Absorption Of Waste Oil By Using Shrimp Skin

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ABSTRACT

The research, titled "Study of Absorption of Waste Oil by Using Shrimp Skin," addresses a pressing environmental concern and aims to raise awareness among the general population about the detrimental effects of waste oil pollution. Total petroleum hydrocarbons (TPH), constituents of oil and grease, can pose more significant risks than those originating from non-petroleum sources, such as vegetable oil. Common avenues for these pollutants to enter the environment include leaks from machinery and vehicles, illegal dumping, spills, and improper disposal of cooking oil. Notably, motor oil leakage into water bodies during storms exacerbates the problem. While waste oil is not a novel concept, public awareness regarding its impact on both direct and indirect aspects of daily life remains crucial. This research sheds light on the potential long-term health effects of waste oil and employs a survey technique to heighten respondents' understanding of the repercussions associated with untreated waste oil being discharged into drains. The central focus of the experiment is to evaluate the efficacy of utilizing organic chitosan from shrimp skin in absorbing waste oil from contaminated water sources. By examining the absorption capabilities of shrimp skin, the study not only contributes to the development of sustainable solutions for waste oil management but also emphasizes the importance of responsible disposal practices. The ultimate goal is to provide valuable insights into the effectiveness of organic chitosan derived from shrimp skin as an eco-friendly and efficient absorbent for mitigating the adverse environmental impact of waste oil pollution in aquatic ecosystems.

KEYWORDS

Absorption of waste oil; *effectiveness of shrimp skin waste shrimp skins*;*Waste Oil*

1. INTRODUCTION

The indiscriminate release of waste oil into various ecosystems has become an alarming environmental concern, necessitating urgent attention and effective remediation strategies. Waste oil, originating from diverse sources such as industrial discharges and accidental spills, poses a persistent threat to water quality, soil health, and the overall balance of ecosystems. Conventional methods of oil spill cleanup are often limited in their efficacy and may involve environmentally detrimental practices. In light of this, there is a growing interest in exploring alternative and sustainable solutions for waste oil absorption, and one such promising avenue is the utilization of shrimp skin. Shrimp skin, typically discarded as waste in the seafood industry, holds potential as a natural and efficient absorbent for waste oil due to its chitin content. Chitin, a biopolymer in shrimp skin, exhibits remarkable oil-absorbing qualities.

However, despite its promise, the utilization of shrimp skin as an oil absorbent is an under-explored area of research. Therefore, there is a critical need for in-depth investigations into the feasibility, efficiency, and environmental impact of employing shrimp skin as a novel absorbent for waste oil, with the ultimate goal of developing a sustainable and ecologically sound approach to mitigate the detrimental effects of waste oil contamination.

The aim of this project is to remove oil spills by using marine shrimp. The scope of our research is to investigate the effectiveness of marine shrimp which is white shrimp (Litopenaeus Vannamei), red shrimp (Pleoticus Robustus) and tiger shrimp (Penaeus Monodon) as an oil spill remover in rivers or drains. The shrimps will be taken from Sabak Bernam, Selangor. Hence, the main objective of choosing the specific material and place is to reduce the amount of solid waste generated and to control water pollution. This project investigate the rate at which waste oil is absorbed by shrimp skin over time. Exploring factors such as shrimp skin particle size, pH, temperature, and agitation speed to enhance absorption efficiency. Moreover, comparing the effectiveness of shrimp skin with other absorbent materials commonly used for oil spill clean-up. Lastly, the assessing the potential for regenerating shrimp skin after oil absorption for reuse or proper disposal.

Shrimp skin has a porous structure and a substantial surface area, which enable it to effectively catch and hold oil. Pores provide oil molecules plenty of room to absorb, which results in effective oil removal. Shrimp skin also possesses hydrophobic qualities, which means it deters water while drawing in and absorbing oil. Proteins improve shrimp skin's ability to absorb pollutants from oil, allowing it to bind and hold onto them more successfully. This quality makes it useful for cleaning up oil spills or contaminated bodies. Moreover, white shrimp is a widely cultivated and consumed species, primarily known for its edible qualities. The absorption efficiency of the white shrimp skin was found to be water comparable, if not superior, to commonly used synthetic absorbents such as activated carbon and polypropylene.

The exploration of innovative and sustainable solutions for waste oil absorption has gained significant attention in recent years, driven by the imperative of environmental sustainability and the search for efficient materials. One such promising avenue is the utilization of shrimp skins as a potent absorbent for waste oil. Shrimp excrement, often dismissed as waste in the seafood industry, harbors intricate bio-material combinations, constituting approximately 50% of shrimp's total body weight, and its improper disposal poses environmental pollution risks.

2. METHODOLOGY

Water quality standards are put in place to ensure the efficient use of water for a designated purpose. Water quality analysis is to measure the required parameters of water, following standard methods, to check whether they are in accordance with the standard. The following is the water quality test that has been performed by using oil and grease, pH test, turbidity test, dissolved oxygen test, and chemical oxygen demand test.

2.1 pH Level Test

The objective is to determine the pH of waste water collected from different water sources. pH test is the degree of acidity is the number of H ion concentration in a compound. The degree of acidity or often called pH value in the range of 1-14. 1-6.9 pH value is acidic, 7 Neutral, and alkaline 7.1-14. The purpose of the test is to determine in what range is the pH of the sample water after being filtered by using waste detain and oil trap. The reagents that are used in this test is distilled water. The equipment that is used in this test is pH meter, beaker and water sampling equipment.

2.2 Turbidity Test

The objective is to measure the water's cloudiness using a turbidity probe. This test measures turbidity by comparing a water sample at different locations with the blank sample. Turbidity is caused by suspended materials which absorb and scatter light. These colloidal and finely dispersed turbidity-causing materials do not settle under quiescent conditions and are difficult to remove by sedimentation. Turbidity is a key parameter in water supply engineering, because turbidity will both cause water to be aesthetically unpleasant and cause problems in water treatment processes, such as filtration and disinfection. Turbidity is also often used as indicative evidence of the possibility of bacteria being present. The purpose of the test is to measure the turbidity of the sample water before and after the filtration by using waste detain and oil trap. The equipment used in this product is turbidity meter (Hach 21100Q), 250ml beaker, wash bottle with distilled water, gloves, water sampling equipment and distilled water.

2.3 Dissolved Oxygen (DO) Test

The objective is to measure dissolved oxygen in various water samples. Dissolved oxygen (DO) is oxygen that is dissolved in water. It can be measured with a dissolved oxygen meter. The standard unit is milligrams per liter (mg/1) or parts per million (ppm). Oxygen present in water by diffusion from the air, by aeration, from photosynthesis. Total dissolved gas concentrations in water should not exceed 110 percent. This is because it could be harmful to aquatic life. Fish in waters containing excessive dissolved gasses may suffer from "gas bubble disease" however this is a very rare occurrence. Dissolved oxygen is used by organic material for decomposition, and is dictated by the temperature, salinity, and the atmospheric pressure. The equipment that is used in this test is a sampling bottle, beaker, and dissolved oxygen meter test water reagent. Effectiveness of the sorbents also highly depends on the properties of oil such as viscosity, stickiness, stiffness and adhesion of the oil. (Choi & Claud, 1992)

3. RESULTS AND DISCUSSION

3. 1. Efficiency Of Shrimp Skin And Time Taken In Absorption (Oil and grease)

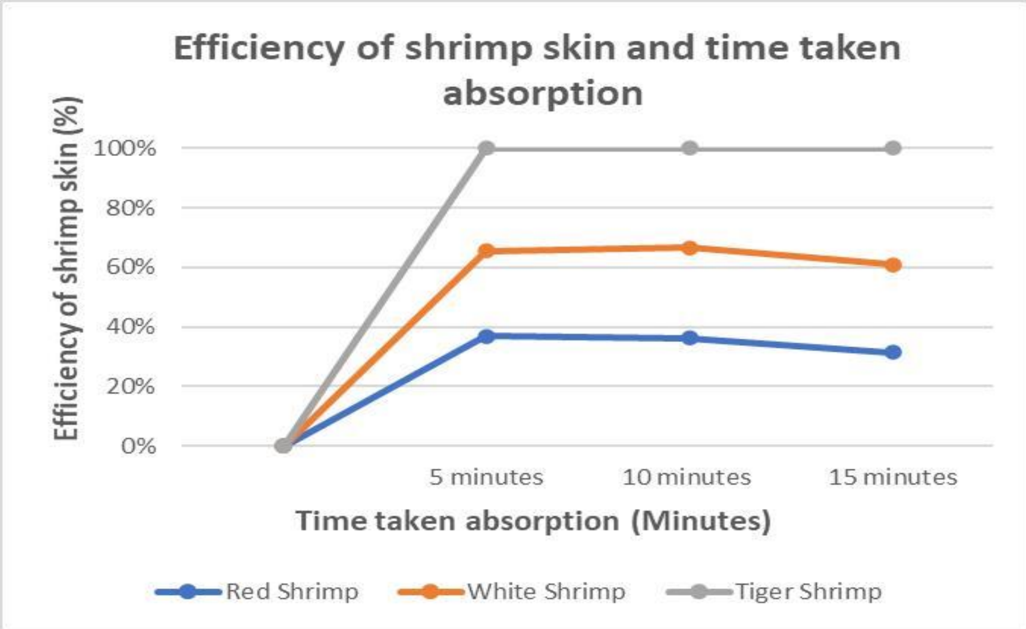

Figure 1. Efficiency Of Shrimp Skin And Time Taken In Absorption

Figure 1 is a comparison between the efficiency of the waste oil with time taken in absorption for the white shrimp, red shrimp and tiger shrimp. The efficiency of the waste oil was increased for red shrimp and tiger shrimp significantly but for white shrimp it decreased. The time taken in absorption for each trial was taken to determine in which specific time the waste oil gets to absorb the automobile oil that is found in the river. Meanwhile the efficiency of waste oil for the first trial in white shrimp is (63%), red shrimp is (49%) and tiger shrimp is (59%) within 5 minutes. Next, the efficiency of the waste oil within 10 minutes for the second trial slightly increased for red shrimp (57%) and tiger shrimp (58%) but white shrimp remained constant. In 15 minutes the white shrimp absorbed 61%, red shrimp (57%) and tiger shrimp (76%). Thus, tiger shrimp absorbed the most waste oil in the last trial within 15 minutes. This shows as time taken in absorption increases, the efficiency of the waste oil also increases. This is because tiger shrimp contain more calcium carbonate and protein . Thus, this increases the surface area of the pulverized shrimp skin for oil addition.

3. 2. pH Test

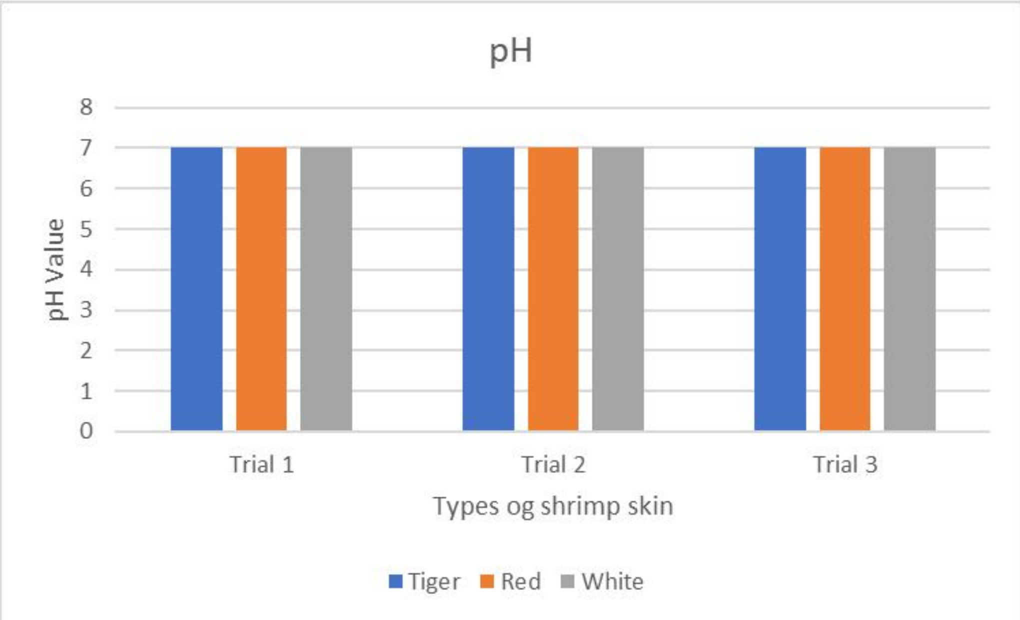

Figure 2: pH Test

Figure 2 shows obtained of the pH value for the wastewater before and after tested by using pulverized shrimp into the teabag. The pH value of the wastewater for before is 8 which is alkaline. Then, The pH value after testing for the three samples which is white shrimp, red shrimp and tiger shrimp remained constant at 7 in all three trials. The three types of shrimp which is white shrimp, red shrimp and tiger shrimp are effectives because they remove unpleasant taste. Through the data obtained, it is proven that determining the pH value is important in order to determine the process of analyzing the acidity, neutral or alkalinity of a solution.

3.3. Turbidity Test

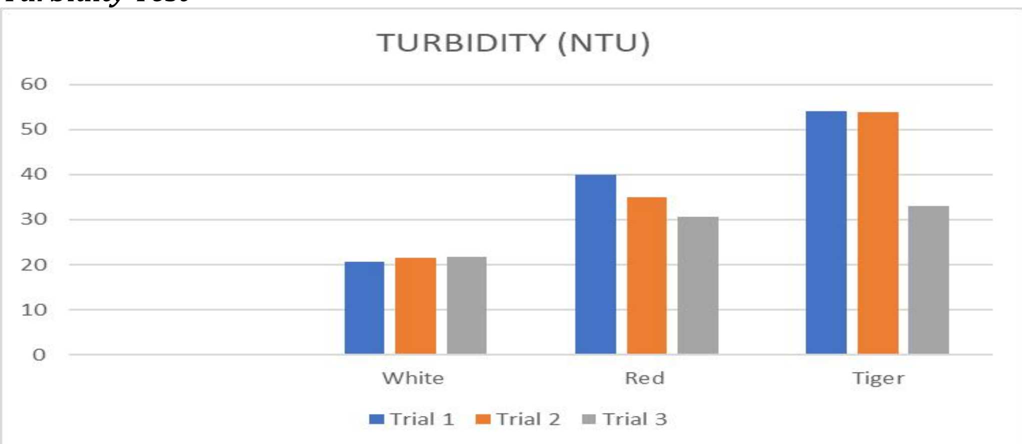

Figure 3: Turbidity Test (NTU)

Figure 3 shows the data obtained of the turbidity value of the wastewater before and after testing by the pulverized shrimp into the tea bag, White shrimp, red shrimp and tiger shrimp. The turbidity value of the wastewater before remained the same as for tree trials is 71.8 NTU. The trial one shows the turbidity value of wastewater after being absorbed by the white shrimp changed to 20.7 NTU, for the second trial shows 21.5 NTU, and the third trial shows 21.8 NTU. The final turbidity reading for each trial after being treated by white shrimp is getting lower compared to before. From the trial 1 trial 3, the value of turbidity of wastewater is increasing from 20.7 NTU to 21.8 NTU. Next, the result shows the turbidity value for red shrimp for the first trial is 40.0 NTU, the second trial shows 35.0NTU, the third trial shows 30.6 NTU. The final turbidity reading shows for each trial is getting less compared to before the absorption. The trial one shows the turbidity value of wastewater after being absorbed by the tiger shrimp changed to 54.1 NTU, for the second trial shows 53.9NTU, and the third trial shows 33.0 NTU. The final turbidity reading for each trial after being treated by white shrimp is getting lower compared to before. From the trial 1 trial 3, the value of turbidity of wastewater is decreasing from 54.1NTU to 33.0NTU. The more the total suspended solids in the wastewater, it seems and the higher the turbidity. In between these three types of shrimp, tiger shrimp shows the lower value of turbidity compared to red shrimp and white shrimp. It shows tiger shrimp absorbed the most suspended solid compared to other shrimp. This is because tiger shrimp contain more calcium carbonate and protein. Thus, this increases the surface area of the pulverized shrimp skin for oil addition.

3.4. Dissolved Oxygen Test

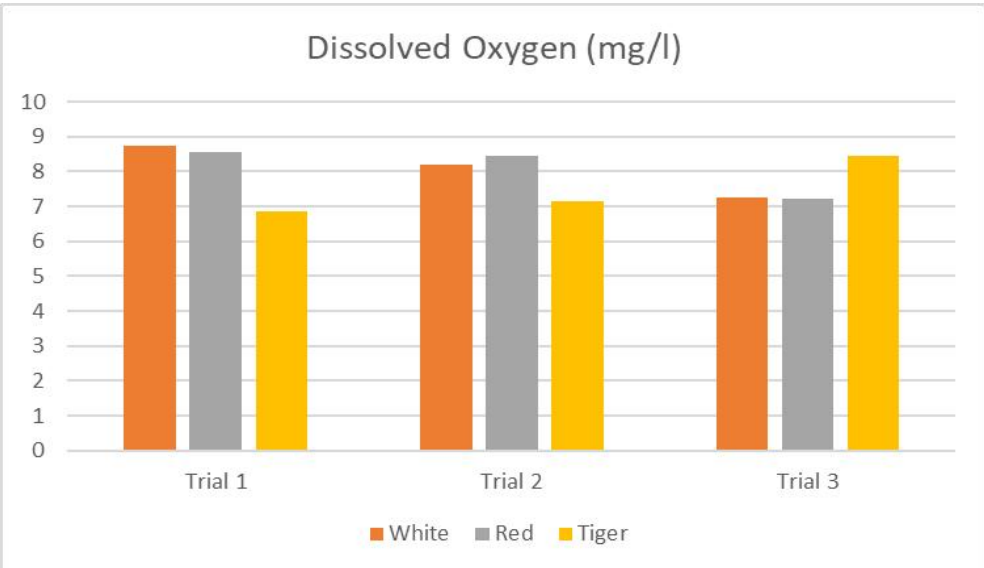

Figure 4: Dissolved Oxygen Test (mg/l)

Figure 4 shows the data obtained of the dissolved oxygen value for the absorption of the wastewater before and after testing by using pulverized shrimp into the teabag.The dissolved oxygen value of the wastewater before reading for white shrimp 6.83 mg/l , red shrimp 6.80 mg/l and tiger shrimp 6.70 mg/l. The dissolved oxygen value of the treated by pulverized shrimp slightly changed from the initial value of the wastewater which is for the first trial for white shrimp 8.75 mg/l , Red shrimp 8.56 mg/l and tiger shrimp 6.87 mg/l. The DO value of the treated by pulverized shrimp drastically changed for tiger shrimp from the initial value to 6.77 mg/l in the first trial while for the second trial it changed to 7.14 mg/l and 8.46 mg/l in the third trial. It is because the more time taken, the more tiger shrimp adjust the dissolved oxygen to support spawning and growth of aquatic organisms. It proves that trial 3, 15 minutes is the best time for tiger shrimp to support spawning and growth of marine ecosystems. The low dissolved oxygen levels indicate wastes in the water and unhealthy , The high DO indicates healthy, well-aerated water.

3.5 CHEMICAL OXYGEN DEMAND TEST

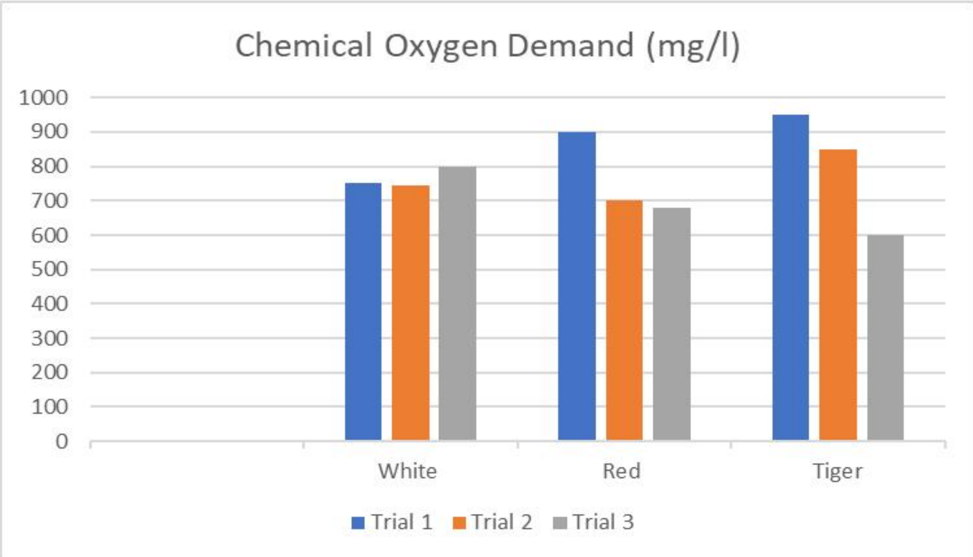

Figure 5: Chemical Oxygen Demand Test (mg/l)

Figure 5 shows the data obtained of the chemical oxygen demand value for the absorption of the wastewater before and after testing by using pulverized shrimp into the teabag. The chemical oxygen demand value of the wastewater before reading for each shrimp is 1264 mg/l. The chemical oxygen demand value of the treated by pulverized shrimp drastically changed for tiger shrimp from the initial value to 1300 mg/l in the first trial while for the second trial it changed to 850 mg/l and 600 mg/l in the third trial. It is because the more time taken, the more tiger shrimp was reduced in dissolved oxygen, which can lead to anaerobic conditions, which is deleterious to higher aquatic life forms. Compared to red and white shrimp. White shrimp contains a high chemical oxygen demand level. High chemical oxygen demand indicates presence of all forms of organic matter, both biodegradable and non biodegradable and hence the degree of pollution in waters.This makes chemical oxygen demand useful as an indicator of organic pollution in surface waters. At trial 3, 15 minutes, it shows that tiger shrimp contains low organic material, which can increase the level of dissolved oxygen in the water course. A high level of chemical oxygen demand means that the wastewater contains too much organic material, which can reduce the level of dissolved oxygen in the water course if the effluent is discharged, thereby harming the local environment and also higher chemical oxygen demand levels mean a greater amount of oxidizable organic material in the sample, which will reduce dissolved oxygen.

3.6 Chemical Absorption & Reaction

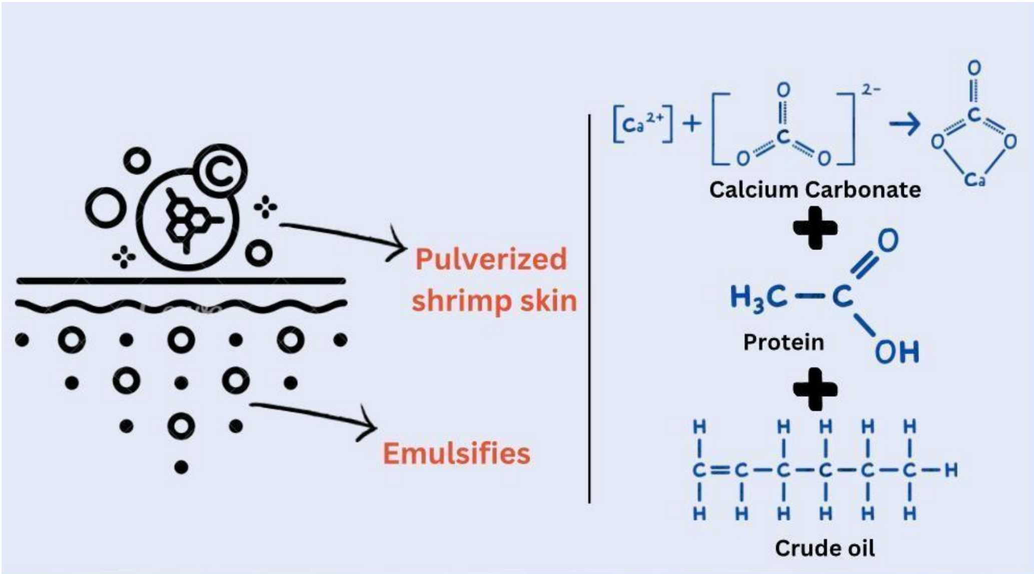

Figure 6: Chemical Absorption And Reaction

Chemical absorption is the process by which a compound, also referred to as the ascorbate, absorbs another substance, referred to as the absorbent, and they interact chemically or physically as a result. Shrimp skin is used as the absorbent when it comes to the absorption of waste oil. Because of its distinct qualities, including its large surface area and the presence of the hydrophobic polymer chitin, shrimp skin works well for this purpose. The hydrophobic properties of chitin draw and trap the hydrophobic elements of waste oil as it comes into contact with the shrimp skin, speeding up the absorption process. Chitin molecules and the oil compounds interact chemically during this process of absorption, which goes beyond simple physical absorption. The amount of oil in the surrounding environment is reduced as a result of the chitin molecules' formation of bonds with waste oil molecules. By using shrimp skin, a natural waste product, as an efficient absorbent for environmental remediation, this process not only aids in the cleanup of waste oil but also demonstrates a sustainable and environmentally friendly approach.

3.7 Discussion

Through the data and results obtained , it is crystal clear that all the three types of shrimp which is white shrimp , red shrimp and tiger shrimp have their own ability in absorbing the waste oil.The main reason on choosing three type of shrimp is to investigate the effectiveness of the shrimp that can absorb the waste oil within 5 minutes,10 minutes and also 15 minutes.For tiger and red shrimp, waste oil efficiency increased dramatically; for white shrimp, it declined. The amount of time that each trial took for absorption was used to calculate the precise amount of time that the waste oil needed to absorb the car oil present in the river.This indicates that the efficiency of the waste oil grows together with the absorption time. This is because tiger shrimp have higher protein and calcium carbonate contents. In order to add oil, this increases the surface area of the ground shrimp skin.The more the volume of oil absorbed the higher the efficiency of the shrimp as an oil spill remover. While the efficiency was calculated in order to show the efficiency of each shrimp absorbing the waste oil.

Moreover, the study shows the pH value after and before absorption.The pH value of the wastewater for before is 8 which is alkaline. Then, The pH value after testing for the three samples which is white shrimp, red shrimp and tiger shrimp remained constant at 7 in all three trials. It shows the shrimp not only have the ability to absorb the waste oil and it can remove the alkalinity in wastewater. the data obtained of the turbidity value of the wastewater before and after testing by the pulverized shrimp into the tea bag, White shrimp, red shrimp and tiger shrimp. The turbidity value of the wastewater before remained the same as for tree trials is 71.8 NTU.After absorption in between these three types of shrimp, tiger shrimp shows the lower value of turbidity compared to red shrimp and white shrimp. It shows tiger shrimp absorbed the most suspended solid compared to other shrimp.This is because tiger shrimp contain more calcium carbonate and protein . Thus, this increases the surface area of the pulverized shrimp skin for oil addition.

The data obtained of the dissolved oxygen value for the absorption of the wastewater before and after testing by using pulverized shrimp into the teabag. It proves that trial 3, in 15 minutes is the best time for tiger shrimp to support spawning and growth of marine ecosystems. The low dissolved oxygen levels indicate wastes in the water and unhealthy,The high DO indicates healthy, well-aerated water. lastly, A high level of chemical oxygen demand means that the wastewater contains too much organic material, which can reduce the level of dissolved oxygen in the water course if the effluent is discharged, thereby harming the local environment and also higher chemical oxygen demand levels mean a greater amount of oxidizable organic material in the sample, which will reduce dissolved oxygen .Compared to red and white shrimp. White shrimp contains a high chemical oxygen demand level. High chemical oxygen demand indicates presence of all forms of organic matter, both biodegradable and nonbiodegradable and hence the degree of pollution in water.

4. CONCLUSION

In the pursuit of advancing environmentally sustainable solutions for waste oil absorption, the investigation into the efficacy of shrimp skin, particularly that of tiger shrimp, has yielded compelling results. The data and outcomes gathered from this study unequivocally establish the superior performance of tiger shrimp skin compared to white and red shrimp varieties in the protracted absorption of waste oil. This research draws insightful parallels to earlier studies involving bio-waste, showcasing the remarkable potential of shrimp skin as a highly effective absorbent material. Within this domain, the tiger shrimp skin emerges as a standout performer, showcasing heightened capabilities in oil absorption when juxtaposed with its counterparts.
The treatment processes applied to the shrimp skin, encompassing specific chemical treatments or modifications, have been instrumental in enhancing its oil absorption capacities. This finding underscores the adaptability and responsiveness of shrimp skin to treatments, paving the way for tailored approaches in optimizing its performance as an

absorbent for waste oil. Intriguingly, the comparative analysis among different shrimp species mirrors the diversities observed in bio-waste, accentuating the critical importance of discerning and selecting the most suitable absorbent for effective environmental remediation.

In conclusion, this research with shrimp skin as a waste oil absorbent not only substantiates it's potential but also establishes tiger shrimp as a front runner in this endeavor. Beyond its inherent oil absorption capabilities, tiger shrimp skin exhibited an extended duration of effectiveness and demonstrated its ability to regulate pH levels in the marine environment, further enhancing its appeal as an environmentally friendly solution for oil spill cleanup. This research, rooted in the project's overarching theme, signifies a significant stride towards sustainable and innovative alternatives in addressing environmental challenges posed by waste oil contamination, marking shrimp skin, especially that of tiger shrimp, as a promising candidate for future applications in oil spill remediation.

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