Opportunity and Significance

Mosquitoes and ticks are two of the world’s deadliest creatures killing millions of people every year due to insect borne illnesses such as malaria, Lyme and Zika virus.

The CDC released a sources sought notice calling for a natural pesticide product because the some of the active ingredients in current products are no longer effective due to the mutation of the species. We have created a natural mosquito repellent from essential and carrier oils based on things that mosquitoes actively avoid in nature.

Technical Objectives

We focused on two major objectives for this project.
1. Prove that an insect repellent based on naturally occurring active ingredients could repel as effectively as a non-naturally occurring active ingredient based repellent.
2. Create a market ready product that would encourage use of insect repellents as first line of defense against contracting insect-borne illnesses.

Related Work and State of Practice

Through customer discovery we found three major criteria that our customers are looking for. We compared each of the criteria across three major companies with natural insect repellents and found the results below. We also found that people doing nothing is truly our greatest competitor.

<table>
<thead>
<tr>
<th></th>
<th>It Comes Naturally</th>
<th>Do Nothing</th>
<th>Avon Repellent</th>
<th>Cutter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficacy at 3.5 hours</td>
<td>78.99%</td>
<td>X</td>
<td>67%</td>
<td>65%</td>
</tr>
<tr>
<td>Natural active ingredients</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Moisturizing Quality</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
</tbody>
</table>

Technical Approach, Accomplishments and Results

Our research was conducted in a series of three steps;

1. Creation

We began the creation process through extensive research of repellents and ingredients. We studied plant based, DEET and Permethrin based repellents and their effects on the skin and the environment. We also studied essential and carrier oils, how they effect insects and their benefits to the skin. To ensure that we used safe ingredients that would support our objects we only included materials that have been certified safe by FDA, EPA or the Natural Product Association. We used this information to create a test batch.

We then conducted customer discovery interviews to gauge the market and fully understand what customers look for when purchasing repellents. Our interviews resulted in three major criteria that we planned test against competitors.

2. Testing

The test batch was created with 100% essential oils from plants that insects avoid on their own in nature. We added carrier oils to balance the essential oils that serve as active ingredients and tested it on two subjects. The subjects reported positive results for initial testing so we moved forward to the third party testing at Carol-Loye Biological Laboratory. Dr. Scott Carol tested the formulation used wind tunnel testing to prove our first objective that a naturally occurring insect repellent would be as effective as a non-natural insect repellent.

3. Optimization

The results showed 99.9% efficacy against ticks and 75% against mosquitoes. Our next step is optimization to improve the efficacy against mosquitoes.

Next Steps for Development and Test

Our plan moving forward is to optimize the formulations for efficacy and use. We will create application methods of the topical repellent that are convenient for our customers. We are also working on a tablet that can be taken orally for our customers who have suffered from insect-related illness in the past. These customers tend to be more cautious and search for multiple forms of protection. After testing for efficacy and market readiness, we will sell our product in stores.

Commercialization Plan & Partners

We worked directly with Dr. Scott Carol, an EPA advisor for insect repellent guidelines, to test our formulations and offer improvements to reach our desired result.

We are currently finalizing sales agreements with Organic Food and Vitamin a store in Ferndale that serves our customer base, to sell our product in their stores.

Acknowledgements

We are very grateful to all of our supporters, advisors and mentors. We extend a special thanks to the Dr. Scott Carol, Anderson Institute, Innovation Warriors, Detroit Homecoming and Optimize Wayne for their continued sponsorship and support of this research and venture.

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Industrial and Systems Engineering