1INTRODUCTION

Molds are ubiquitously present in the environment, including in houses and even in the materials used and, in the food, eaten. These molds and other fungi could be ingested and inhaled. In addition, it can affect people through skin contact that could cause infections. Because of the diversity of mold species, humans can be exposed to them. Though many of the molds are considered harmless, some pose serious contamination. Food preservatives are used to keep the products in good conditions. But, the preservatives that are used are believed to contain toxic properties that are also negative to health. Preservatives in foods are designed to prevent microbial growth and spoilage, but sometimes they can also increase the risks of disease. Some of the harmful effects of food preservatives, according to clinical studies conducted include breathing difficulties, behavioral changes, internal organ damage, as well as cancer [Simpson; 1]; Traister, [2]; Kannall [3]; Vera [4]; and Koerner [5]. The use of trees and other plant species is not new. Many years ago, people used the different parts of the plants for natural healing, alternative medicine, and for deriving substances for a wide range of benefits. Natural Remedies which are organic and are derived from plants, also possess antimicrobial properties that can battle mold infestations. Since the Philippines has a rich variety of plant species, sources of organic moldicides can be obtained. Spices that contain aromatic scent and flavoring agents are said to combat microbial activity. Several plant parts were also seen to possess agents that can be utilized for their vast uses. Recent studies had revealed the presence of molds in food products that are widely distributed and consumed around the globe. Tournas, et. al. [6], evaluated the mycological quality of various tree nuts and dried fruits presently available in the U.S. market. The results of their study demonstrated that various dried fruits and tree nuts purchased in the local market showed yeast and mold contamination. Applications to

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bacteria, as well as their efficiency in inhibiting some fungi. Thus, these represent an alternative to synthetic preservatives in the food industry against spoilage yeasts and molds. Compounds derived from these plant substances, as emphasized in Bakerpedia [14], also accounted for their effect on mycotoxin production of molds. Their properties, therefore, can further be capitalized on for other product application to protect materials from fungal infestation, specifically molds. To support, Yang and Clausen [15] tested seven essential oils for their ability to inhibit the growth of fungi on southern yellow pine stakes that were either dip-treated or exposed to vapors of the test oils. In general, the use of essential oils in wood successfully inhibited fungal growth on southern yellow pine, therefore, indicating the usefulness of plant compounds on wood in service or during storage of building materials, such as framing lumber, millwork, or truss systems. Mold inhibitors, as underscored by Jacela, et. al. [16], can be a promising tool in controlling issues brought about by molds and mycotoxins. Accordingly, the creation and commercialization of plant-derived products are fundamental to the healthy progress of several agencies and industries and for a broad-spectrum advancement of the local community and societal units. The study focused in developing mold inhibitor using oregano tincture and orange peel powder, and observed their antimicrobial properties, which can be used in food preparations, such as in baking and pastry, in the application for the materials we use, and to prevent infections caused by fungal infestations. Also, further findings can be used for future applications to preserve resources and avoid diseases.

This study aimed to:
1. Determine the mold inhibitory property of Oregano Tincture and Orange Peel Powder on bread, cheese, and wood as to:
   1.1. visible mold growth; and
   1.2. mold smell.
2. It is also aimed at assessing the product’s level of acceptability in terms of:
   2.1. appearance; and
   2.2. odor.

MATERIALS AND METHODS
Oregano leaves, orange peels, and vodka were the primary materials utilized in the development of the product. Product development and descriptive research methods were employed in the study to determine the mold inhibitory property of Oregano Tincture and Orange Peel Powder and its level of acceptability. To create Oregano Tincture and Orange Peel Powder Mold Inhibitor prepare first all the materials, tools and equipment needed. Then, wash the Oregano leaves with water and have them shade-dried. Next, cut the Oregano leaves and place them on a clean container. Subsequent to that, peel the Orange fruits and sun-dry the peel. Place the dried Orange peel on the blender to pulverize it. Then, pour the vodka on the container with Oregano leaves and cover the jar with a cap and store for two (2) days in a cool, dry place for extraction. After two (2) days, filter the extract using a strainer. Next, pour the tincture on another clean container and mix the orange peel powder on the jar. Store the container for another day. After three (3) days of extraction, filter the extract using a clean cloth. Finally, transfer the extract on atomizers to have the finished product. To determine the acceptability of the product, selected homeowners and experts in Biology and Chemistry professors in University were chosen as respondents. The participants assessed the product in terms of appearance, and odor. Prior to the distribution of the questionnaires, the instrument was reviewed and validated by research experts. On the other hand, the data needed to determine the mold inhibitory property of the product were obtained via observation notes, using visible mold growth and mold smell as indicators. Bread, cheese, and wood were used as media. For a period of one (1) week, the product was applied on the test materials and was observed under a non-laboratory setting for its efficiency in inhibiting molds. For statistical data analysis, weighted mean, standard deviation, and t-test were applied in the study.

Results and Discussion
The succeeding tables and accounts reveal the results and findings of the study.

Table 1. Level of Acceptability of Oregano Tincture and Orange Peel Powder Mold Inhibitor as Rated by the Respondents

<table>
<thead>
<tr>
<th>INDICATORS</th>
<th>HOMEOWNERS</th>
<th>EXPERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>SD</td>
</tr>
<tr>
<td>APPEARANCE</td>
<td>4.48</td>
<td>0.65</td>
</tr>
<tr>
<td>ODOR</td>
<td>4.52</td>
<td>0.64</td>
</tr>
</tbody>
</table>

LEGEND:
Range: 1.80-5.00
Verbal Interpretation:
- Highly Acceptable (HA)
- Acceptable (A)
- Moderately Acceptable (MA)
- Less Acceptable (LA)
- Not Acceptable (NA)

Table 1 presents the level of acceptability of the finished product in terms of appearance, odor, as rated by the respondents. The data signified that the homeowners and experts perceived the product as “highly acceptable,” except for the odor, which was deemed “acceptable” by the experts. This implied that the product can be on par with existing commercialized products.

Table 2. Difference on the Level of Acceptability of Oregano Tincture and Orange Peel Powder Mold Inhibitor as Rated by the Respondents

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Computed t-value</th>
<th>Critical t-value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>2.599 × 10⁻¹⁵</td>
<td>2.306</td>
<td>Not Sig.</td>
</tr>
<tr>
<td>Odor</td>
<td>1.903</td>
<td>2.306</td>
<td>Not Sig.</td>
</tr>
</tbody>
</table>

The difference in the acceptability of the finished product in terms of appearance, odor, is revealed in Table 2. As depicted, the computed t-values of all the indicators were apparently less than the critical t-value. Therefore, it can be inferred that there was no significant difference in the ratings given by the homeowners and experts. Hence, the respondents perceived the product in a similar way. The mold inhibitory property of Oregano Tincture and Orange Peel Powder on bread, cheese, and wood as indicated by visible mold growth and mold smell are presented on the ensuing tables.

Table 3 illustrates the mold inhibitory property of the product on the test media. Colony pigmentation was observed to...
The inhibitory effect of plant substances was also reported by Krisch, et al. [17] as they noted the significant reduction of spoilage molds on bread using essential oils of marjoram and clary sage. The study conducted by Hussain, et al.[18], in addition, supports that most plant extracts possess antifungal ingredients for wood. The results of the study are, by and large, in consonance with the preceding citations previously mentioned. The outcomes of this research concur with Borrego, et. al.[19] that natural products, specifically those obtained from plants, serve as great alternatives as biocides, without bringing out negative environmental and human health impacts.

These findings illustrate the promising potentials of plant-derived compounds to be harnessed for a wide range of benefits.

**Table 3. Mold Inhibitory Property of Oregano Tincture and Orange Peel Powder on Bread, Cheese, and Wood as indicated by Visible Mold Growth**

<table>
<thead>
<tr>
<th>Visible Mold Growth</th>
<th>BA</th>
<th>BB</th>
<th>CA</th>
<th>CB</th>
<th>WA</th>
<th>WB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colony Pigmentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Blue</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Yellow</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>White</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Brown</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Gray</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Black</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

Legend: (colony pigmentation)
- not present
+ present
0-1 color strong
2-3 colors Average
4 more colors Weak

As presented, the product exhibited a strong inhibitory effect on bread and wood. However, the inhibitory property on cheese is undetermined because no macroscopic indication of molds was observed on both treated and untreated samples. Thus, further analysis is recommended. Similarly, the musty odor was also used as an indicator to measure the level of mold inhibitory property of the product on the same test materials. As depicted in Table 4, the product also exhibited a strong inhibitory effect on both bread and wood. Nevertheless, further analysis is required to determine the mold inhibitory property of the product on cheese, as indicated by the presence and degree of mold smell, since no clear comparison was established from the cheese samples observed.

**Table 4. Mold Inhibitory Property of Oregano Tincture and Orange Peel Powder on Bread, Cheese, and Wood as indicated by Mold Smell**

<table>
<thead>
<tr>
<th>Mold smell</th>
<th>Bread A</th>
<th>Bread B</th>
<th>Cheese A</th>
<th>Cheese B</th>
<th>Wood A</th>
<th>Wood B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musty Odor</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

Legend: (level of mold inhibitory property)
- not present
+ present
if observe to be - no musty odor strong
if observe to be + light musty odor Average
strong musty odor Weak

Figure 1 presents the samples of test materials used to observe and determine the mold inhibitory property of the product. Samples designated A were treated by the product developed. On the other hand, samples labeled B were not treated. Evidently, both the untreated bread and wood samples exhibited mold growth. Conversely, the treated bread and wood samples clearly exhibited no signs of mold growth. Both the treated and untreated cheese samples exhibited no obvious indication of mold growth, thus the product’s inhibitory effect on cheese was not established. Nevertheless, Oregano Tincture and Orange Peel Powder showed strength in inhibiting molds on bread and wood.

**Conclusion**

The developed product demonstrated a strong ability to inhibit mold growth on bread and wood, although its effect on cheese was not clearly established. This study is just a beginning of further study wherein laboratory setting be done to further assess the level of mold inhibitory property of the product, especially on cheese. Chemical analyses and toxicity examinations are also advised to be completed to maximize the potentials of the product to be employed in food processing and be used in food products. Further application and testing of the product on different media and materials are suggested to evaluate if the product possesses the same degree of effectiveness, notwithstanding the product type.

**References**


