Efficiency of organic deodorizer in removing foul smell in shoes

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Abstract

Bromodosis or foot odor affects many people around the world. Shoe deodorizers are used to prevent the malodor, but most of the products available may use harmful materials that do not fully eliminate its cause. These products contain substances that degrade the environment (Steinmann, 2016), and pose as a health hazard (Engelund, et al., 2005). The researchers plan to utilize natural materials (activated charcoal and freeze- dried lemon) in creating a shoe deodorizer that can eliminate the cause of foot odor while reducing ecological footprint. Based on previous studies, foot odor was released from Isovaleric acid, which is the result of *Staphylococcus epidermidis* breaking-down leucine present in sweat (Ara, et al., 2006). When the bacteria in feet eat amino acids such as leucine, it produces a by-product called Isovaleric acid which causes the foul smell. Various studies have also been made regarding the use of lemon and activated charcoal to reduce foul smell (Otang & Afolavan 2016, Tada, et al., 2016). The researchers will focus on the effectiveness of freeze- dried *Citrus limon, (*Lisbon variety) in removing malodor. A revised version of the Modified Kirby Bauer disc diffusion test method was done by the Industrial Technology Development Institute, Department of Science and Technology (ITDI-DOST. The researchers were able to verify the antibacterial properties of freeze-dried lemons. Results showed that the sample freeze–dried lemons (10mm), produced complete inhibitory activity with a Total Mean of Inhibition of 12.74mm, with mild reactivity against the test organism *Staphylococcus aureus*, a common specie of the normal microbiota of the skin. It was concluded from the research that freeze-dried lemons have a good potential to inhibit foul smell, and may be an effective ingredient for a shoe deodorizer.

Keywords: antimicrobial, inhibitory, lemon, organic

Introduction

Bromodosis or foot odor is a condition experienced by thousands of people worldwide. Deodorizers neutralize the smell of the perspiration mixed with bacteria and act as an antiseptic against bacteria (Matthew, et al., 2017). However, most shoe deodorizers available in the market cannot eliminate the cause of malodor due to the absence of antimicrobial properties. Some manufacturers also use harmful ingredients and processes, and non-biodegradable materials in creating their products that contribute to the exploitation of the environment. The researchers planned to develop an organic and eco-friendly shoe deodorizer that can be effective in removing malodor in shoes. The motive was to make an organic shoe deodorizer that will produce minimal or no ecological footprint. The research team involved include the authors of this paper. The study was conducted under the guidance of their research teacher,

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Johanna Camille D. Liwanagan, and the Senior High School Coordinators. The research would also not be possible without the support of the school and the parents of the researchers.

Background

Deodorizers come in different forms and there have been many reports on its negative effects on the consumer and the environment. In a study a conducted by Engelund, et al., (2005), chemical substances in shoe deodorizers may cause health hazards when inhaled or when one is totally exposed in it such as: turpentine oil, mineral turpentine, isoalkanes, propan-2-ol and heptane. Another common ingredient used in shoe care products that poses health hazards when inhaled is silica, or silicon dioxide, that can cause permanent lung damage (American Lung Association). The process of acquiring silicon dioxide is done by mining which further contributes to the degradation of the environment (Chepkemoi, 2017). In addition, most shoe care products are manufactured with non-biodegradable plastic that contributes to the waste emitted into the environment (Parker, 2019). With strong evidence of adverse health effects and damage to the environment, the researchers decided to create an organic and eco-friendly product that can eliminate odor in shoes. Due to the high cost of testing, only the antibacterial properties of one ingredient, being lemon, will be tested by ITDI-DOST. Results showed that the sample freeze-dried lemons (10mm), produced complete inhibitory activity with a Total Mean of Inhibition of 12.74mm, with mild reactivity against the test organism *Staphylococcus aureus.* It was concluded that freeze-dried lemons would be an effective ingredient in eliminating malodor in shoes. A constraint in the study was the prohibition qualitative assessments to conduct the study. A limitation of this research was the lack of funds to test the antimicrobial activity of the final prototype with the freeze-dried lemon, and the longevity of the freeze-dried lemon.

Process

The efficacy of one ingredient to be used in the shoe deodorizer, being freeze-dried lemon, was tested using a laboratory-controlled disc diffusion test. The researchers utilized *Lyophilization* (freeze-drying) method for some of the sample lemons. On the other hand, the juice from the lemon fruit and lemon zest were extracted as the other samples, by the researchers. The antibacterial properties of the different samples were tested through the Standards and Testing Division (Microbiology-Section) of the ITDI-DOST, using a modified disc diffusion assay against *S. aureus*. Reactivity of the antimicrobial agents against the bacteria were then tested by measuring its zone of inhibition.

Results

Outcomes of the experiment showed that lemon extract (juice) contained no antimicrobial property as compared to lemon extract (zest) that contained good potential antimicrobial property with mild reactivity, and a zone of inhibition of 10mm. Additionally, freeze-dried lemon also showed good potential antimicrobial property with mild reactivity, and a slightly higher zone of inhibition of 12.74mm. Based on the results of the experiment, the researchers found out that freeze-dried lemons contain antimicrobial properties that can eliminate the cause of malodor.

Future Work

The researchers recommend that freeze-dried lemons be tested against other skin microorganisms such as *Trichophyton* for a more comprehensive report. Further studies on different citrus fruits should also be explored to determine the possibility of fruits with higher antimicrobial properties such as local and easily sourced fruits such as calamansi (*Citrofortunella microcarpa*) and dayap (*Citrus aurantifolia)*.

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