Is Laundry Ball a Sustainable Washing Option? Examining the Effect of Laundry Ball on Microfiber Shedding for Clothing Made of Synthetic Materials

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Introduction and Background. Consumers across the globe use detergent as a regular household washing option for more than 100 years for cleaning apparel products (Kogawa et al., 2017; Tsompou & Kocherbitov, 2022). However, environmentalists are concerned about the excessive usage of detergent during home laundering because of its harmful environmental effect (Pradhan & Bhattacharyya, 2017). For instance, phosphates, an ingredient in detergent, is the leading cause of aquatic pollution (Sobrino-Figueroa, 2018). As an alternative to detergent, laundry ball (e.g., ceramic laundry ball, lint remover laundry ball, scrubbing laundry ball) is often used to wash apparel products during home laundering (Lamichhane, 2018). Ceramic laundry ball performs cleaning with the friction of garment, lint remover laundry ball executes cleaning by removing pet hair or lint from clothing, and scrubbing laundry ball creates friction to enhance cleaning during home laundering (Washmode, 2022). Because of the alternative to detergent that causes water pollution, some users claim laundry ball as a sustainable washing option (Sanitizer, 2021). However, little research exists to showcase whether using laundry ball causes harm to the environment by producing microfiber shedding during home laundering.

Clothing made of synthetic materials such as polyester, nylon, and acrylic is one of the major sources of microfiber shedding during the home laundering process (Carr, 2017). Microfiber, less than 5 mm in length, is too tiny to trap into the filter of a home laundering machine, eventually flowing out with rinse waters and entering to oceans (Dris et al., 2016). Ocean species (e.g., fish, plankton) consume microfibers, which ultimately disturb food chains and the health of marine lives (Napper & Thompson, 2016). Microfiber also has been detected in human lung biopsies, lakes, drinking waters, and soil samples (Machado et al., 2018; Prata, 2018; Wagner et al., 2014). It is urgent to examine the home laundering process of synthetic clothing using laundry ball to protect the environment and the health of human being. Thus, this study aimed to examine the effect of different laundry balls on microfiber shedding during the home laundering process of synthetic clothing with different washing cycles.

Method. An experimental research design, consisting of 4 (laundry balls) x 3 (washing cycles) x 2 (repetition) was used for this study. In this study, 100% polyester fleece blanket was used as synthetic clothing. Three laundry balls used in this experiment included ceramic laundry ball (8 cm diameter), lint remover laundry ball (19.98 cm x 15.01 cm x 3.50 cm), and scrubbing laundry ball (14.47 cm x 10.4 cm x 3.30 cm). In this experiment, laundry balls were the treatments with four levels, including the control group with polyester clothing, polyester clothing with ceramic laundry ball, polyester clothing with lint remover laundry ball, and polyester clothing with scrubbing laundry ball. A top-loaded portable washing machine was used for laundering with 2 liters of water at 30°C temperature. Filter papers with 9 cm diameter were used for filtering the discharged water from the washing machine using a vacuum filtration system, consisting of 500 ml vacuum filtering flask, 60 cm length of plastic vacuum tubing, 200 ml Buchner funnel, and hand vacuum pump with pressure gauge. A digital scale was used to weigh the filter paper to measure the microfiber content in milligram per liter (mg/L).

SAS 9.4 was used for statistical analysis at the significance level of $p < .05$. A F-test in ANOVA was used to determine the significant effects of different laundry balls on microfiber shedding. A t-test was used to check the effect of each laundry ball on microfiber shedding. A pairwise Tukey adjustment method was used to compare the different laundry ball options. A Z-test was also conducted to determine the effects of different washing cycles within the same laundry ball option.

Results and Discussion. The F-test in ANOVA revealed the statistical significance of different laundry balls on microfiber shedding ($F(3,8) = 9.64$, $p = .0049$). It demonstrates that the following four laundering options (control group with polyester clothing, polyester clothing with ceramic laundry ball, polyester clothing with lint remover laundry ball, and polyester clothing with scrubbing laundry ball) have significant effects on microfiber shedding of 100% polyester clothing at different washing cycles. The t-test also revealed the significant effects of laundry balls on microfiber shedding of polyester clothing at different washing cycles with the control group ($t(8) = 22.46$, $p < .0001$), with ceramic laundry ball ($t(8) = 28.40$, $p < .0001$), with lint remover laundry ball ($t(8) = 22.21$, $p < .0001$), and with scrubbing laundry ball ($t(8) = 21.95$, $p < .0001$).

The Tukey's pairwise comparisons revealed no significant difference of the control group, laundering with lint remover laundry ball ($t(8) = .18$, $p = .9977$) and with scrubbing laundry ball ($t(8) = .37$, $p = .9822$). On the other hand, a significant difference was found between laundering with ceramic laundry ball and the control group ($t(8) = 4.20$, $p = .0128$). Specifically, washing synthetic clothing with ceramic laundry ball produced 15.33 mg/L more microfiber contents than the control group. This presents while laundering synthetic clothing at different washing cycles, laundering synthetic clothing with ceramic laundry ball produces higher microfibers, whereas laundering synthetic clothing with lint remover laundry ball and scrubbing laundry ball produce approximately the same amounts of microfibers compared to the control group. The Z-test revealed that the effect of different washing cycles within the same laundry ball was not significant ($Z = 0.52$, $p = .3012$), indicating that different washing cycles do not influence microfiber shedding while laundering synthetic clothing together with ceramic laundry ball, lint remover laundry ball, or scrubbing laundry ball.

Conclusion. Laundry ball is promoted as a substitute for detergent and claimed as a sustainable washing option. This experimental study examined this claim by evaluating the effect of different laundry balls on microfiber shedding of synthetic clothing at different washing cycles during the home laundering process. The use of ceramic laundry ball, lint remover laundry ball, and scrubbing laundry ball contributed to microfiber shedding for synthetic clothing. In fact, using ceramic laundry ball at home laundering increased microfiber shedding compared to the regular laundering of synthetic clothing. This study unearthed the negative environmental effect of laundry ball although they were considered as an alternative washing option in public. This finding resonates the importance of educating consumers to choose appropriate washing options to minimize microfiber pollution. Further research is recommended to test other commercially available laundry balls from the market to validate their effects on microfiber shedding compared to the outcome of this study.

This research only used 100% polyester clothing, one type of many synthetic clothing, for the experiment, which is the limitation of this study. Thus, future research is suggested evaluating microfiber shedding of synthetic clothing with various fiber types. Despite the study limitation, the findings of this study contribute to the overall body of knowledge related to microfiber shedding and its negative impact to the environment. Specifically, the findings have implications for industry professionals and academic researchers to think about and develop better sustainable laundering options than using laundry ball to minimize the negative environmental impact by controlling microfiber pollution at home laundering.

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