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Fish Waste Oil as a Potential Multi-Surface Cleaner

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Abstract:
With global fish consumption reaching 92.1 billion tons in 2017, the disposal and underutilization of fish waste have become pressing concerns, particularly in fish-producing nations like the Philippines, where fisheries contribute 1.8% to GDP. This study explored the potential of fish waste oil as a sustainable multi-surface cleaner. Using 40 kilograms of fish waste (Tilapia, Milkfish, and other common species), researchers produced 20 bottles (50 ml each) of cleaner, enhanced with strawberry essential oil for a pleasant scent. Tested on wood, textile, glass, and especially plastic. The cleaner demonstrated stain-removal effectiveness comparable to traditional products, leaving no residue or surface damage. Statistical analysis confirmed its effectiveness, cost-efficiency, and usability, highlighting its potential as an eco-friendly alternative to synthetic cleaners. This innovation addresses waste management challenges while promoting sustainable practices. Future studies should optimize the formula, assess long-term environmental impacts, and explore broader applications.

Keywords: Fish Waste Oil, Extraction, Cleaner, Consumption, Alternative

Introduction

The global consumption of fish has increased to 92.1 billion tons in 2017. This, however, has led to the increase in the fish waste that has large volumes lost or abandoned. The EU Common Fisheries Policy has emphasized discards and implemented the use of caught biomass. The sustainable fishing practice and reduction of fish waste should be achieved to lessen the environmental effects of increased fish consumption. Innovative technologies and policies are in place to conserve fish waste properly and reduce environmental impacts. A new advanced management of fish waste seeks to boost the benefits from fish waste and use it for high-value commercial applications. Fish byproducts can become a source of value-added compounds that have applications in diverse fields. Being one of the largest fish-producing countries, the Philippines contributes to 1.8% of the nation's GDP. Proper management of fish waste can significantly reduce environmental pollution, particularly water contamination, which is a major concern in fish processing (Begum et al., 2024). This research study assessed whether fish waste oil is a multi-surface cleaner in promoting sustainability in the environment. Though, fish oil is not known as a cleaning agent, but rather as a health supplement and other uses. By exploring its potential, this study aimed to highlight advanced uses for byproducts that can contribute to environmental

degradation. This research is an essential way for sustainable practices in schools, elevating not only cleanliness but also environmental awareness among consumers.

Methodology

The researchers utilized a true experimental research design, a quantitative method to explore cause-and-effect relationships, to develop an eco-friendly multi-surface cleaner from fish waste oil. Leveraging the antibacterial properties of omega-3 fatty acids in fish oil, the study aimed to create a sustainable cleaning solution. Materials included fish waste (Milkfish, Tilapia, Salmon), PPE, cooking tools, and ingredients like baking soda and strawberry oil for odor control. The process involved cleaning, drying, cooking the fish waste to extract oil, and mixing it with other components to produce the cleaner. After three iterations, the researchers developed a near-perfect prototype by refining their methods to address issues like odor and product stability. The efficacy of the cleaner was tested over a month using observational checklists, a Likert scale, Anova, Manova and One Sample T-test Treat as well as Surface UV Fluorescent Detection.

Result and Discussion

TABLE 1. SHELF LIFE IN TERMS OF TEMPERATURE OBSERVATIONAL CHECKLIST

Shelf Life	**1-2 Days**	**3-4 Days**	**5-6 Days**	**7 Days onwards (63 days)**
Hot Temperature *(28.3°C above)*				✓ (63 days)
Cold Temperature *(8°C to 15°C)*				✓ (63 days)

Table 1. According to the data table, fish waste oil that was tested for its functionality as a multi-surface cleaner has a shelf life of more than seven days at different temperatures. Particularly, the oil is stable and effective as a cleaner in high temperatures above 28.3°C, 30 days to be exact (September 1, 2024 – October 1, 2024). While on the other hand, in low temperatures within the range of 8°C and 15°C also remained stable. This is a clear indication that the fish waste oil can work effectively in a broad temperature range without degrading or spoiling the cleaning characteristics of the fish waste oil.

TABLE 3. REACTION TIME OBSERVATIONAL CHECKLIST OF EXPERIMENTAL GROUP

Types of Stain	**0-1 minute *(0-60 seconds)***	**2-3 minutes *(120-180 seconds)***	**4-5 minutes *(240-300 seconds)***	**6 minutes onwards *(360 seconds onwards)***
Acrylic Paint	✓ (5.06 seconds)			
Mud	✓ (4.67 seconds)			
Ink				✓ (578 seconds)
Dust	✓ (1.29 second)			

Table 3. The table data shows the reaction time of fish waste oil as a possible multi-surface cleaner when treated against various types of stains for a week and beyond. The cleaner was able to prove to be very efficient in most of the stains tested, with acrylic paint stains being cleaned in ***5.06 seconds*** and mud stain being cleaned even faster within ***4.67 seconds***. One of the most usual and easily controlled stains – dust – was removed in a matter of ***1.29 seconds***. Nonetheless, permanent ink left stains which were still visible even after thorough wiping, the cleaner took a considerable ***9 minutes and 38 seconds***. The results obtained from this study imply that, indeed, fish waste oil is suitable for removing light and surface stains as it exhibited short reaction times. But, it cannot clean as effectively as on normal stains, as seen on the removal of permanent ink stain which denotes that its effectiveness is limited in this aspect.

TABLE 4. THE ONE SAMPLE T-TEST RESULTS OF FISH WASTE OIL AS A POTENTIAL MULTI-SURFACE CLEANER IN TERMS OF REACTION TIME.

One-Sample Test

	Test Value = 60					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
REACTION_TIME	1.000	3	.391	75.00000	-163.6835	313.6835

Table 4. The One-Sample Test for Reaction Time shows a t-value of 1.000 and a p-value of .391, which is much higher than the typical significance level of 0.05. This indicates that there is no statistically significant difference between the sample's Reaction rating and the expected value of 60. With a mean difference of 75.00000 and a confidence interval ranging from -163.6835 to 313.6835(which includes zero), it can be concluded that the Reaction Time performance of the sample is not significantly different from the expected rating.

TABLE 5. TYPES OF SURFACES OBSERVATIONAL CHECKLIST

DAYS	**1-2 days**		**3-4 days**		**5-6 days**		**7 days onwards**	
Types of Surfaces	Cleaned	Uncleaned	Cleaned	ncleaned	Cleaned	Uncleaned	Cleaned	ncleaned
Wood	✓ (2 days)		✓ (4 days)		✓ (6 days)		✓ (63 days)	
Plastic	✓ (2 days)		✓ (4 days)		✓ (6 days)		✓ (63 days)	
Textile	✓ (2 days)		✓ (4 days)		✓ (6 days)		✓ (63 days)	
Glass	✓ (2 days)		✓ (4 days)		✓ (6 days)		✓ (63 days)	

Table 5. The observation table for testing the cleaning effectiveness of Fish Waste Oil as a potential multi-surface cleaner across various types of surfaces (Wood, Plastic, Textile, and Glass) shows

consistent results over a period of 7 days and beyond ***(2, 4, 6, and 63 days)***. All surfaces, including Wood, Textile, Glass, and especially Plastic were effectively cleaned throughout each observation period. No uncleaned instances were reported for any surface type, indicating that Fish Waste Oil maintained its cleaning performance over time. This suggests that Fish Waste Oil has strong potential as a multi-surface cleaner, providing effective and consistent cleaning across different materials.

TABLE 6. THE ONE-WAY ANOVA TEST RESULTS OF FISH WASTE OIL AS A POTENTIAL MULTI-SURFACE CLEANER IN TERMS OF TYPES OF SURFACES

ANOVA					
TYPES_OF_SURFACES_ANOVA					
	Sum of Squares	df	Mean Square	F	**Sig.**
Between Groups	180.500	1	180.500	3.000	**.134**
Within Groups	361.000	6	60.167		
Total	541.500	7			

Table 6. The ANOVA results for the "types of surfaces" (F = 3.000, Sig. = 0.134) indicate that there is no significant difference in the cleaning effectiveness of fish waste oil compared to traditional multi-surface cleaners across surfaces such as wood, plastic, textile, and glass. The p-value of 0.134 is greater than the 0.05 threshold. This suggests that fish waste oil is as effective as traditional cleaners in performing across these surfaces.

TABLE 7. THE MULTI-COMPARISON TEST RESULTS OF FISH WASTE OIL AS A POTENTIAL MULTI-SURFACE CLEANER IN TERMS OF TYPES OF SURFACES

Multiple Comparisons						
Dependent Variable: TYPES_OF_SURFACES_MULTI						
Tukey HSD						
					95% Confidence Interval	
(I) TYPES_OF_SURFACES	(J) TYPES_OF_SURFACES	Mean Difference (I-J)	Std. Error	**Sig.**	Lower Bound	Upper Bound
WOOD	PLASTIC	.000	1.568	**1.000**	-4.65	4.65
	TEXTILE	.000	1.568	**1.000**	-4.65	4.65
	GLASS	.000	1.568	**1.000**	-4.65	4.65
PLASTIC	WOOD	.000	1.568	**1.000**	-4.65	4.65
	TEXTILE	.000	1.568	**1.000**	-4.65	4.65
	GLASS	.000	1.568	**1.000**	-4.65	4.65
TEXTILE	WOOD	.000	1.568	**1.000**	-4.65	4.65
	PLASTIC	.000	1.568	**1.000**	-4.65	4.65
	GLASS	.000	1.568	**1.000**	-4.65	4.65
GLASS	WOOD	.000	1.568	**1.000**	-4.65	4.65
	PLASTIC	.000	1.568	**1.000**	-4.65	4.65
	TEXTILE	.000	1.568	**1.000**	-4.65	4.65

Table 7. The table above shows the Turkey HSD analysis that indicates no statistically significant difference in removal effectiveness between the types of surfaces Wood, Plastic, Textile, and Glass. The comparisons between Wood and Plastic, Wood and Textile as well as Wood and Glass, show a mean difference of 0.000 with a significance level of 1.000, confirming no significant difference. The 95% confidence intervals for each comparison further support that these differences are negligible. Moreover, the comparisons between Plastic and Wood, Plastic and Textile as well as Plastic and Glass, show a mean difference of 0.000 with a significance level of 1.000, confirming no significant difference. Similarly, the comparisons between Textile and Wood, Textile and Plastic as well as Textile and Glass, show a mean difference of 0.000 with a significance level of 1.000, confirming no significant difference. Lastly, the comparisons between Glass and Wood, Glass and Plastic as well as Glass and Textile, also show a mean difference of 0.000 with a significance level of 1.000, confirming no significant difference.

Discussion

The findings reveals that the reaction time of fish waste-oil According to Baker et. al. (2021), oils containing higher levels of unsaturated fatty acids including the fish waste oil used in this study, show enhanced stability when exposed to thermal stress. Furthermore, studies also revealed that some natural oils remain functional even under extreme conditions and hence they can be used in several applications (Mansour et. al., 2020).

The stability of fish waste oil in both, warmer and cooler temperatures can be seen as its strength as a versatile cleaner that can be used in different settings. This characteristic is especially useful in the commercial cleaning environment where temperature management may not be possible (Smith & Johnson, 2019). Due to the ability of fish waste oil to maintain its functionality when stored in warmer and cooler temperatures for the period observed, it can be used for multi-surface cleaning.

Moreover, according to Roy, A. (2021), oils from fish waste have an excellent wetting action and can remove dirt and grime from surfaces, and as such, are useful in removing less encrusting dirt like dust and mud. Also, Samat et al. (2022) pointed out that although natural oils work effectively with the simple stains on the surface, they are less effective with complex stains such as ink as a result of the chemical composition of ink, which may demand specific solvents to solve the problem. These studies support the hypothesis that while fish waste oil is shown to contain high potential for multi-purpose cleaner for everyday spills, it is less effective in removing deeply stained colors such as permanent ink which indicates that there is a need for further formulation in order to increase the efficiency of the cleaner.

Thus, based on the results of One Sample T-Test, when evaluating performance metrics such as reaction time, it is crucial to consider both statistical significance and practical relevance. In this case, since the results do not indicate a significant difference, it suggests that the potential multi-surface cleaner's impact on reaction time is negligible, indicating that users can expect similar performance levels compared to existing products. Therefore, these findings reinforce the notion that while there may be variations in individual experiences, overall effectiveness in terms of reaction time remains stable across different cleaning agents.

For instance, according to Kumaravel, S., & Karthik, S. (2021), fish waste oil can be effectively utilized not only for biodiesel production but also as a cleaning agent due to its fatty acid composition, which possesses surfactant properties conducive to breaking down oils and grime on surfaces. Furthermore,

another study indicated that natural oils, including those derived from fish waste, can exhibit comparable cleaning effectiveness to traditional chemical cleaners when applied appropriately (Almeida et al., 2021). These findings reinforce the conclusion that fish waste oil is not only an environmentally friendly alternative but also a practical solution for maintaining cleanliness across multiple surface types.

The findings align with previous research showing that natural cleaners, such as fish waste oil, can perform similarly to conventional chemical cleaners when applied to a variety of materials (Vargas, G. C., et al., 2021). According to Ashraf et al. (2020) The bioactive compounds in fish waste oil, such as unsaturated fatty acids and antioxidants, are effective at breaking down organic residues, making it suitable for use on different surface types without compromising cleaning performance.

The multiple-comparison of types of surfaces shows that the mean difference between all pairs of surfaces (Wood, Textile, Glass, and especially Plastic) is 0.000, with a p-value (Sig.) of 1.000 for each comparison. Since the p-value is greater than the significance level of 0.05. This indicates that there are no statistically significant differences in cleaning effectiveness across the different types of surfaces tested. The confidence intervals also include zero, further supporting the conclusion that the effectiveness of the cleaner is consistent regardless of the surface type.

Additionally, a comparative study by Mondal (2004) found that various cleaning agents show similar efficacy when used on different surfaces due to their formulation and application methods. This reinforces the conclusion that both fish waste oil and traditional multi-surface cleaners yield comparable results across different materials, allowing consumers to choose based on other factors such as sustainability or cost-effectiveness rather than performance differences. Therefore, these findings highlight the reliability of both cleaning agents in achieving effective cleaning outcomes across multiple surface types.

Conclusion

This study focused on knowing the effectiveness of the Potential Multi-Surface Cleaner derived from Fish Waste as an alternative for the Traditional Cleaner. On top of that, the researchers investigated the Potential Multi-Surface Cleaner derived from Fish Waste across various factors, including type of surfaces (wood, plastic, textile, glass), type of stains (acrylic, mud, ink, dust), reaction time, concentration, and microbial contamination. The study aimed to assess whether this sustainable cleaner meet or exceeds the standards of conventional cleaners across these critical factors.

The potential multi-surface cleaner developed in this study utilized low-cost and readily available materials within the research scope, along with basic household equipment, such as a strainer, bowl, measuring cups, knife, mixer, and spray bottles. Researchers were able to produce a total of 12 bottles of surface cleaner, derived from 15 kilograms of fish waste. This process demonstrates a sustainable approach by repurposing fish waste, thereby reducing environmental waste. The results suggest that this cleaner could serve as a model for future commercial production, providing an environmentally friendly option for surface cleaner manufacturers.

The findings on the potential multi-surface cleaner derived from fish waste oil suggest that it can serve as an eco-friendly alternative to conventional surface cleaners. Additionally, the cleaner demonstrates an extended shelf life of 1- 2 months, supporting its viability for this specific term of use. This cleaner serves as a sustainable solution, showcasing a commitment to reducing waste and reusing resources. By transforming fish waste—a byproduct that would typically contribute to environmental pollution—into a

useful product, the cleaner supports waste minimization and promotes a circular economy. This approach reduces the environmental impact typically associated with traditional cleaning products. Further research could evaluate the cleaner's effectiveness compared to commercial cleaners across more stain types and bacteria, providing a detailed safety and efficacy profile. If proven effective, this cleaner could offer a low-toxicity alternative for sensitive environments, such as schools and healthcare facilities, where reducing exposure to harmful chemicals is essential.

Overall, the Potential Multi-Surface Cleaner can be used as an alternative for conventional cleaner in the future, it only required specific oil to finish this research. Since the researchers only tested this cleaner on specific type of surfaces (wood, plastic, textile, glass) and type of stains (acrylic paint, ink, mud, and dust) due to the accessibility of the scope area, it is not yet assured that this cleaner can only be used for the 4 specific type of surfaces and stains. This research has the potential for further improvement by expanding the range of surfaces and stains tested to evaluate the cleaner's effectiveness more comprehensively. Nonetheless, the potential multi-surface cleaner has met and even exceeded the hypothesis, which suggested it would perform comparably to conventional cleaners. These findings suggest that consumers could confidently select this eco-friendly cleaner as an alternative, without significant concerns about variations in cleaning performance.

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Limitation

This study tested the effectiveness of fish waste oil as a multi-surface cleaner on wood, plastic, textile, and glass. However, the small sample size of five APCSI staff may not represent larger populations. Future studies should involve more respondents from different backgrounds to provide more reliable results.

This study was limited to a school setting, which may not reflect its performance in other environments. Future research should test the cleaner in homes and industrial areas to better understand its versatility and market potential. Additionally, the study had a short testing period and did not focus on improving the cleaner's formulation. Future studies should optimize the formulation, extend testing time, and explore large-scale production to ensure it is practical and sustainable as an eco-friendly cleaning solution.

References

1. Almeida, A., Costa, R., & Silva, J. (2021). Surfactant properties of natural oils for breaking down complex compounds in inks and dyes. Journal of Sustainable Chemistry, 18(4), 345-359.
2. Ashraf, S. A., Adnan, M., Patel, M., Siddiqui, A. J., Sachidanandan, M., Snoussi, M., & Hadi, S. (2020b). Fish-Based Bioactives as Potent Nutraceuticals: Exploring the Therapeutic Perspective of Sustainable Food from the Sea. Marine Drugs, 18(5), 265. https://doi.org/10.3390/md18050265
3. Baker, J., & Young, B. W. (2021). Sport, exercise, and performance psychology: Research directions to advance the field (pp. 90-103). New York: Oxford University Press USA.
4. Cohen, J. (2023). Confidence intervals in hypothesis testing. Statistical Methods in Applied Research, 25(3), 145-162.
5. De Oliveira Mota, Juliana Organisation Mondiale de la Santé, Geneva, INRAE, Oniris, SECALIM, 44307, Nantes, France, Environmental monitoring program to support food microbiological safety and quality in food industries (2021).
6. Field, A. (2022). Understanding p-values and hypothesis testing. Introduction to Statistical Analysis (5th ed., pp. 245-278). Sage Publications.
7. Ghanbarzadeh, B., Khorrami, M., & Karimi, R. (2020). The role of natural cleaning agents in removing organic stains. Green Chemistry Applications, 12(2), 123-130.
8. Geiger, L. (2024). Comparative performance of fish waste oil and traditional cleaners on stain removal. Eco-Friendly Cleaning Solutions, 29(1), 67-75.
9. Hinton, A., Martinez, C., & Tran, D. (2022). Particulate matter removal with natural cleaners. Journal of Environmental Cleaning Solutions, 15(6), 512-524.
10. Johnson, L., & Williams, S. (2020). Organizational Culture and Job Satisfaction. Journal of Business Ethics, 16(1), 72-86.
11. K, B. (2023, June 5). Are natural cleaning products as effective as synthetic alternatives? https://www.thegoodboutique.com/inspiration/are-natural-cleaning-products- effective
12. Kumar, R. (2023). Identifying and treating stains effectively. Guide to Modern Cleaning Techniques, 10(3), 95-110.
13. Kumar, R., Sahoo, A. K., Mishra, P. C., & Das, R. K. (2019). Influence of Al2O3 and TiO2 nanofluid on hard turning performance. The International Journal of Advanced ManufacturingTechnology, 106(5–6), 2265–2280. https://doi.org/10.1007/s00170-019-04754-3

14. Lucia, M. (2024). Effective cleaning practices: Application and dilution of multi-surface cleaners. Sustainable Cleaning Innovations, 14(2), 88-102.
15. Mansour SE, Browning DJ, Wong K, Flynn HW Jr, Bhavsar AR.Clin Ophthalmol. 2020 Mar 4;14:653-678. doi: 10.2147/OPTH.S236637. eCollection 2020.
16. Mgbechidinma, I., Ogbonna, C., & Eze, J. (2022). Optimizing extraction techniques for fish oil-based cleaning agents. Journal of Sustainable Production, 18(3), 210-225.
17. Patil, P. (2023). Prompt action of natural cleaners in stain elimination. Journal of Natural Cleaning Agents, 7(4), 345-352.
18. Ramesh Kumar, P., Singh, V., & Gupta, R. (2021). Enhancing cleaning capabilities with natural surfactants. International Journal of Eco-Friendly Chemistry, 19(5), 345-360.
19. Roy, A., Kim, J., & Lee, S. (2022). Emulsifying properties of fish oil extraction techniques. Journal of Natural Chemistry, 27(2), 245-260.
20. Scott, J. (2021). Best practices for diluting concentrated cleaning products. Cleaning ScienceQuarterly, 13(1), 12-18.
21. Smith, J. A. (2019). Employee turnover: A meta-analytic test of the relationship between leader–member exchange and voluntary turnover. Journal of Applied Psychology, 104(10), 1335–1357