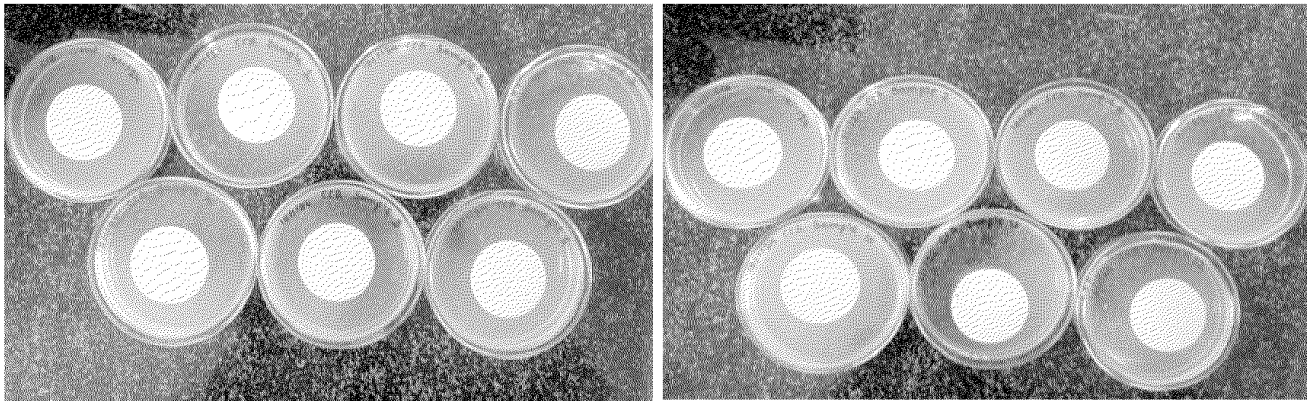


Fig.2 Observations for Yeast and Mould

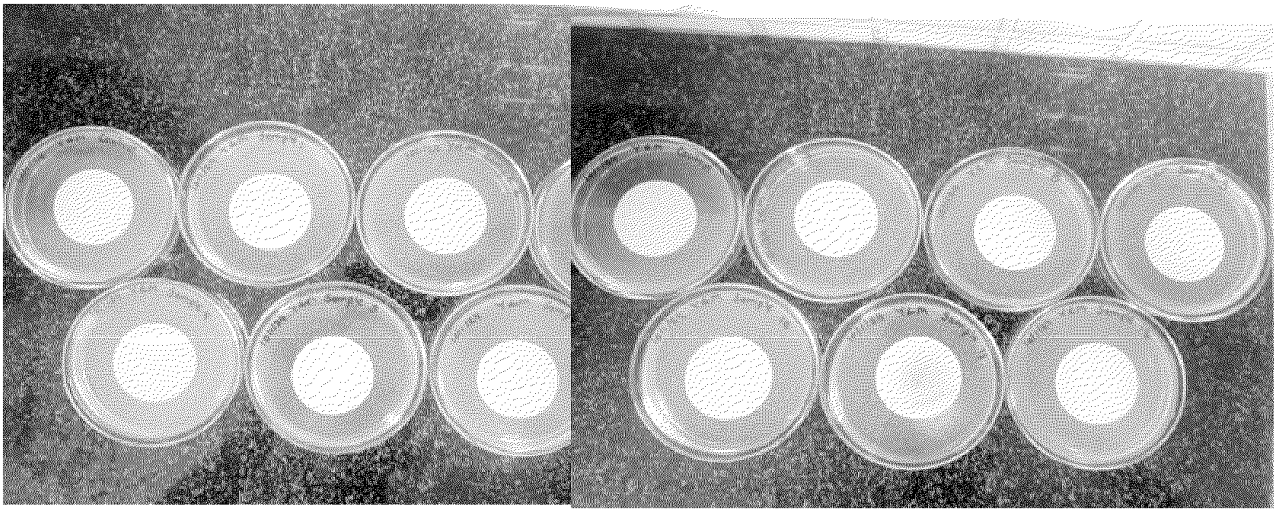


Fig. 3 Observation for Sulphite Reducing Anaerobes (SRA)

Fig. 4 Observation for Pseudomonas Aeruginosa (PS)

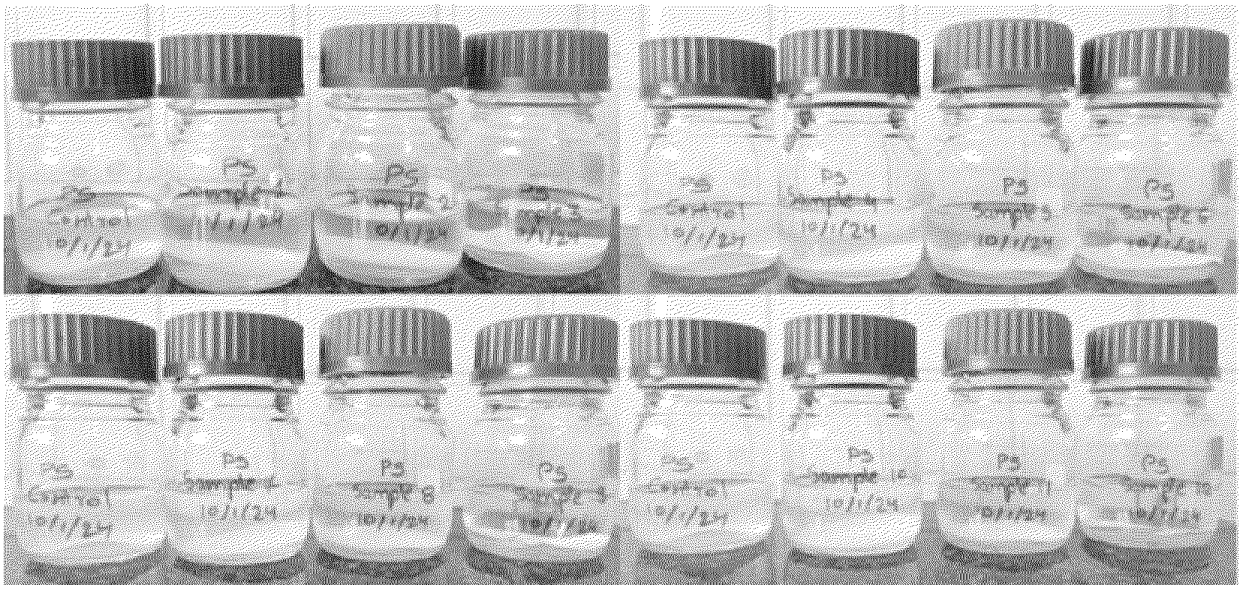
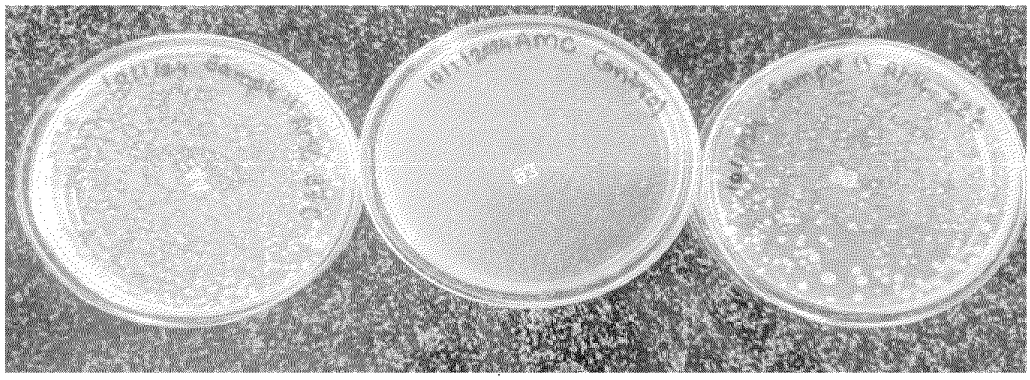


Fig.5 Observation for Aerobic Microbial count (37°C & 22°C) for Sample 11



Conclusion

The present work deals with the water quality analysis from different locations nearby Mumbai. The study of physico-chemical and microbiological analysis of drinking water was performed. A total of 12 water samples were collected during the study. These samples were analyzed for different Physico-chemical and microbiological parameters. The present study reveals some of the water samples wears within the permissible limit drinking water standard. As compared to all samples, in sample 11 minerals are not present in adequate amounts and there is a presence of coliform, mold and aerobic microorganisms. So, this Sample 11 needs some treatments to be potable. It is necessary to maintain the Standard limit of each parameter to be the drinking water.

If E. coli, mould and aerobic microbes are present in water, it poses a risk of causing gastrointestinal illness and other health problems if ingested. If aerobic microbial counts are

present in water, it suggests that the water may be contaminated with microorganisms that require oxygen for growth. While some aerobic bacteria are harmless, elevated microbial counts can indicate potential health risks and water quality issues. Therefore, this water sample can be treated in the following ways to remove coliforms from the water and make it potable.

1. Boiling Water
2. Filtration
3. Chlorination
4. Water Treatment Systems

Bibliography

- Biadglegne F, Tessema B, Kibret M, Abera B, Huruy K, Anagaw B, Mulu A. Physicochemical and bacteriological quality of bottled drinking water in three sites of Amhara Regional State, Ethiopia. Ethiop Med J. 2009 Oct;47(4):277-84.
- Chonde Sonal G., Mohite Ashwini S. and Raut P. D. Studies on drinking water quality at public transport stations from Kolhapur and Sangli city Pelagia Research Library, 2014, 5(2):316-327.
- Igbeneghu OA, Lamikanra A. The bacteriological quality of different brands of bottled water available to consumers in Ile-Ife, south-western Nigeria. BMC Res Notes. 2014 Nov 28; 7:859
- Pandit B R and Forum B Oza., 2005, Nature Environment and Pollution Technology, Techno-science publications, vol.4, No.3, page 453-454.
- Product manual for packaged drinking water (other than packaged natural mineral water) According to IS 14543:2016. May 2020
- Sasikaran S, Sritharan K, Balakumar S, Arasaratnam V. Physical, chemical and microbial analysis of bottled drinking water. Ceylon Med J. 2012 Sep;57(3):111-6

21. Ecosorb: Harnessing Power of Pineapple in Pharmaceutical and Dye Waste Cleanup

Mithil Suhas Rane
Department of Biotechnology, DSPM'S K. V. Pendharkar College of Arts, Science & Commerce (Autonomous), Dombivli.
Swapnil Eknath Malavkar
Department of Biotechnology, DSPM'S K. V. Pendharkar College of Arts, Science & Commerce (Autonomous), Dombivli.
Sneha Pande
Assistant Professor, Department of Biotechnology, DSPM'S K. V. Pendharkar College of Arts, Science & Commerce (Autonomous), Dombivli.

Abstract

This abstract discusses the critical issue of Emerging Contaminants (ECs), including Pharmaceutical Active Compounds (PhACs) and toxic dyes, posing risks to ecological and human health in low concentrations in wastewater. The persistent nature of these contaminants, found in various industrial sectors like textiles and pharmaceuticals, necessitates effective management and disposal strategies. It proposes the adsorption process. Particularly leveraging pineapple waste with its high cellulose content. The biosorbent derived from pineapple waste removes and reduces the pharmaceutical pollutants and dyes when treated with the same. Amount of biosorbent and time period required for lowering the levels of contaminants are key points for the action of biosorbent. Thus "Ecosorb" is a cost-effective and eco-friendly solution to mitigate the dangers associated with these contaminants in industrial waste discharge.

Introduction

Despite low concentrations, they pose threats due to potential health effects and resistance to conventional degradation. Pharmaceutical active compounds (PhACs) are significant ECs, persisting in the environment. The rise in Pharmaceuticals and Personal Care Products (PPCPs) contributes to increased water pollution. The discovery of penicillin in 1929 marked a pivotal moment in medicine, but the widespread use of antibiotics has led to environmental contamination. Antibiotic pollution, poorly regulated globally, extends to diverse environments, impacting human-made settings and contributing to hazardous waste in

pharmaceutical contexts, particularly in diagnostic laboratories. Notable hazardous chemicals include Xylene, Acetone, Ethyl acetate, N- butyl alcohol, Cyclohexanone, Methanol, Toluene, Isobutanol, chloroform and Benzene.

The textile industry is a major water consumer and polluter due to the release of industrial dyes. These dyes harm water bodies, affecting visual appearance, increasing BOD and COD, hindering photosynthesis, and posing risks to ecosystems and human health. Organic dyes, especially in industries like textiles, dyestuff, leather, food, paper, and printing, create complex pollution due to their molecular structures. Methylene Blue, a commonly used dye, has applications like paper colouring and temporary hair colorant but can have harmful effects on humans, including increased heartbeat and other health issues.

Pineapple waste, often discarded, possess valuable properties such as cellulose content ranging from 69.5-71.5%. These waste, rich in cellulose, lignin, pectin, and other substances, have the potential to serve as an eco-friendly adsorbent for pharmaceutical waste contaminants and dyes in polluted water. The carbon compounds in pineapple leaves, particularly cellulose and lignin, make them suitable for reducing and handling pharmaceutical contaminants and dyes in industrial waste, preventing environmental pollution. Utilizing pineapple leaves as a natural adsorbent presents an economical and environmentally friendly approach to address water pollution caused by industrial discharge. This paper focuses on harnessing potential of alternative biosorbent derived from nature to mitigate the impact of waste contamination. Meanwhile, pineapple waste contains cellulose, lignin, pectin, and other substances, with cellulose content ranging from 69.5-71.5%. Recognizing the environmental impact of pharmaceutical waste and dyes, the paper explores pineapple waste as an alternative adsorbent material to reduce EC's pollution in water bodies. The adsorption process emerges as a cost-effective and environmentally friendly solution to mitigate the dangers associated with pharmaceutical contaminants and dyes from industrial waste discharge.

Materials and Methodology

Preparation of Treated Pineapple Biosorbent

Pineapple waste (crown) is collected from nearby fruit vendors. Then pineapple waste is washed and clean with distilled water to remove dust and impurities. Pineapple crown then dried in oven at 100°c for 24-48hr. Sample is then grind and screened by 175-micron sieve. Dried powder were treated with 1M NaOH using a 1:10 ratio of weight/volume. The slurry then boiled

for 3hr with continuous stirring at 300RPM in incubator shaker. Slurry mixture then washed with distilled water few time until p.H.7 is obtained. Then slurry mixture is oven dried at 100°c for 18-24hr. Then dried powder was stored in air tight container.

Preparation for Different Concentration of Pharmaceutical Contaminants

Different concentration solutions of penicillin G were prepared by dissolving required amount of penicillin G powder in distilled water. Concentrations of 0.009, 0.01 and 0.04mg/dl of Penicillin is prepared by dissolving in 100ml of water. Concentration of erythromycin of 250, 300, 350mg/10ml is prepared by dissolving the required amount of standard erythromycin solution in distilled water. In prepared concentration 0.2ml methylene blue dye is added and keep it in boiling water bath at 50°c for 15 min.The standard concentration of xylene is prepared by adding 0.004, 0.006, 0.008ml of xylene solutions in 10ml of distilled water.

Preparation for Different Concentration of Industrial Dyes

Textile, dye, leather, and food industries produce colourful and harmful waste which contains toxic dyes. Commonly dyes found in wastewater are crystal violet, methylene blue and safranine are prepared for the testing and treatment.50mg of dye powder is added in 50ml of distilled water to make 1000ppm concentration of dyes. For this volume 10, 0.8 and 0.6ml of dye solution is added in to 90ml of distilled water to prepare concentrations of 60, 80 and 100ppm.

Observation

1. Prepared Biosorbent from Pineapple Waste

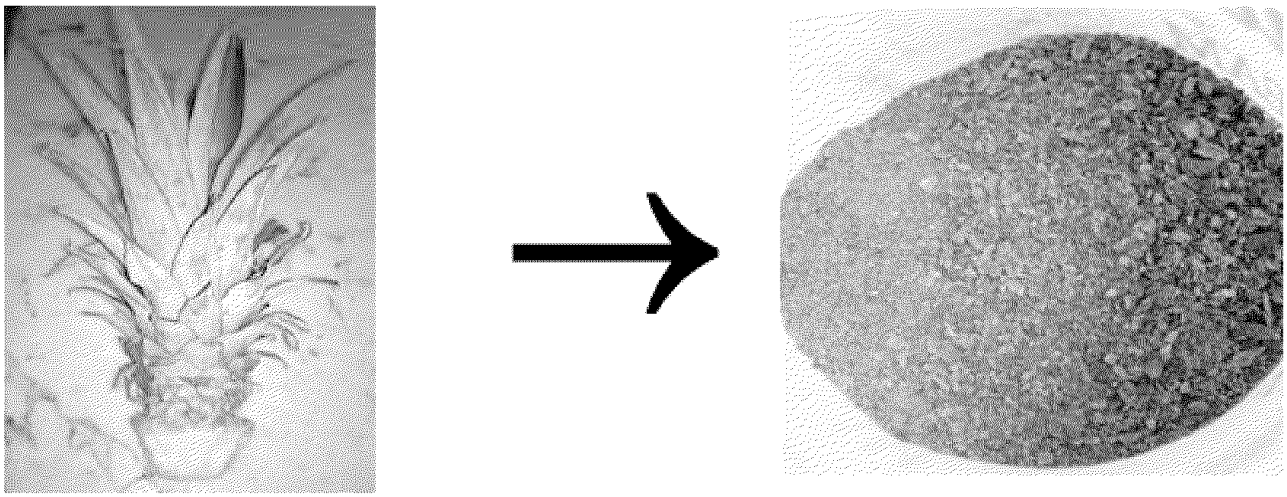


Figure 1: Pineapple Powder made from Waste

Figure 2: Biosorbent Chips Prepare from Pineapple Powder

2. Tests of Penicillin G. Contamination in Water

Sr.no	Concentration of stock solution (mg/dl)	Absorbance at 283nm without biosorbent	Absorbance at 283nm with biosorbent. 0.2gm/ 5min	Absorbance at 283nm with biosorbent 0.2gm/10min
1	0.009	0.057	0.013	0.007
2	0.01	0.074	0.016	0.007
3	0.04	0.089	0.023	0.005

Table 2.1: Observation table of Penicillin G at 282nm.

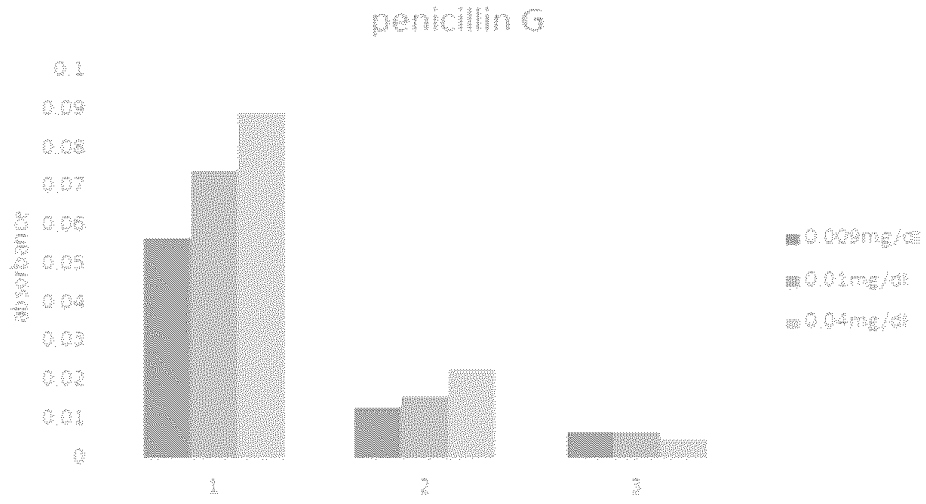


Figure 2.1: Graphical Representation of Change in Penicillin Concentration

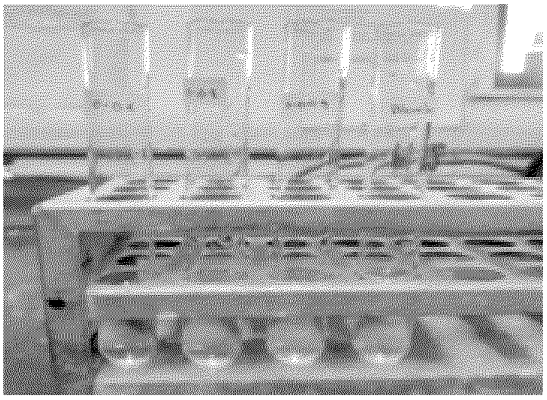


Figure 2.2: Before addition of biosorbent.

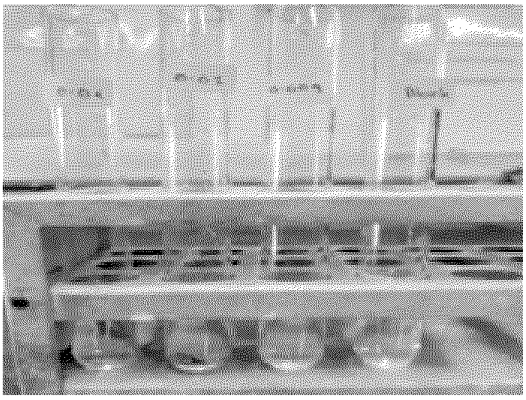


Figure 2.3: After addition of biosorbent.

3. Tests of Erythromycin Contamination in Water

Sr.no	Concentration of solution. (mg/10ml)	Initial (absorbance at 480nm)	With biosorbent 0.05gm/10min (absorbance at 480nm.)
1	250mg/10ml	0.12	0.09
2	300mg/10ml	0.09	0.08
3	350mg/10ml	0.05	0.02

Table 3.1: Observation table of Erythromycin at 480nm.

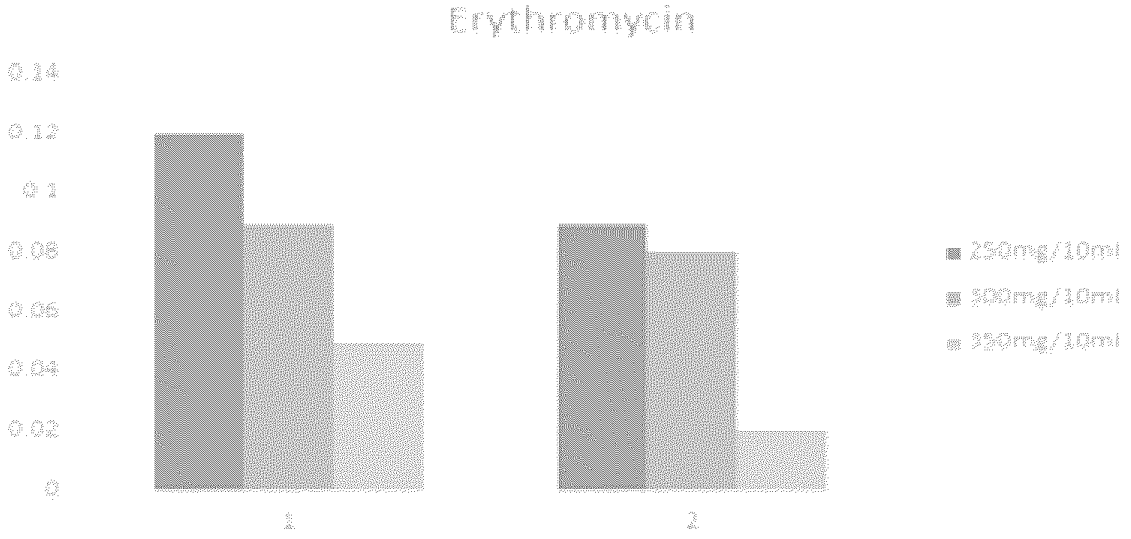


Figure 3.1: Graphical Representation of Changes in Erythromycin Concentration

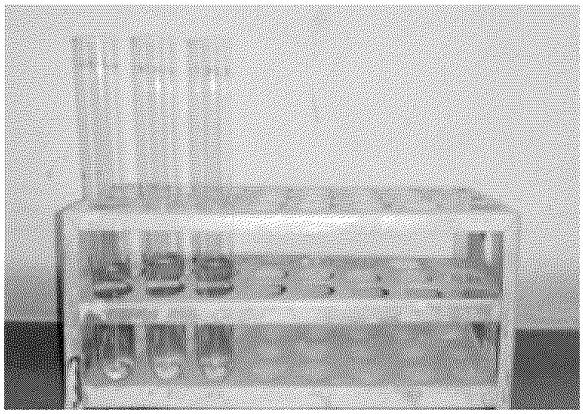


Figure 3.2 Before addition of biosorbent.

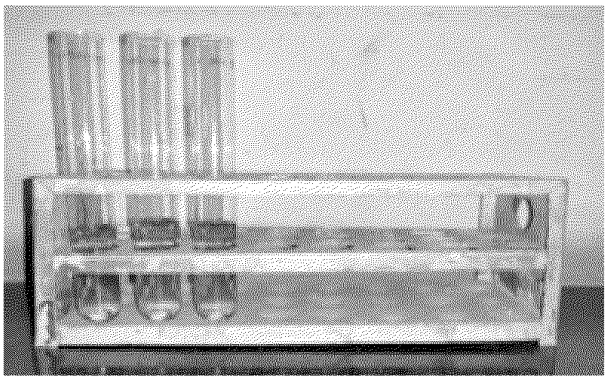


Figure 3.3: After addition of biosorbent.

4. Tests of Xylene Contamination in Water

Sr.no	Concentration of solution. (mg/10ml)	Initial (absorbance at 192nm.)	With biosorbent 0.05gm/10min (absorbance at 192nm.)	With biosorbent 0.1gm/ 20 min (absorbance at 192nm.)
1	0.004ml/10ml	0.148	0.146	0.144
2	0.006ml/10ml	0.149	0.147	0.145
3	0.008ml/10ml	0.150	0.148	0.146

Table 4.1: Observation table of Xylene at 192nm.

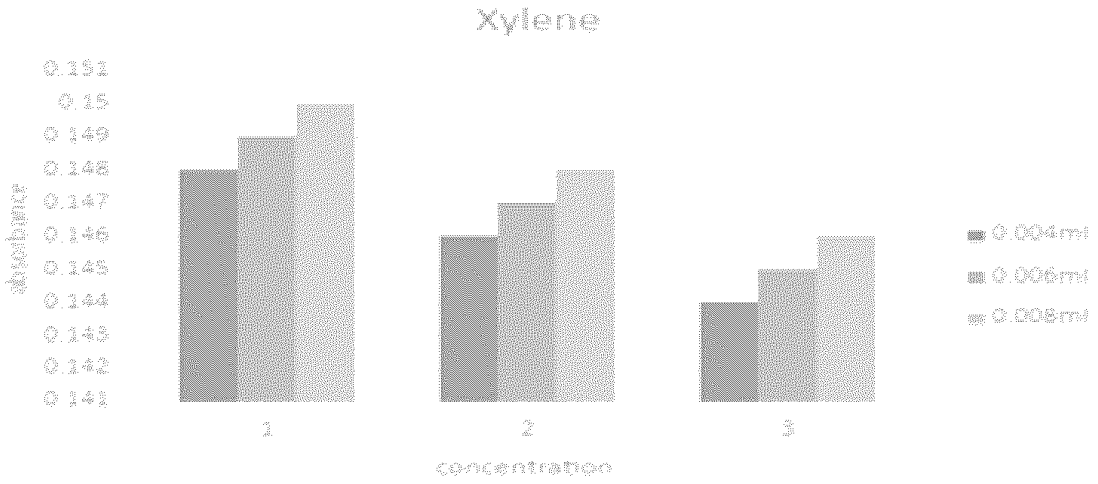


Figure 4.1: Graphical Representation of Changes in Xylene concentration.

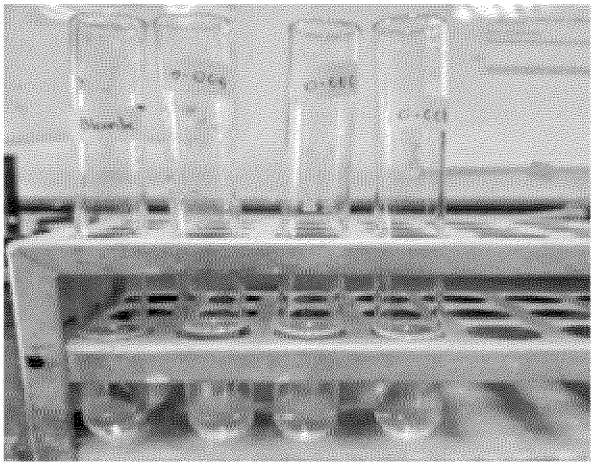


Figure 4.2: Before addition of biosorbent.

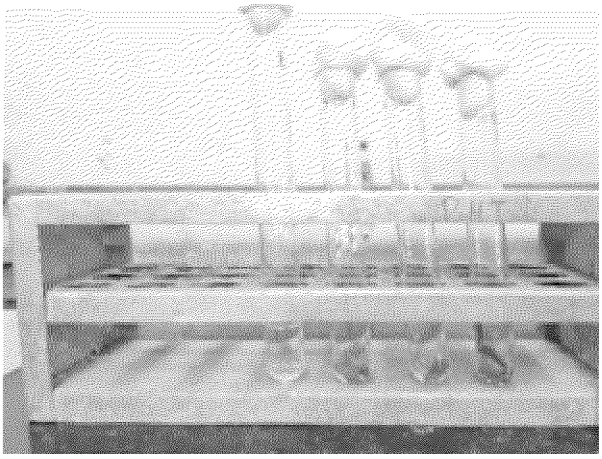


Figure 4.3: After addition of biosorbent

5. Tests of Methylene Blue dye Contamination in Water

Sr.no	Concentration of solution (ppm).	Initial (absorbance at 668nm.)	With biosorbent, 0.05gm/5min. (absorbance at 668nm.)	With biosorbent, 0.05gm/10min. (absorbance at 668nm.)
1	60ppm	1.157	1.064	0.994
2	80ppm	1.454	1.325	1.181
3	100ppm	1.928	1.630	1.446

Table 5.1: Observation Table of Methylene Blue Dye at 668nm.

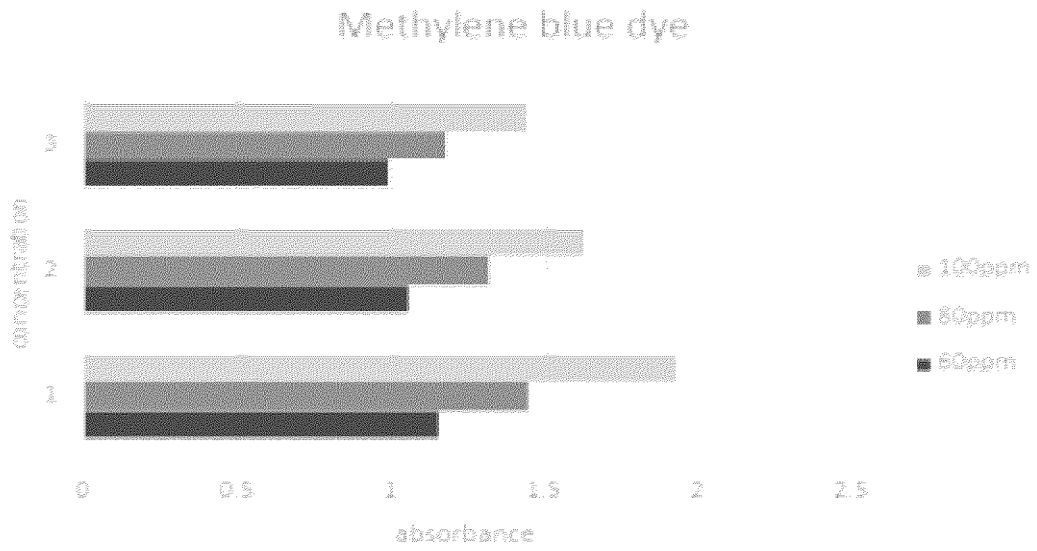


Figure 5.1: Graphical Representation of Changes in Dye Concentration.

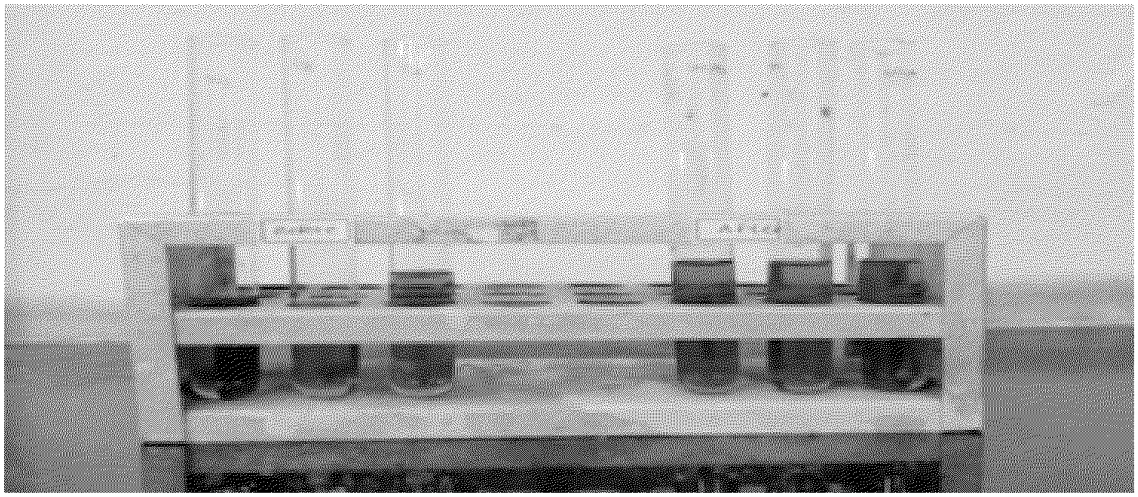


Figure 5.2: Before and after Addition of Biosorbent

6. Tests of Crystal Violet Dye Contamination in Water

Sr.no	Concentration of dye. (ppm)	Initial (absorbance at 592nm.)	With biosorbent, 0.05gm/5min (absorbance at 592nm.)	With biosorbent, 0.1gm/15min (absorbance at 592nm.)
1	60ppm	2.18	2.16	2.13
2	80ppm	2.21	2.19	2.14
3	100ppm	2.23	2.21	2.18

Table 6.1: Observation table of Crystal violet dye at 592nm.

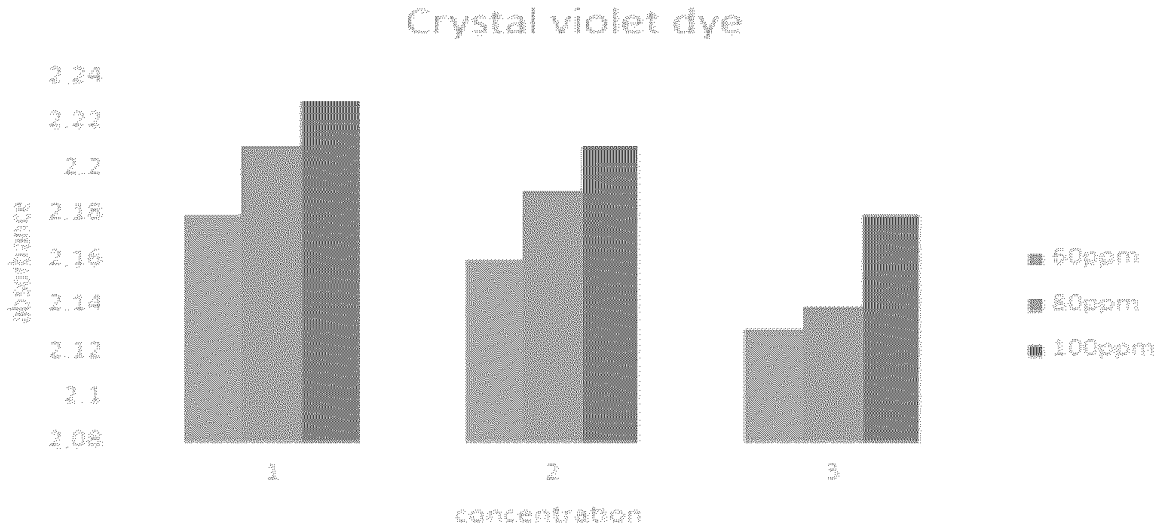


Figure 6.1: Graphical Representation of Changes in Dye Concentration

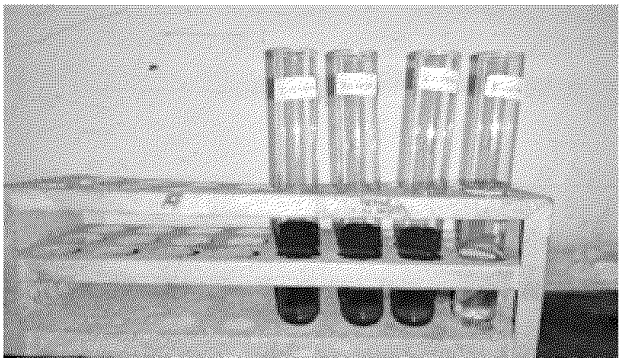


Figure7.2: Before addition of biosorbent.

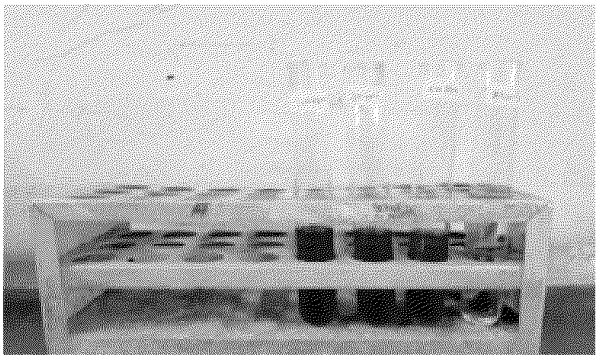


Figure 7.3: After addition of biosorbent.

Conclusion

The pineapple waste biosorbent, proven effective through UV-vis spectrophotometry, swiftly reduces pharmaceutical pollutants and dyes. Just 5 minutes of exposure demonstrates a noticeable decrease, while extending to 10 minutes amplifies the impact. Doubling the biosorbent quantity significantly enhances contaminant reduction, showcasing its pivotal role in achieving improved results. Time and quantity of biosorbent used are key in optimizing wastewater treatment.The transformative potential of biosorbent extracted from pineapple waste, enriched with cellulose, pectin, and lignin, emerges in combatting pharmaceutical waste contaminants and dyes. The carbon compounds within, notably cellulose and lignin, empower this biosorbent to not only reduce but effectively remove pollutants from wastewater, serving as a shield against environmental pollution.

This eco-friendly revolution of adsorbent which is cost-effective, crafted from abundant pineapple waste, emerges as a beacon of simplicity in waste management. Abstain from complexity, we employ basic techniques washing, cutting, drying, and slurry formation to create a powerful chips or flakes of biosorbent. With pineapple waste outweighing its edible counterpart, this solution not only tackles environmental issues but also proves economically efficient. Its reliability extends to a commendable shelf life, ensuring easy storage in airtight containers for continued, impactful waste removal.

In essence, this pineapple waste-derived biosorbent emerges as a beacon in the water bioremediation. Its cost- effectiveness and sustainability present a compelling solution, addressing the pressing challenges posed by pharmaceutical and dye pollution. By harnessing the potential of biosorbents, we not only purify water but also contribute to a brighter, cleaner environment, and marking healthier future.

Bibliography

1. Ahmed, M. J., & Hameed, B. H. (Mar 2018). Removal of emerging pharmaceutical contaminants in a fixed bed column. *Ecotoxicology and Environmental Safety, 149*, 257-266.
2. Ayob, A., Nirfatiha, M., Zamre, M., Arifin, N. I. M., Rani, N. H. A., & Mohamad, N. F. (2020). Pineapple waste as an adsorbent to remove lead from synthetic wastewater. International Journal of Latest Research in Engineering and Management, 4(10), 1-8.
3. Bhattacharjee, C., Dutta, S., & Saxena, V. K. (2020). A review on biosorptive removal of dyes and heavy metals from wastewater using watermelon rind as biosorbent. Environmental Advances, 2, 100007.
4. Gros, M., Petrovic, M., Ginebreda, A., Barcelo, D., (2010). Removal of pharmaceuticals during wastewater treatment and environmental risk assessment using hazard indexes. Environment International, 36(1), 15-26.
5. Herriott, R. M. (1946, March 28). Spectrophotometric Method for the Determination of Penicillin.*Rockefeller Institute for Medical Research.*725-737
6. https://www.mdpi.com/2305-6304/10/10/561
7. Mohammed, M. A., Ibrahim, A., & Shitu, A. (2014). Batch removal of hazardous safranin-O in wastewater using pineapple peels as an agricultural waste-based adsorbent. *International Journal of Environmental Monitoring and Analysis*, 2(3), 128-133.
8. Wankhade, R., Bhalerao, S., Panchory, H., Pundir, A., & Pradhan, R. (2012). Analysis of Erythromycin and Benzoyl Peroxide in Combined Dosage Form by UV-Visible Spectrophotometry. International Journal of Pharmacy and Pharmaceutical Sciences, 4, [527-531].
9. Yamuna, M., & Kamaraj, M. (Year). Pineapple peel waste activated carbon as an adsorbent for the effective removal of methylene blue dye from aqueous solution. *International Journal of ChemTech Research*, 9(05), 544-550.

22. Production of Bioplastic from Agro-Wastes

Sakshi Yadav
Department of Biotechnology, DSPM's K.V. Pendharkar College (Autonomous), Dombivli.
Seema Agashe
Department of Biotechnology; DSPM's K. V. Pendharkar College (Autonomous), Dombivli.

Abstract

Agro-wastes sourced from various origins, such as pineapple, orange, and lemon peels, along with rice husk and watermelon rinds, serve as carbon-rich precursors for bio-based polymer production. Utilizing these renewable resources minimizes environmental impact. This research investigates the viability of employing waste materials like watermelon rind and orange peels to craft bioplastics. The materials underwent drying, grinding, and glycerol processing to create the bioplastics. Assessment included characterizing the resulting bioplastics for water absorptivity, biodegradability, and antimicrobial properties. Leveraging agro-waste for bioplastic production offers an eco-friendly solution for waste management, reducing reliance on non-renewable resources. The development of cost-effective production methods is crucial for advancing commercial bio-based polymer production and replacing synthetic polymers.

Keywords: Agro-waste, bioplastic, biodegradability, antimicrobial, water absorptivity.

Intoduction

Research based on plastics proves their injurious nature towards human health in many direct or indirect ways. Phthalates or phthalate esters are esters of phthalic acid mainly used as plasticizers (substances added to plastics to increase their flexibility) in Poly Vinyl Chloride (PVC). PVC is a widely used material, including extensive use in toys and other children's products such as chewy teethers, soft figures and inflatable toys. Di (2-ethylhexyl phthalate (DEHP), dibutyl phthalate (DBP), di-isononylphthalate (DINP), di-isodecyl phthalate (DIDP), benzyl - butyl - phthalate (BBP) and di-n- octyl- phthalate (DNOP) are phthalates mainly used in converting polyvinyl chloride (PVC) from a hard plastic to a flexible plastic. Phthalates migrate into the air, into food and into people including babies in their mother's wombs. Growing literature links many of the phthalates with a variety of adverse outcomes, including increased adiposity and insulin resistance, decreased anogenital distance in male infants, decreased levels of sex hormones, and other consequences for the human reproductive system, both for females and males; Infants and children may be especially vulnerable to the toxic effects of phthalates

given their increased dosage per unit body surface area, immature metabolic system capability and developing endocrine and reproductive system.[6].

Currently, the bioplastic industry promises good opportunities in this new era, there is a high demand for plastic in global markets. Macromolecules from natural polymers and smaller molecules such as sugar, disaccharides and fatty acids are becoming major raw materials in the production of bioplastics. Starch is one of the major sources in the development of bioplastic. Many previous studies have been conducted by using starch as a natural biopolymer. Starch consists of a long chain of two glucose units joined together, namely branched polymerized amylopectin and amylose, which gives its granular structure. Due to its large availability, low cost, renewability and biodegradability, starches are commonly used in the production of bioplastics.[7]. The bioplastic can be manufactured depending on the general requirements and easily transported and distributed to its resident populations.[9] Agro-wastes are derived from diverse sources including pineapple, orange, and lemon peels, watermelon rinds, rice husk, among other affordable and commonly available materials. The carbon-rich precursors are used in the production bio-based polymers.[6]. Citrus fruits, such as Citrus Sinensis (orange) including natural lignocellulosic materials, consist of three main organic compounds, namely cellulose, hemicelluloses and lignin. It is a kind of biodegradable biopolymer that can be decomposed by microorganisms available in soil naturally into carbon dioxide and water. [10].

One of the plants that contain starch is Citrullus lanatus (Watermelon). Just like other fruit peels, watermelon skins are always trash. As a food ingredient, watermelon rind (albedo) is rarely consumed because of its sour taste. Watermelon albedo still has several useful substances such as vitamin C, citrulline, minerals, and enzymes and contains starch that can be used for the manufacture of bioplastics. Glycerol is suitable for use as a plasticizer in the process of making starch-based plastics. The more plasticizers are added, the more water resistance (swelling) is added. [8].

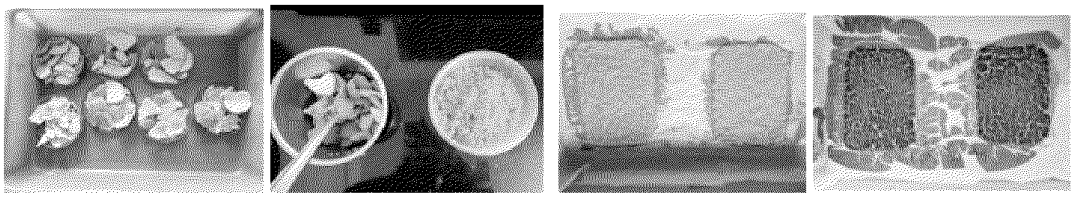
Materials and Methods

Preparation of Orange Peels-Based Bioplastic

- **Materials:** 25g orange peels, 0.1 N HCl- 6 ml, Glycerol- 4 ml, distilled water.
- **Method:** Cut the orange peel into small pieces and keep in hot air oven at 120° for 10 minutes. Blend the orange peels with water. Add 6 ml of 0.1 HCl in sample and stir with glass rod. Add 4 ml of glycerol to the mixture and mix thoroughly with Distilled water. Pour the sample on butter paper placed into tray and keep it for 48 hours. A thin

layer of dry plastic is removed from the plate with the help of the end of the spatula slowly.

Image1: Preparation of Orange peel-based Bioplastic

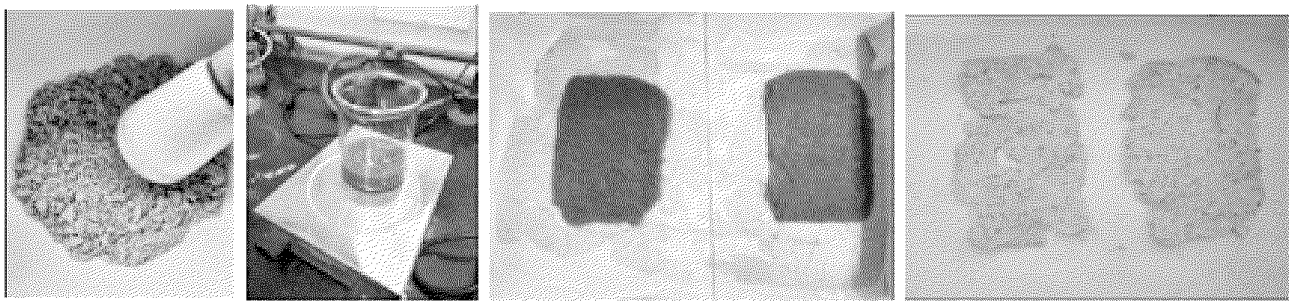


Preparation of Watermelon Rinds-based Bioplastic

Materials: Watermelon rinds, Glycerol- 3ml, distilled water- 100ml.

Method: Wash the watermelon rind and blend with ratio of watermelon : water 3:1(w/w). Watermelon rind pulp is soaked for 24 hrs and separated by water and sediment. The precipitate was dried at room temperature with air circulation which was sprinkled on a longboard for 24 hrs. Five grams of watermelon rind starch was dissolved with 60 ml of distilled water in a beaker and stirred using a magnetic stirrer for 10 mins. Add 3 ml of glycerol in mixture placed on boiling water bath at 80°C for 20 mins. Pour the thick solution on butter paper and air dry for 72 hours.

Image2: Preparation watermelon rind-based bioplastic



Observation

Water Absorption test

Water resistance is an important characteristic in determining a suitable source for bioplastic. The water-resistant capacity is determined with Water Absorption Test. The water absorption of the plasticized starch bioplastic film was carried out at room temperature for 24 hours to obtain the maximum water uptake data. Cut small piece of film into 1cm× 2cm size. Record initial weight of the sample. Place the sample in a beaker containing 60ml water at RT for 24 hours. Take the sample out of the water and wipe it off. Record the final weight.

$$WA\ (\%) = \frac{\text{Final weight (g)} - \text{Initial weight (g)}}{\text{Initial weight (g)}} \times 100$$

Image3: Water absorptivity of Watermelon Rind-based and Orange Peel-based Bioplastic

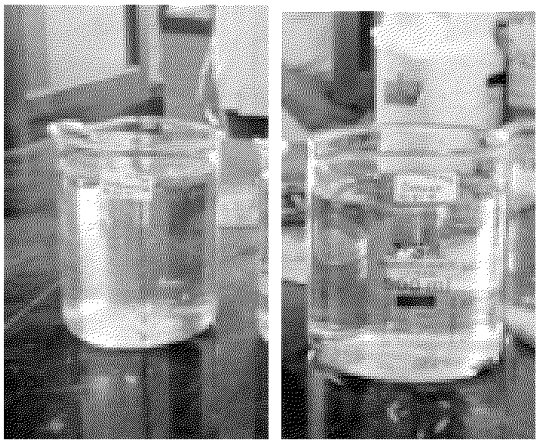


Table1: Water Absorptivity of Watermelon Rind-Based and Orange Peel-Based Bioplastic

Sr. no	Sample	Orange peel bioplastic	Watermelon rind bioplastic
1.	Wo (initial weigh) (g)	1	1
2.	W (final weight) (g)	4.615	13.877
3.	Water Absorptivity(%)	361.5	1287.7

Biodegradability Test

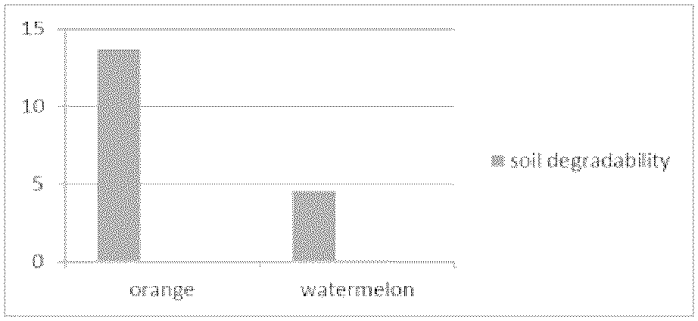
Biodegradability is the capacity for biological degradation of organic materials by living organisms down to the base substances such as water, carbon dioxide, methane, basic elements and biomass. The bioplastic was degraded for 30 days into the soil.

$$\text{Degradation (\%)} = \frac{\text{Initial weight (g)} - \text{Final weight (g)}}{\text{Initial weight (g)}} \times 100$$

Table2: Biodegradability of Watermelon Rind-based and Orange peel-based Bioplastic

Sr.no	Sample	Wo (initial weigh) (g)	W (final weight) (g)	Degradability (%)
1.	Orange peels	0.810	0.698	13.7 %.
2.	Watermelon rinds	1.468	0.908	3.81 %

Graph 1: Biodegardablity of Watermelon Rind-based and Orange Peel-based Bioplastic



Antimicrobial test

This research used disc diffusion (Kirby Bauer) test as antimicrobial activity test for bioplastics film. Bioplastics with 1 cm diameter were placed on solid nutritive media (nutrient agar) which contain a suspension of Staphylococcus aureus (gram-positive bacteria) or Escherichia coli (gram negative bacteria) swabbed evenly on its surface. Afterwards, petri dish was incubated for 24 h. After the incubation period, the inhibitory zone was determined around the bioplastic's samples on the agar plate.

Image 4: Antimicrobial Activity of Watermelon Rind-Based and Orange Peel-Based Bioplastic

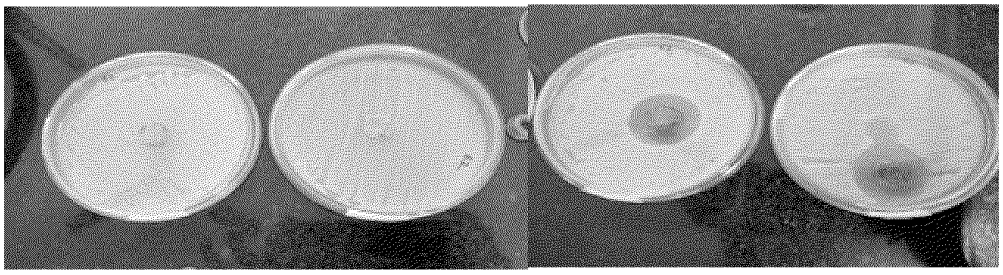


Table 3: Antimicrobial Activity of Watermelon Rind-Based and Orange Peel-Based Bioplastic

Sample	**Clear zone diameter(mm)**	
	Gram positive (Staphylococcus aureus)	**Gram negative (Escherichia coli)**
Orange	3.0	3.0
Watermelon	0.0	0.0

Results and Discussion

Bioplastic film from watermelon peels and orange peels were prepared by extracting starch and using glycerol as a plasticizer. Later tests were performed to check its durability and

efficiency. The films were determined to have a water uptake percentage more than 50% because biopolymers are hydrophilic in nature. Besides, the water molecules interact with hydroxyl group in starch structure. Glycerol has three carbons attached to their backbone with one hydroxyl group attached to each carbon, which causes the molecules to bind to the highest amount of water corresponding to the weight portion. Water absorption test indicated the hydrophilic nature of starch molecules, which showed affinity towards water. The Water Absorption (%) of Bioplastic was found to be 361.5% in orange peel and 1287.7% in watermelon rind bioplastics.

A biodegradation test can be used to evaluate the ability of a starch-based bioplastic films to degrade in a natural environment. The biodegradation of the developed plastic was carried out according to the soil burial method. The result of biodegradability test towards watermelon rind-based and orange peel-based bioplastics are presented in Table2. The Soil Degradability Test within one month shows some amount of weight loss within the orange peels and watermelon rinds. The Soil Degradability of bioplastic was found to be 13.7 % in orange peel, and 3.81% in watermelon rind. An antimicrobial test was used to evaluate the ability of a starch-based bioplastic films to inhibit the growth of microorganisms. The Antimicrobial activity test was performed using disc diffusion (Kirby Bauer) test for bioplastics film on Nutrient Agar media plate for 24 hrs . The orange peel-based bioplastic showed antimicrobial activity against Staphylococcus aureus and Escherichia coli but watermelon rind bioplastic does not show any anti-microbial activity.

Conclusion

This study aims to investigate the water absorption test, biodegradability and anti–microbial activity to produce biodegradable plastic from agro-waste. The water absorption of the 1cm × 2cm plasticized starch bioplastic was carried out at room temperature for 24 hours to obtain the maximum water uptake data and calculated by formula. The Water Absorption (%) of Bioplastic was found to be 361.5% in orange and 1287.7% in watermelon rind bioplastics. The Soil Degradability Test within one month shows some amount of weight loss within the bioplastic. The Soil Degradability of bioplastic was found to be 13.7 % in orange peel, and 3.81 % in watermelon rind. The breakdown of orange bioplastic was comparatively more. Hence, Soil degradation of orange bioplastic was found to be faster than another bioplastic. The orange peel-based bioplastic showed anti-microbial activity against Staphylococcus aureus and Escherichia coli. However, watermelon rind-based bioplastic did not exhibit any anti-microbial activity. As this study, it is recommended to conduct more tests in the future for a better performance of the film, like Loading Test, FTIR analysis, X-ray diffraction (XRD) analysis , Thermogravimetric

analysis (TGA), SEM with EDS analysis etc. Thus, new formulations can be developed in the future to achieve the standard bioplastic requirements.

References

1. Agustin,Y.,Padmawijaya,K.,(2017),Effect of glycerol and zinc oxide addition on antibacterial activity of biodegradable bioplastics from chitosan-kepok banana peel starch, IOP Conf. Series: Materials Science and Engineering,223, IOP Publishing.
2. Fadzil, Nur. and Othman,Siti.,(2021),Preparation and Characterization of Orange Peels for Commercial Plastic: A Review,International Journal of AdvancedReserach in Engineering Innovation, 3(1): 97-102, ResearchGate.
3. Ghamande,Manasi.,Chaure,Rohit.,et.al.,(2019), Diy Bioplastic from Orange Peels, www.conferenceworld.in,pp(200-202),Htmldesign.
4. Maraveas, Chrysanthos., (2020), Production of Sustainable and Biodegradable Polymers from Agricultural Waste,Polymers,2(5),MDPI Journals.
5. Mohammed, Mustafa., Kannan, Hemah.,et.al.,(2020), Antibacterial activities of watermelon (Citrullus lanatus) rind and seed extracts against selected gram-positive and gram-negative bacteria,International Journal of Medical Toxicology & Legal Medicine, 23(3-4):95-100, ResearchGate.
6. Rustagi, Neeti., Pradhan,S., et.al., (2011), Public health impact of plastics: An overview, Indian Journal of Occupational and Environmental Medicine, 15(3):100-103,ResearchGate.
7. Sultan, Noor. and Johari,Wan.,(2017), The Development of Banana Peel/Corn Starch Bioplastic Film: A Preliminary Study, Bioremediation Science and Technology Research, 5(1):12-17, Hibiscus Publisher.
8. Syaubari, Abubakar, et.al., (2022),Synthesis and characterization of biodegradable plastic from watermelon rind starch and chitosan by using glycerol as plasticizer,Materials today: proceedings, 63(S501- S506),Elsevier.
9. Yaradoddi, Jayachandra., Banapurmath,Nagaraj.,et.al.,(2012),Bio-based material from fruit waste of orange peel for industrial applications,Journal of Materials Research and Technology, 17(43), Elsevier.
10. Yi,Vanessa.,Peng,Teoh.,et.al.,(2021),Isolation of Cellulose Derived from Orange peel and its Application in Biodegradable films, Cellulose Chemistry and Technology, 55(3-4):311 324,Research Gate.

T.Y. BIOTECHNOLOGY RESULT

(ACADEMIC YEAR 2023-2024)

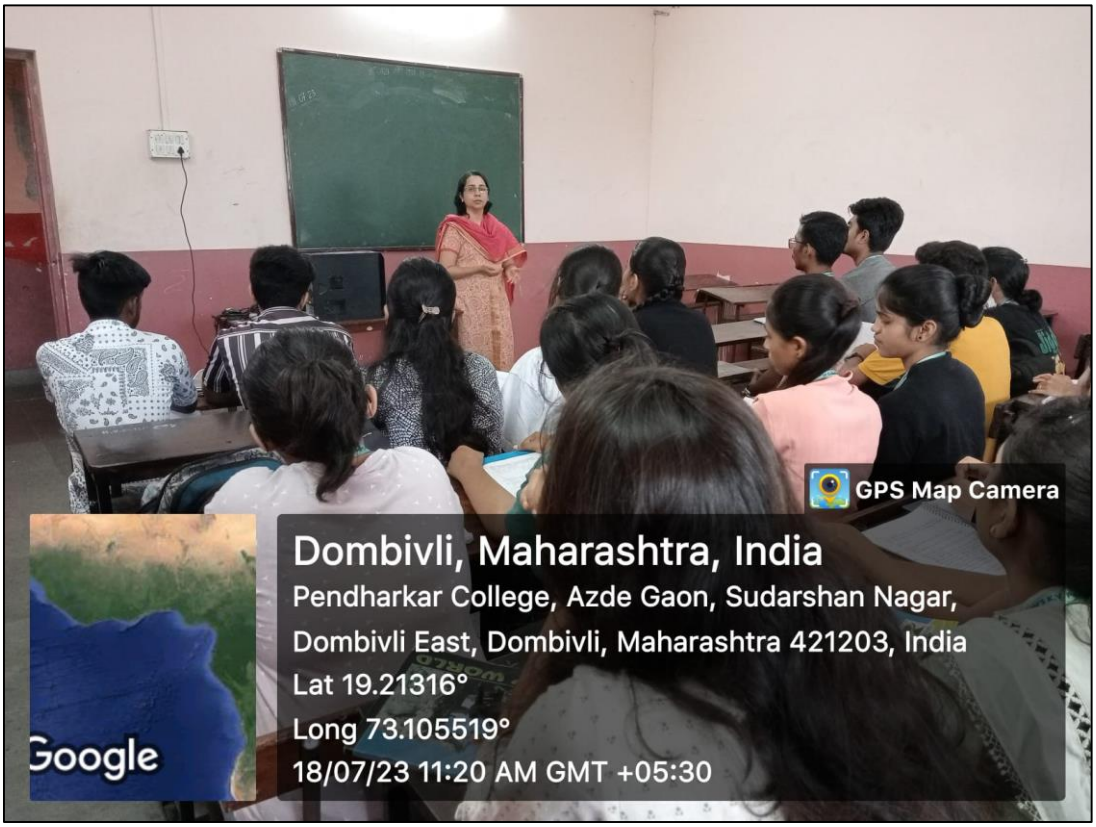
DEPARTMENT CONGRATULATES MERITORIOUS STUDENTS SECURING 'O & A+' GRADE

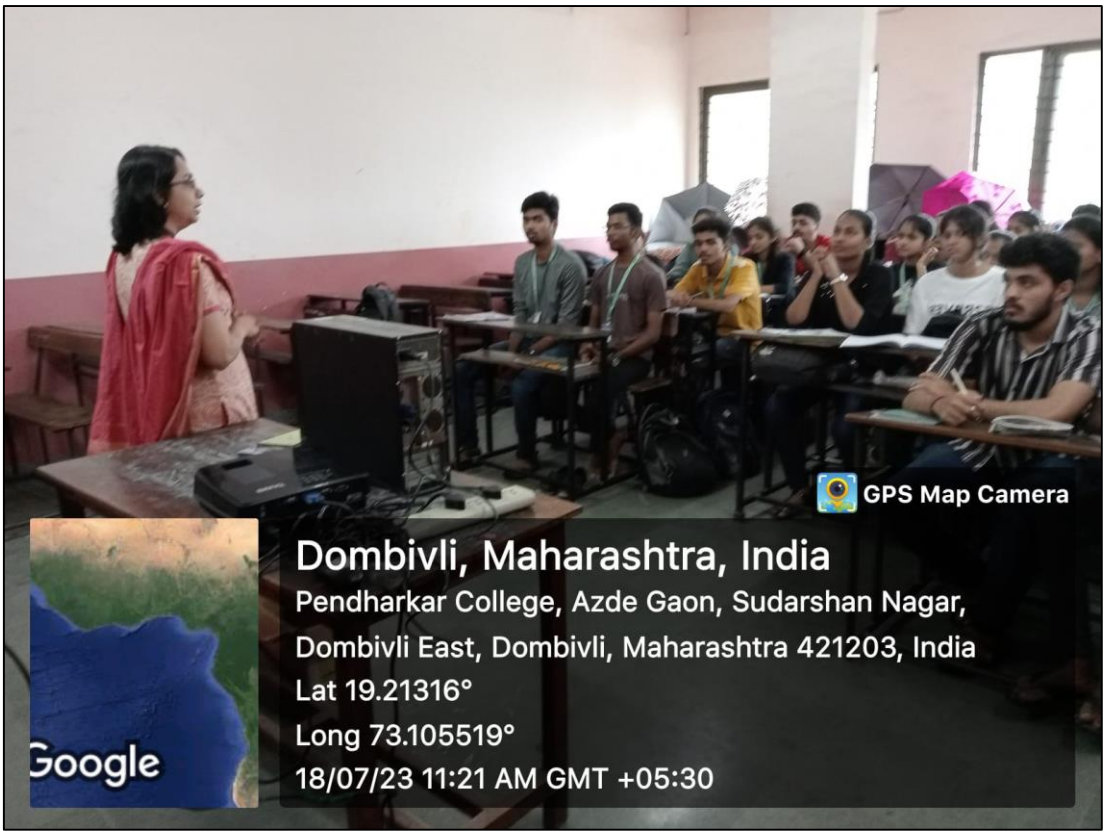
Sr. No.	Name of Student	Grade
1.	Bane Krutika	O
2.	Jadhav Aishwarya	O
3.	Maharana Pratibha	O
4.	Pusalkar Siddhi	O
5.	Singh Sakshi	O
6.	Gund Shivam	A+
7.	Kale Sakshi	A+
8.	Khandare Anshuka	A+
9.	Malavkar Swapnil	A+
10.	Michael Anna	A+
11.	Nayak Sidhhi	A+
12.	Patil Prashansa	A+
13.	Rane Mithil	A+
14.	Raorane Soham	A+
15.	Tiwari Sakshi	A+
16.	Yadav Supriya	A+

PHOTO GALLERY

Guidance lecture on How to Write Book Review

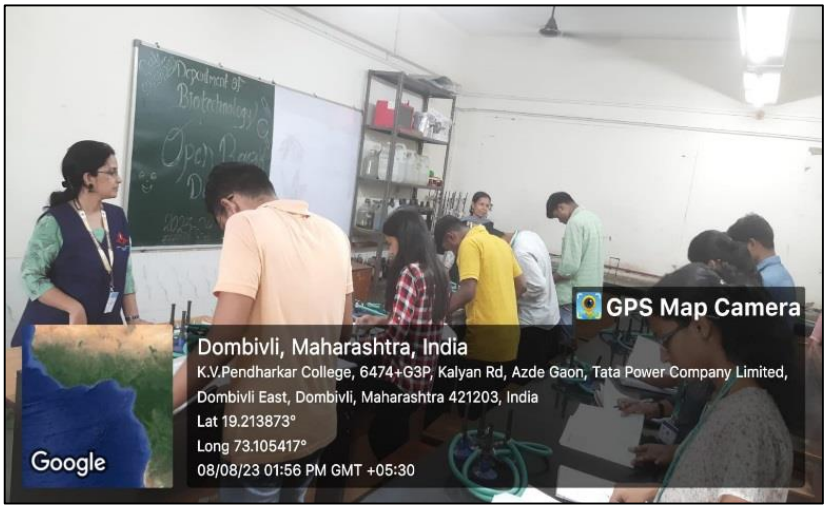
Speaker: Librarian, Dr. Amla Patwardhan





Skill Enhancement Activity - Art Meets Biotechnology

OPEN BOOK DAY ACTIVITY



Gallery Walk Activity

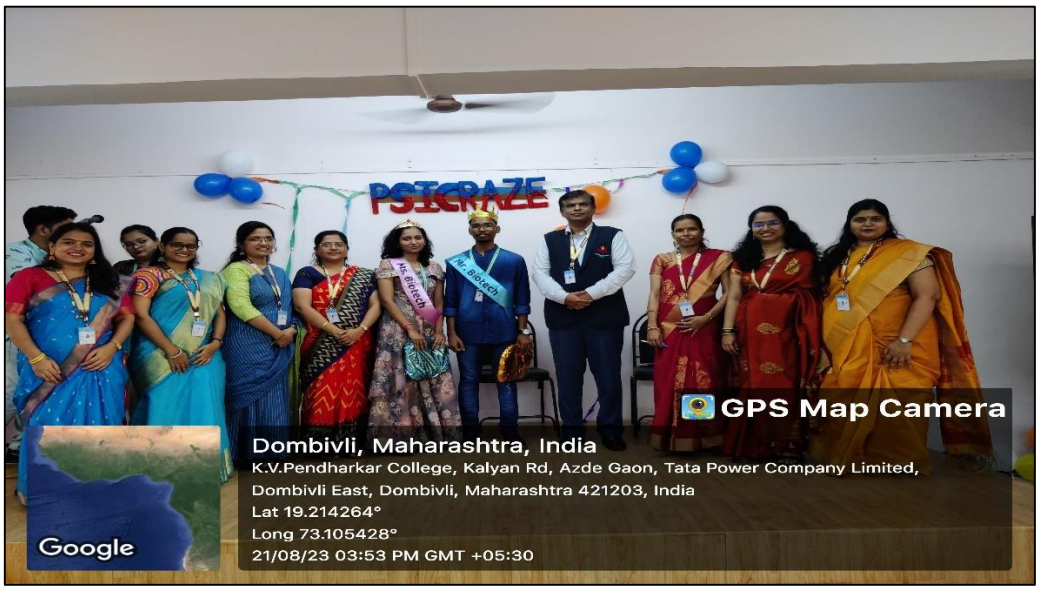
Guest Lecture on Bioinformatics: Future and Scope

Speaker: Dr. Sushant Parab

Workshop on Laboratory Safety

Speaker: Mr. Anant Saple

Departmental Event: PSI-CRAZE 2023-2024




PSYCRAZE
SHEEP
SHEEP
GOAT
Shot on OnePlus


GPS Map Camera
Dombivli, Maharashtra, India
Next to Delizio Momo, 6473+GJM, near Pendharkar College, Azde Gaon, Tata Power Company Limited, Dombivli East, Dombivli, Maharashtra 421203, India
Lat 19.213851°
Long 73.104163°
18/08/23 12:39 PM GMT +05:30
Google

INDUSTRIAL VISITS

ACTREC Visit

LifeSenz Laboratory Visit

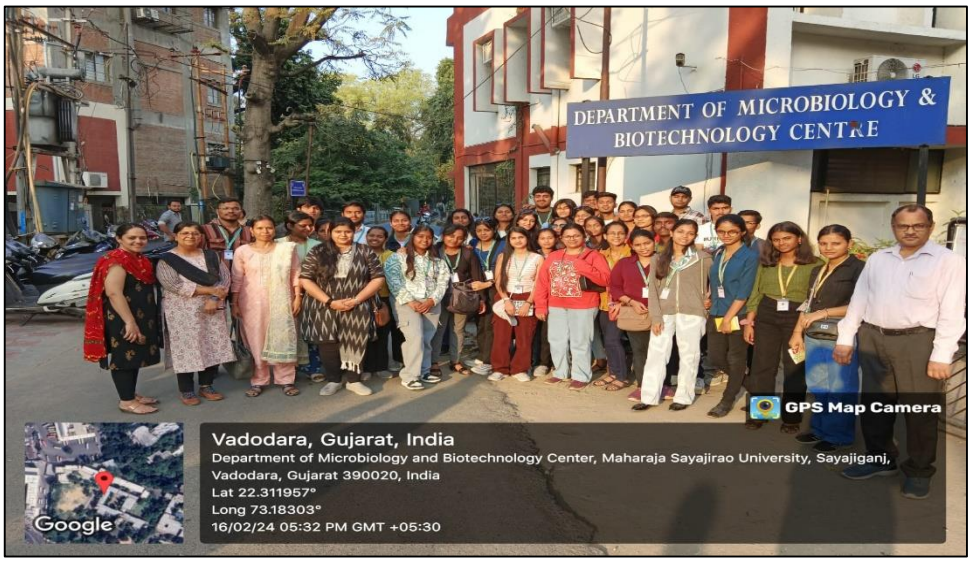
NMIMS Visit


GPS Map Camera
Mumbai, Maharashtra, India
4R3P+5XM, Navpada, Suvarna Nagar, Vile Parle West, Mumbai, Maharashtra 400047, India
Lat 19.102978°
Long 72.837523°
20/12/23 12:53 PM GMT +05:30
Google


NMIMS
SUNANDAN DIVATIA SCHOOL OF SCIENCE
Welcomes You to "Open Day"
Walk-in through:
Molecular Biology Lab
Cell Culture Lab
Instrumentation Lab
Analytical Chemistry Lab
Nanotechnology Lab
Bioinformatics Lab


NMIMS
SUNANDAN DIVATIA SCHOOL OF SCIENCE
Welcomes You to "Open Day"
Walk-in through:
Molecular Biology Lab
Cell Culture Lab
Instrumentation Lab
Analytical Chemistry Lab
Nanotechnology Lab
Bioinformatics Lab

Study tour to Gujrat, Baroda



Students Achievements

National Science Day Competition
Science: Fact and Fusion
1st Prize: Super Baby Model

Foundation Day
Indiam Art and Heritage
3rs Prize: Wall hangigs and handcrafts

Sports Achievements

T.Y.Biotechnology Student
Arjun Barkul
Sports: Kabaddi and Box Cricket