ILOILO DOCTORS' COLLEGE
College of Arts and Sciences
West Avenue Molo, Iloilo City

Controlled Analysis of Mangrove Root Systems as Natural Filters for Microplastic Contamination in Coastal Waters of Leganes

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Introduction

Microplastic pollution is a growing problem in coastal areas and can harm marine life and water quality. Mangroves are known to trap sediment and slow water flow, but their ability to filter microplastics remains poorly studied, especially in Leganes. This study aims to determine whether mangrove root systems can act as natural filters for microplastics in coastal waters, and the results may support mangrove conservation and improved coastal management.

Framework

This study is based on ecological and hydrodynamic theories which explain that vegetation in coastal areas can reduce water flow and trap suspended particles. Mangrove root systems, because of their complex and dense structure, slow down moving water and allow small particles to settle and accumulate. Microplastics, which are light and easily transported by water, may be trapped within mangrove roots and nearby sediments due to this process. Guided by this theory, the study assumes that areas with mangrove root systems will have lower microplastic levels in the water and higher retention compared to areas without mangroves, supporting the idea that mangroves act as natural filters in coastal environments.

The researchers will employ IPO model as a guide for the paradigm of the study, In this study, the researchers will be collecting, observing, and measuring data in the presence of microplastic particles that may be found in Leganes' coastal water. This study wll go through the process of water sampling and filtration analysis.. The purpose of this study is to assess the effectiveness of mangrove root systems in filtering and reducing microplastic contamination in Leganes' coastal waters and to provide insights into their filtration mechanisms, and recommendations for their role in coastal management and pollution mitigation.

Problem

How potent are the Mangrove Root Systems in straining, purifying, and filtering of Microplastic sediments in the Coastal Waters of Leganes and How effective are they as natural filters in preventing and reducing the Microplastc in the environment?

1. What are the different types of Mangrove species that can be found in the coastal water of Leganes and what are their differences in Root System that contribute to filtration of Microplastic particles?
2. What are the types of Microplastic particles trapped in the Mangrove Root Systems of Coastal water of Leganes before and after Tidal currents?
3. How do the environmental and seasonal factors affect the filtration efficiency of Mangrove roots?

Objectives: How will you answer each of the problems?

1. Mangrove Root Systems as Natural Filters for Microplastics
2. Identify and classify mangrove species present in the coastal waters of Leganes and document differences in their root system structures through field observation.
3. Collect water samples before and after tidal currents in mangrove and non-mangrove areas, filter the samples, and quantify microplastic particles using microscopy.
4. Measure environmental parameters such as salinity, turbidity, pH, and tidal flow, and analyze their relationship with microplastic filtration efficiency using ANOVA and regression analysis.

Methodology

An experimental quantitative comparative ecological research design will be employed involving controlled microplastic introduction, water sampling upstream and downstream of mangrove roots, microscopic quantification, and statistical analysis.

The research will be conducted in selected mangrove stands within Leganes, Iloilo, focusing on areas with varying mangrove species and densities. Non-mangrove coastal waters will serve as control sites.

Data collection and analysis will be through the following:

- Microplastic particles of standardized size (<5 mm) will be introduced at controlled concentrations.
- Water samples will be collected upstream and downstream of mangrove roots at intervals of 24, 48, and 72 hours.
- Water samples will be filtered using mesh sieves and microplastics will be quantified through microscopy.
- Salinity, pH, turbidity, and tidal flow rates will be recorded to contextualize filtration efficiency.
- ANOVA will be used to assess significant differences among treatment groups, while regression analysis will assess the relationship between root density and microplastic retention.

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Usnic Acid from *Usnea barbata*: Mechanisms of Action Against Drug-Resistant *Streptococcus pneumoniae* and *Staphylococcus aureus*

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Introduction

Drug-resistant bacteria such as Streptococcus and Staphylococcus aureus are a growing health problem because they are becoming harder to treat with common antibiotics. There is a need to find alternative antibacterial agents that are effective and safe. Usnic acid from Usnea barbata is a natural compound known for its antimicrobial properties, but its effects on drug-resistant bacteria are not fully understood. This study is conducted to determine how usnic acid acts against these bacteria and to support the development of natural and alternative treatments for bacterial infections.

Framework

This study is based on antimicrobial theory, which explains that certain natural compounds can inhibit or kill bacteria by disrupting their normal cellular functions. Usnic acid, a bioactive compound found in Usnea barbata, has been reported to have antibacterial properties that may interfere with bacterial cell walls, protein synthesis, and energy production. Drug-resistant Streptococcus and Staphylococcus aureus are known to survive common antibiotics due to resistance mechanisms, making alternative treatments necessary. Guided by this theory, the study assumes that usnic acid can reduce the growth or survival of these

drug-resistant bacteria by targeting essential cellular processes, supporting its potential use as a natural antibacterial agent.

The researchers will employ IPO model as a guide for the paradigm of the study. In this study, the inputs include Usnic acid, drug resistant strains of *Streptococcus pneumoniae* and *Staphylococcus aureus*, and a controlled laboratory environment. The process in this study will begin with tincture process, antibacterial assays, and mechanism of action testing. The expected outputs are empirical evidence of Usnic Acid's effectiveness, insights into its antibacterial mechanisms, and recommendations for its potential use as an alternative antimicrobial agent.

Problem

What is the Anti Microbial effect and mechanism of action of Usnic Acid extracted from *Usnea barbata* as an natural alternative against Drug-Resistant *Streptococcus pneumoniae* and *Staphylococcus aureus*?

1. What is the Anti Bacterial activity of Usnic acid and its inhibitory effect against Drug-Resistant *Streptococcus pneumoniae* and *Staphylococcus aureus*?
2. How does the exposure to Usnic acid changes the growth patterns of *Streptococcus pneumoniae* and *Staphylococcus aureus* after exposure to Usnic acid?
3. How does the Anti Bacterial potency of Usnic Acid differ in both Drug-Resistant *Streptococcus pneumoniae* and *Staphylococcus aureus*?

Objectives: How will you answer each of the problems?

- Prepare Usnea barbata tincture extracts and evaluate their antibacterial activity using the disc diffusion method.
- Measure zones of inhibition and observe changes in bacterial growth patterns of drug-resistant Streptococcus pneumoniae and Staphylococcus aureus after exposure to usnic acid.
- Perform statistical analysis (ANOVA) to determine significant differences in antibacterial potency between the two bacterial strains.

Methodology

An experimental quantitative laboratory-based pharmacological research design will be utilized including tincture preparation, antibacterial assays, and controlled testing of antimicrobial effectiveness.

The study will be conducted in Nagpana, Barotac Viejo, Iloilo, a community known for its indigenous practices and rich ethnomedicinal knowledge.

Data collection and analysis will be the following:

- Preparation of tincture wherein the *Usnea barbata* is collected and will be prepared for the tincture process.

- Antibacterial testing will be conducted using the disc diffusion method with positive and negative control.
- Observation and measurement will focus on comparing the inhibition zones produced by the tincture with those of the controls. Anova test will be performed to validate the significance

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Comparative Analysis on Biofilm Formation of Bacteria on Plastic, Wooden, and Metal Cutting Boards Used in Food Preparation: Implications for Food Safety in Karinderyas along Brgy. Infante, Iloilo City

Proponents: Cryzta Jheralyn L. Jalandoni, Althea B. Jantican, Amber Johanna N. Rupiñan, Samantha Joy B. Dueñas (Group 4)

Introduction

Foodborne illnesses are a common problem, especially in small eateries like karinderyas, where food is prepared in high volumes. Cutting boards are frequently used surfaces that can harbor bacteria, and biofilms make these bacteria harder to remove with normal cleaning. However, there is limited local information on how different materials—plastic, wood, or metal—affect bacterial biofilm formation in Brgy. Infante, Iloilo City. This study is conducted to compare bacterial growth on these surfaces, helping karinderya owners and food handlers improve hygiene practices and reduce the risk of food contamination.

Framework

This study is based on microbial adhesion and biofilm formation theory, which explains that bacteria can attach to surfaces and form protective communities called biofilms. Different surface materials, such as plastic, wood, and metal, have unique textures, porosity, and hydrophobicity that affect how easily bacteria can attach and multiply. Biofilms protect bacteria from cleaning and disinfectants, increasing the risk of food contamination. Guided by this theory, the study assumes that cutting boards made of different materials will support different levels of

bacterial biofilm formation, helping to identify which surfaces are safer for food preparation and which may pose higher risks for foodborne illnesses.

The researchers will employ IPO model as a guide for the paradigm of the study. In this study, plastic, wooden, and metal cutting boards used in karinderyas at Brgy. Infante, Iloilo City. Samples will be collected after food preparation to assess bacterial biofilm formation. The process will be controlled experiments will be conducted to measure biofilm density on each cutting board type. Standard laboratory assays and statistical analysis will be applied to ensure objective, factual results under the positivist paradigm. The expected outputs will reveal which cutting board material harbors the most bacterial biofilm. Results will provide evidence-based recommendations for safer food preparation practices in local karinderyas.

Problem

What is the comparatively analysis of bacterial Biofilm formation in the different types of cutting board appliances used in food preparation in Karinderyas along Brgy. Infante, Iloilo City and how do these differences imply risks to food safety and public health?

1. What are the different types of bacteria that can be found on plastic, wooden and metal cutting boards used in food preparation?
2. Which cutting board material is most sucseptible to the formation and accumulation of bacterial film under typical operating condition?

3. Which cutting board material promotes greater Biofilm formation when exposed in raw food contaminants?

Objectives: How will you answer each of the problems?

- Collect swab samples from plastic, wooden, and metal cutting boards used in food preparation in selected karinderyas.
- Culture bacterial samples on nutrient agar and quantify biofilm formation through colony density assessment.
- Compare levels of bacterial biofilm formation among different cutting board materials using ANOVA and relate findings to food safety risks.

Methodology

An experimental quantitative microbiological research design will be conducted involving field sampling from karinderyas, laboratory culture of bacteria, biofilm quantification, and comparative statistical analysis.

The study will be conducted in selected *karinderyas* located in Brgy. Infante, Iloilo City. These establishments are chosen because they commonly use plastic, wooden, and metal cutting boards in daily food preparation, making them ideal for assessing biofilm formation and food safety risks.

Data collection and analysis procedure will be the following:

- Purposive sampling will be used to select karinderyas that utilize all three types of cutting boards.
- Representative cutting boards swabbed after routine food preparation and a minimum of 5 replicates per material type will be collected to ensure reliability.
- Microbial culture will then proceed from the samples inoculated onto nutrient agar
- Documentation of practices will be performed through observing cleaning methods, frequency of use, and food types processed.
- ANOVA test will be used to determine significant differences.