

Research Article

Save Our Planet: Use Leaf Straw

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Abstract: As the beverage industry, such as bubble tea, gains popularity among young people in the bustling streets, the use of non-biodegradable plastic straws presents a pressing global environmental crisis. In fact, our country, Malaysia, is currently grappling with the problem of mismanaged plastic waste, particularly in plastic straws. The government has launched extensive campaigns to reduce plastic usage, leading to the introduction of various biodegradable straw options in the market. This research focuses on using leaves as an alternative straw. Five common leaves in Malaysia, namely oil palm leaf, banana leaf, pandan leaf, coconut leaf, and corn leaf, were selected for potential leaf straw production. Preliminary studies showed that only banana leaf, pandan leaf, and corn leaf had minimal effects on water, particularly in terms of color. These three leaf straws then underwent water quality analysis, including pH value, water conductivity, and total dissolved solids (TDS). Throughout the one-hour analysis, the pH value of the water dropped slightly from 6.85 to around 6.50, water conductivity varied between 155 and 95 $\mu\text{S}/\text{cm}$, while TDS varied from 105 to 65 ppm. Overall, the results indicated that all three types of leaf straws had no significant effect on water quality. In conclusion, the research demonstrated the potential of using banana leaf, corn leaf, and pandan leaf as suitable alternatives to plastic straws in Malaysia. These biodegradable leaf straws have a minimal impact on water quality, making them environmentally-friendly choices for everyday use.

Keywords: biodegradable straw , pandan leaf , banana leaf , corn leaf , characterisation



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1. INTRODUCTION

Plastic pollution has become a grave concern in the whole world. Malaysia is tracking global trends in both the overall generation of plastic waste and the consumption of single-use plastics and since 2017 has been the world's largest importer of plastic waste.(Chen, Nath, Chong, Foo, Gibbins,& Lechner, 2021). The beverage shop industry, especially bubble tea shops has witnessed substantial growth in Malaysia, resulting in a proliferation of such establishments. With this rapid increase, concerns regarding the environmental impact have arisen caused by the use of plastic straws. This

situation was even worse during the COVID-19 pandemic era. People have been encouraged to use drinking straws by the public due to their thought of virus transmission reduction because of non-contact with liquid-containing cups/containers.(Aragaw,2023).

As a result, the Malaysian Government and Non-Governmental Organisations (NGOs) has made significant efforts to encourage the adoption and uptake of biodegradable alternatives to address the serious issues of plastic pollution. For instance, Malaysia has created a 12-year action plan called the Roadmap towards Zero Single-Use Plastics 2018-2030 in response to the pitfalls of failing to execute strong governance in tackling plastic waste reduction. The goal of the roadmap is to minimize the use of single-use plastic garbage via an integrated effort by all stakeholders. (Kamaruddin,Radzi,Marwan & Patittingi, 2022). Furthermore , the ban on the use of plastic drinking straws effective Jan 1, 2020, is aimed at traders and operators of food outlets who are licence holders, and not at the public.(Malay Mail,2019) Apart from that, Nestle Malaysia has announced that they will be using paper straws across their entire range of UHT products by the end of 2020 (Malay Mail ,2020).

Various types of biodegradable straws, such as paper straws, metal straws, and bamboo straws, have been introduced into the market. However, these alternatives have their downside. For instance, paper straws tend to become soggy and disintegrate easily when they come into contact with liquids ,which can diminish the overall drinking experience. All the evaluated paper straws lost 70% to 90% of their compressive strength after being in contact with the liquid for less than 30 min. Furthermore, the paper straws absorbed liquid at approximately 30% of the straw weight after liquid exposure for 30 min. (Gutierrez,Royals, Jameel, Venditti & Pal,2019). Similarly, although the metal straws are durable , they can impart a metallic taste on drinks, can clink against the teeth and, as metal is extremely heat conductive. (Anna Lawson ,2022). Nevertheless, bamboo straws may not meet desired hygiene standards as they are the hardest of the straws to clean and can have a little bit of a chalky aftertaste. Also, the absorbent bamboo material can soften, warp, and crack if left soaking in liquid. (Elinor Aspegren,2019).

In this study, an alternative of leaf straw fabricated using 5 different types of leaf which are commonly found in Malaysia was introduced. The 5 types of leaf were oil palm leaf, banana leaf, pandan leaf, corn leaf and coconut leaf. Initially, a preliminary study on the effect of leaf straw dipped into water was conducted to find out the effects of the leaves on the colour of water. After that, a series of water analyses such as pH value, total dissolved solid and water conductivity of water dipped with the selected leaf were investigated. Through the study, it was found that the banana leaf, pandan leaf and corn leaf were suitable to be made into leaf straws.

2. METHOD & MATERIAL

2.1 Leaf Straw Production

Leaves chosen for this research were oil palm leaf, banana leaf, pandan leaf, coconut leaf and corn leaf. Other materials needed for the fabrication of leaves are parchment papers, a round stick and food glue. All leaves will be washed before being used for the fabrication of straw. The leaf straws were prepared by folding a layer of parchment paper between leaves.

2.2 Preliminary Study of Leaf

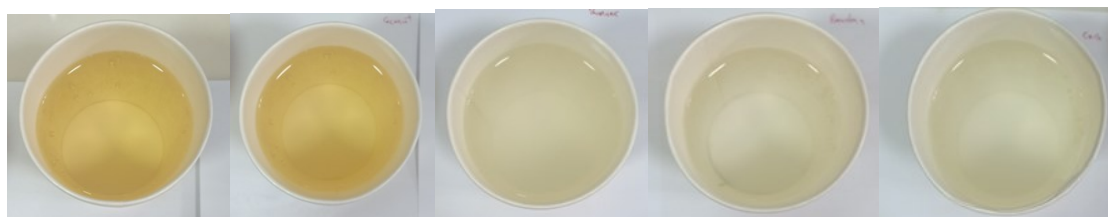
Five different leaf straws were dipped into water for the effect of the leaf on water were observed after one hour.

2.3 Water Quality Analysis

Water quality analyses such as the pH value, water conductivity and total dissolved solids (TDS) were conducted using a pH meter RCYAGO 4 in 1 pH/TDS/EC/Temperature Meter Water Quality Monitor Horticulture Water Quality Test Pen.. Water used in the study was from the Coway machine. Only the selected leaf straws were analysed at this stage.

3. FINDINGS

3.1 Preliminary Study : The Effect of Leaf on the Water



Oil Palm Leaf

Coconut Leaf

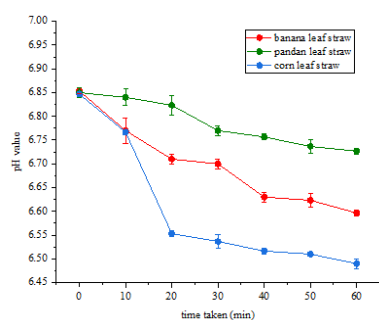
Banana Leaf

Pandan Leaf

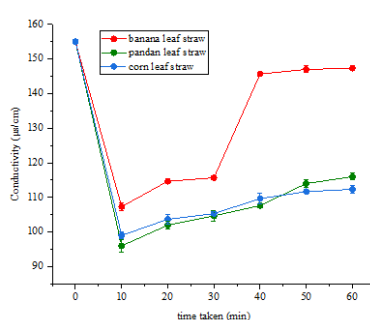
Corn Leaf

Based on the observation after dipping the leaf straws in water for 1 hour, oil palm leaf straw and coconut leaf straw were excluded from continuing the water quality analysis. As these leaf straws changed the colour of the water from colourless to yellow which showed that it had a dominant impact on water. Banana leaf straw, pandan leaf straw and corn leaf straw were selected for the water quality analysis as the water remained clear and clean after dipping these leaf straws into the water for 1 hour, which showed that the impact of these leaf straws on the water was minimal.

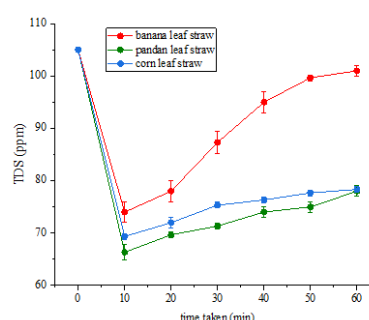
3.2 Water Quality Analysis



pH Value



Water Conductivity



Total Dissolved Solids (TDS)

Throughout the one-hour analysis, the changes in pH value were tiny and could be neglected. As the result above showed that the pH value of the water dropped slightly from 6.85 to around 6.50. The variation of water conductivity was also not significant as the result above showed the water conductivity varied between 155 and 95 $\mu\text{S}/\text{cm}$ after one-hour analysis while Total Dissolved Solids (TDS) varied from 105 to 65 ppm which showed the water was still regarded as high-purity. Overall, the results indicated that all three types of leaf straws had no significant impact on water quality.

4. DISCUSSION

The reason to carry out the research was to determine the leaf straws that have minimum effects on the water, particularly in terms of taste. The pH value analysis was to study the effects of leaf straws on the pH value of the water. This is because pH itself can affect the taste of drinking water. (Adams, Burlingame, Ikehata, Furatani & Suffet, 2022). As for the Total Dissolved Solids (TDS) analysis, a higher level of TDS results in lower water purity. The result was also confirmed with the similar trend showing in the water conductivity study. Generally, the water with TDS varies between 50 to 150 ppm and is excellent for drinking. (Bisleri, 2020). Overall, the results of the analysis showed that banana, pandan and corn leaf straws had minimum effects on the taste of the water.

5. CONCLUSION

Leaf straws can be used as an alternative to replace plastic straws. Banana leaf, pandan leaf and corn leaf are suitable to make leaf straws as they give minimum effect on the water quality .

References

- Anna Lawson (2022) .Best Reusable Straws 2023,Tried and Tested, BBC Good Food.
- Aragaw, T. A. (2023). Sustainable Management of Drinking Plastic Straws is Required to Reduce Plastic Pollution: Are We Using Them More During COVID-19. *Journal of Hazardous Materials Advances*, 100328.
- Bisleri (2020) Understanding TDS and Its Role in Drinking Water, Bisleri, 24 July.
- Burlingame, G.A., Dietrich, A.M. and Whelton, A.J. (2007), Understanding the Basics of Tap Water Taste. *Journal - American Water Works Association*, 99: 100-111.
- Chen, H. L., Nath, T. K., Chong, S., Foo, V., Gibbins, C., & Lechner, A. M. (2021). The Plastic Waste Problem in Malaysia: Management, Recycling and Disposal of Local and Global Plastic Waste. *SN Applied Sciences*, 3, 1-15.
- Elinor Aspegren(2019).Plastic Straw Alternatives Bad for Planet, People With Disabilities ,USA Today
- Gutierrez, J. N., Royals, A. W., Jameel, H., Venditti, R. A., & Pal, L. (2019).Evaluation of Paper Straws Versus Plastic Straws: Development of A Methodology for Testing and Understanding Challenges for Paper Straws. *BioResources*, 14(4), 8345-8363.
- Hunter Adams, Gary Burlingame, Keisuke Ikehata, Laith Furatani, I. H. (Mel) Suffet (2022); The Effect of pH on Taste and Odor Production and Control of Drinking Water. *AQUA - Water Infrastructure, Ecosystems and Society*, 1 November.
- Kamaruddin, H., Radzi, M. S. N. B. M., Marwan, M. A., & Patittingi, F. (2022). Critical Analysis on the Malaysian Legal Approach and Policy in Plastic Waste Reduction. *res militaris*, 12(2), 1738-1745.
- Malay Mail (2019) Plastic Straw Ban Effective 2020, Ministry Clarifies, Malay Mail, 22 September.
- Malay Mail (2020) Nestle Malaysia to Use Paper Straws for Their Entire UHT Range by The End of 2020,Malay Mail,23 July.