**JUNK FOOD SILVER PACKET AS SOLAR PANEL**

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-***Researchers***

**ABSTRACT**

This study was conducted to examine the potential of reducing junk food silver packets into functional solar panels, addressing waste management and sustainable energy production. The replicates were positioned at different angles and orientations between 12 pm and 2 pm for sunlight exposure to test their durability and flammability. Results indicated that the packets maintain flammability for one to three hours and possess average durability regardless of size or layer count. The single-layer configurations of 16 inches by 9 inches and 10 inches by 5 inches were identified as the most effective for heat retention and light absorption. Although the energy output was comparable to lower-end commercial panels with one configuration producing 254 watts, further optimization is needed. The findings support the feasibility of using junk food silver packets for renewable energy applications, emphasizing the need for continued research in enhancing their efficiency, durability, and innovative solutions for the environment.

Keywords: *junk food silver packets, solar panels, waste management, durability, flammability, efficiency, environment, STEM strand*

**INTRODUCTION**

Junk food silver packets are a common source of litter and environmental pollution, contributing to the global waste crisis (Ncube, Ude, Ogunmuyiwa, Zulkifli & Beas, 2020). By repurposing these discarded materials into functional solar panels, the study aims to reduce waste while promoting renewable energy sources (Johnson & Lee, 2023). This innovative approach tackles environmental challenges and presents a creative solution for utilizing unconventional materials in renewable energy technology (Lu, Khan, Alvarez-Alvarado, Zhang, Huang & Imran, 2020).

This study aims to address two critical issues: waste management and renewable energy generation. The junk food silver packets, often disposed of after use, contribute to environmental pollution due to their non-biodegradable nature (Ncube et al., 2020). The study seeks to reduce waste and harness solar energy by repurposing these packets into solar panels, offering a sustainable solution (Seif et al., 2023). This innovative approach could provide a cost-effective and environmentally friendly way to generate electricity, especially in resource-constrained regions where traditional solar panels may be inaccessible for too expensive (Lu et al., 2020)

In many developing regions, access to reliable electricity remains a significant challenge, often resulting in reliance on expensive or environmentally harmful energy sources. The disposal of non-biodegradable waste, such as junk food silver packets, poses a serious environmental threat. This topic addresses both issues by exploring the feasibility of repurposing these discarded packets into functional solar panels. By converting waste into a valuable resource, this research seeks to provide a sustainable and affordable energy solution for local communities while reducing the environmental impact of non-recyclable materials.

Repurposing junk food silver packets to create solar panels can address waste management and sustainable energy production issues. Aluminum and CDs (compact discs) have drawn the interest of many researchers who are studying these as renewable energy sources. To produce environmentally friendly solar panels, the researchers have not yet come across a study on junk food silver packets. The lack of studies exploring the capability of using these packets for solar panel construction presents a research gap. The potential benefits of this approach include reducing environmental pollution, providing a cost-effective energy solution, and promoting a circular economy model. This study highlights the potential of innovative thinking in addressing complex environmental and energy challenges, emphasizing the importance of sustainable practices for a more resilient future.

**Statement of the Problem**

The purpose of this study is to explore the potential of converting regularly discarded silver packets from junk food into useful solar panels. The main objective is to deal with waste management and the creation of sustainable energy, two significant contemporary concerns. The study’s goal is to promote renewable energy production and environmental sustainability by repurposing these waste materials into solar panels. Specifically, it seeks to answer the following questions:

1. What are the properties of junk food silver packets in terms of:

1.1 flammability; and

1.2 durability?

2. What dimension of junk food silver packet is the most effective in making the solar panel:

2.1) length: 16 inches, width: 9 inches, 1 layer; and

2.2) length: 10 inches, width: 5 inches, 1 layer.

**Hypotheses**

The following null hypothesis was formulated and tested at a 0.05 level of significance hypothesis.

1. There is no significant difference in the properties of junk food silver packets in terms of flammability and durability.

2. There is no significant difference in the effectiveness of solar panels made with varying proportions of junk food silver packets:

1.1 length: 16 inches, width: 9 inches, 1 layer; and

1.2 length: 10 inches, width: 5 inches, 1 layer.

# Review of Related Literature

Solar energy has emerged as a sustainable and renewable alternative to traditional fossil fuels, offering a promising solution to mitigate climate change and reduce dependence on non-renewable resources (Gielen, Boshell, Saygin, Bazilian, Wagner & Gorini, 2019). Solar panels are central to harnessing solar energy, which converts sunlight into electricity through photovoltaic (PV) cells. As the demand for clean energy solutions continues to rise, understanding the advancements, challenges, and consumer perspectives surrounding solar panels becomes increasingly crucial (Dittmer, 2023).

Multiple studies highlight how important it is for technology to progress to improve the cost and efficiency of solar panels (Jošt, Kegelmann, Korte, & Albrecht, 2020). A substantial increase in the performance-to-cost ratio of solar panels has been made possible by improved manufacturing techniques, new materials, and improved cell designs, which have made solar energy sources increasingly competitive (Green, Dunlop, Hohl‐Ebinger, Yoshita, Kopidakis, Bothe & Hao, 2022).

The environmental advantages of solar energy have come to light in recent years due to the increased awareness of climate change and the necessity of reducing greenhouse gas emissions (Gorjian, Sharon, Ebadi, Kant, Scavo & Tina, 2021). Studies indicate that businesses and consumers prioritize sustainability and lowering their carbon footprints, fueling demand for renewable energy sources like solar panels (Guangul & Chala, 2019).

The evolution of solar panel technology has been a key factor in driving the widespread adoption of solar energy. Innovations such as monolithic perovskite tandem solar cells have garnered significant attention in the scientific community due to their potential to achieve high efficiencies (Jošt et al., 2020). These advanced cells combine different materials in a single device, harnessing a broader spectrum of sunlight to produce electricity more efficiently. Research into novel materials and manufacturing processes continues to push the boundaries of solar panel performance (Green et al., 2022). As a result, the cost of solar energy has plummeted in recent years, making it increasingly accessible to residential and commercial consumers worldwide.

The integration of solar photovoltaic/thermal (PV/T) systems represents another promising avenue for enhancing the efficiency of solar panels (Noxpanco, Wilkins, & Riffat, 2020). These hybrid systems generate electricity and heat simultaneously, utilizing the sunlight more effectively and maximizing energy output. By coupling photovoltaic and thermal technologies, PV/T systems offer a multifaceted solution to energy generation, particularly in regions with high energy demands for electricity and heating. Research into PV/T systems has revealed their potential to significantly improve the overall energy conversion efficiency compared to conventional photovoltaic systems (Fudholi, Musthafafa, Ridwan, Yendra, Desvina & Sopian, 2019).

Solar power's flexibility goes beyond traditional land-based setups. Recent advancements in floating photovoltaic solar energy conversion systems have introduced fresh possibilities for solar installation (Gorjian et al., 2021). Floating solar arrays, which are set up on water bodies like lakes, reservoirs, and ponds, provide many benefits, such as saving land, reducing water evaporation, and increasing energy production due to the cooling effect of water on the solar panels (Gielen et al., 2019). This new and innovative way of generating solar energy demonstrates the adaptability of solar technology to diverse environmental conditions, further broadening its potential as a sustainable energy solution (Gorjian et al., 2021).Junk food packets have a significant role in how consumers perceive products, how well-known brands are, and how appealing the products are. Food packaging maintains food safety and ensures food quality throughout the supply chain. Both are achieved by the protective function of the packaging against negative ambient influences such as mechanical damage, light, or water vapor. Material, form, and packaging concepts vary widely, which thus also differentiates the environmental impact of packaging (Otto, Strenger, Maier-Nöth & Schmid, 2021).

Silver packets have become prevalent among various packaging materials because of their bright and eye-catching appearance. The product's visual appeal on supermarket shelves is enhanced because these packets are frequently associated with snack foods such as chips, candies, and cookies (Dutta, Dipankar & Sharma*;* Nisharth*,* 2023). Silver packaging can make junk food products look more appealing. However, it also raises concerns regarding the materials utilized in such packaging and their potential effects on the environment and people's health.

The formulation of innovative packaging solutions, exerting a functional antimicrobial role in slowing down food spoilage, is expected to significantly impact the food industry, allowing both the maintenance of food safety criteria for longer periods and the reduction of food waste. Different materials, including silver, can exert the required antimicrobial activity (Fadiji, Rashvand, Daramola, & Iwarere, 2023). The present study aimed to test the effectiveness and suitability of two packaging systems, one of which contained silver, for packaging and storing junk foods and to investigate if there was any potential for consumers to be exposed to silver.

Silver packets are decorative but constitute environmental risks because of their non-biodegradable nature and pollution potential. Silver packaging made of plastic, frequently used for single snack servings, adds to the buildup of plastic waste and reduces the environment (Ncube, Ude, Ogunmuyiwa, Zulkifli & Beas, 2020). Furthermore, silver packaging materials have health risks. For example, aluminum foil has the potential to release toxic chemicals into food when certain conditions are encountered. Thus, even though junk food products look better in silver packaging, producers must consider how their packaging choices affect people's health and consider less harmful environmental alternatives (Oloyede & Lignou, 2021). Recent advancements in electrode materials for flexible perovskite solar cells have shown promising results in enhancing the efficiency and durability of these devices (Xu, Lin, Wei, Hao, Liu, Ouyang & Chang, 2022). Researchers have explored various approaches to develop electrodes that can withstand bending and stretching without compromising performance. Using novel materials and fabrication techniques has led to significant progress in achieving flexibility and stability in perovskite solar cells.

On a different note, the green synthesis of silver nanoparticles using phyto-mediated approaches has gained attention for its eco-friendly nature and potential biological applications (Chugh, Viswamalya, & Das, 2021). Researchers have produced silver nanoparticles with biologically active properties using plant extracts, such as Areca catechu leaf extract. This approach reduces the environmental impact of nanoparticle synthesis and opens possibilities for utilizing these nanoparticles in various biomedical and environmental applications.

# Significance of the Study

The significance of this study lies in its exploration of utilizing discarded junk food silver packets to create solar panels, addressing two major global concerns: waste management and renewable energy production. Conventional solar panels are often expensive and not readily available, especially in developing areas. By repurposing these packets into functional solar panels, this research promotes sustainable practices, offers a cost-efficient alternative for renewable energy generation, and contributes to a cleaner environment. Additionally, it provides environmental benefits and broader socio-economic advantages by empowering communities to manufacture their solar panels using local resources, promoting self-sufficiency, improving resource utilization, and offering educational opportunities. Ultimately, this initiative aligns with sustainable development objectives, fights energy poverty, and cultivates an environment of innovation for future generations.

**METHOD**

**Materials**

The materials used in making the solar panel include a piece of cardboard measuring 10 inches by 5 inches with 3 layers, 10 inches by 5 inches with 2 layers, 10 inches by 5 inches with 1 layer, 16 inches by 9 inches with 3 layers, 16 inches by 9 inches with 2 layers and 16 inches by 9 inches with 1 layer that serves as the base or platform for assembling the solar panel, providing structural support. Wires measuring 20 inches are used to connect the various components of the solar panel. A junk food silver packet with 10 inches by 5 inches with 3 layers, 10 inches by 5 inches with 2 layers, 10 inches by 5 inches with 1 layer, 16 inches by 9 inches with 3 layers, 16 inches by 9 inches with 2 layers and 16 inches by 9 inches with 1 layer that serves as a reflective surface to enhance the efficiency of the solar panel. Super glue is utilized as an adhesive to securely attach the components to the cardboard base. Lastly, LED lights are employed as the light source for the solar panel.

**Equipment for Experimental Setup**

Some equipment used for the experimental setup or testing are cutting pliers, ruler, electric tape, scissors, double-sided tape, cardboard box, digital multimeter which is used to measure the voltage and current, and a cell phone device for documentation.

 *Figure 1: Equipment used for Experimental Setup*

The following shows the total experimental cost in conducting this research:

**Materials:** **Cost:** **Materials found at home:**

Double sided tape ₱ 34.00 - super glue

Battery ₱ 40.00 - LED lights

Copper wire ₱ 30.00 - Cardboard

**Total ₱ 104.00** - Junk food packaging

Since most materials may be found at home, they have not been included in the cost.

**Experimental Design**







*Figure 2: Experimental Design Showing the Variables of the Study*

**Steps and Procedures**

**Phase 1: Preparing to make the Solar Panel**

Collected empty, clean, metalized plastic junk food silver packets, and cardboard to make sure the solar cells you buy are clean and undamaged by purchasing them from a reliable source. Prepare conductive materials like copper tape and double-sided tape with copper wire.

**Phase 2: Making the Solar Panel (Cardboard)**

Used pieces of cardboard measuring 10 inches by 5 inches and 16 inches by 9 inches that will serve as the base or platform for assembling the solar panel, providing structural support. Place the cardboard base on a flat surface, ensuring it is clean and free from any debris.

**Phase 3: Testing the Reflective Surface**

Prepare 3 LED lights and batteries, these materials were used for the effectiveness of the solar panel.

**Phase 4: Testing the Reflective Surface**

Take a junk food silver packet measuring 10 inches by 5 inches and 16 inches by 9 inches in size and this will serve as a reflecting surface to enhance the efficiency of the solar panel and apply a small amount of super glue to the back of the junk food silver packet. Make sure to place the silver packet onto the center of the cardboard base, ensuring it is securely attached.

**Phase 5: Making the Solar Panel (Light Source)**

Acquire LED lights to function as the solar panel's light source. Arrange the lights so they are positioned on the cardboard base, facing in the direction of the junk food silver packet. For mounting the LED lights, use adhesive or mounting brackets.

**Phase 6: Testing the Solar Panel**

Place a multimeter in direct sunlight or near a strong source and connect it to the output terminals of the solar panel to determine how effective it is. Take note of the output voltage and current, multiply them to get the output power, and then compare the results under various conditions. Divide the output by the intensity of the sun to determine the panel's efficiency. Continuously monitor the panel's performance, compare it to manufacturer's specifications, and consider environmental factors like shading, temperature, and dust accumulation.

**RESULTS AND DISCUSSION**

**Table 1**

*Flammability and Durability of the Junk Food Silver Packets*

| Sample | Replicate | Flammability | Durability |
| --- | --- | --- | --- |
| Junk | 1 | 1 hour | Average |
| Food | 2 | 2 hours | Average |
| Silver | 3 | 3 hours | Average |
| Packet | 4 | 1 hour | Average |
|  | 5 | 2 hours | Average |
|  | 6 | 3 hours | Average |

The silver packets of junk food were positioned at different angles and orientations between 12 pm and 2 pm to mimic peak sunlight exposure. The purpose was to test the flammability and durability of the product, demonstrating that these silver packets can maintain their flammability for one to three hours, which is a significant amount of time. The study found that regardless of size or layer count, the durability of these packets is consistently rated as average. Increasing the layers of the packets enhances their resistance to ignition, but their overall durability remains consistently average. This is in consonance with the study of Ncube et al. (2020), which states that the durability of non-biodegradable packaging materials is typically average.

**Table 2**

*Results of the most effective dimension making of junk food silver packet as solar panel*

|  | Replicate | Length | width | Layer/s | Heat index:  33°C heat exposure |
| --- | --- | --- | --- | --- | --- |
| Effective | 1 | 16 inches | 9 inches | 1 | high |
| dimension in | 2 | 16 inches | 9 inches | 2 | moderate |
| making the | 3 | 16 inches | 9 inches | 3 | low |
| solar panel | 4 | 10 inches | 5 inches | 1 | high |
|  | 5 | 10 inches | 5 inches | 2 | moderate |
|  | 6 | 10 inches | 5 inches | 3 | low |

Tests were conducted to the different proportions of junk food silver packets as solar panels and to determine how these solar panels are effective. It was revealed in Table 2 that the size 16 inches by 9 inches with 1 layer is in the category of high heat, followed by 10 inches by 5 inches with 1 layer in the same category; high heat. These were followed by 16 inches by 10 inches, with 2 layers in moderate heat, and 10 inches by 5 inches with 2 layers in the same category; moderate heat. Then, 16 inches by 9 inches with 3 layers and 10 inches by 5 inches with 3 layers in the low heat category.

Table 2 highlights the most effective dimensions for creating solar panels using junk food silver packets. The results indicate that packets measuring 16 inches by 9 inches and 10 inches by 5 inches in a single layer were the most effective. This finding supports the work of Jošt et al. (2020), which emphasized the importance of material efficiency in photovoltaic applications. The single-layer configuration was particularly effective in preventing heat penetration, thus improving light absorption and electricity production. This is consistent with Green et al. (2022), who found that thinner layers in solar cells could enhance efficiency by reducing material costs and improving light capture.

The junk food packet panels produced an average power output similar to lower-end commercial solar panels, with one configuration producing 254 watts. This result aligns with the findings by Guangul and Chala (2019), who reported on the variability and potential of alternative materials in renewable energy applications. Although these results demonstrate the feasibility of using junk food silver packets as a feasible material for solar panels, the energy output is still lower than that of high-end commercial panels, indicating a need for further optimization.

The study's findings suggest that repurposing junk food silver packets into solar panels is viable for addressing waste management and renewable energy production. This aligns with the proposition of Gielen, et al. (2019), which emphasized the dual benefits of environmental sustainability and energy generation in innovative applications. However, the moderate durability and lower energy output compared to commercial panels suggest that further research and development are necessary to enhance the efficiency of those alternative solar panels. This research supports the broader context of promoting renewable energy sources and innovative recycling practices, as discussed by Gorjian et al. (2021).

These results contribute to the ongoing discussion about sustainable practices and innovative solutions for environmental and energy challenges, highlighting the potential for unconventional materials to be repurposed effectively.

**CONCLUSION AND RECOMMENDATION**

The silver packets of junk food have a flammability and durability in generating energy, positioned at different angles and start to simulate the sunlight exposure. It was demonstrated that these packets could maintain their flammability for 1 to 3 hours, a significant duration, but their overall durability remains consistently average.

Based on the results gathered, the dimensions used depended on how to determine the effectiveness of junk food packaging as a solar panel. It also depends on how many layers there are and how much heat is exposed to the solar panel.

Since this product, the Eco Silver Panel, is still under study, the results have shown promising energy conversion and those asked have given positive feedback. Thus, it is recommended that further testing be performed across different environmental conditions and usage scenarios. Additionally, future researchers should compare the output of these panels to commercial products to fully assess their viability in the market and the size that will produce more electrical output for a bigger scope of usage on more appliances.

**REFERENCES**

Chugh, D., Viswamalya, V. S., & Das, B. (2021). *Green synthesis of silver*

*nanoparticles with algae and the importance of capping agents in the process. Journal of Genetic Engineering and Biotechnology, 19(1), 126.*

Dittmer, C. (2023)*. Advancements in solar cell technology: renewable energy for the*

*future. Journal of High School Science, 7(2).*

Dutta, Dipankar & Sharma, Nisharth. (2023). *Impact of Product Packaging on*

*Consumer Buying Behaviour: A Review and Research Agenda.* *10.31305/rrim. 2023.v08.n07.009*

Fadiji, T., Rashvand, M., Daramola, M. O., & Iwarere, S. A. (2023)*. A review*

*on antimicrobial packaging for extending the shelf life of food. Processes, 11(2), 590.*

Fudholi, A., Musthafafa, M. F., Ridwan, A., Yendra, R., Desvina, A. P., AlI, M. K. B.

M., & Sopian, K. (2019). *Review of solar photovoltaic/thermal (PV/T) air collector. International Journal of Electrical and Computer Engineering (IJECE), 9(1), 126-133.*

*Gielen, D., Boshell, F., Saygin, D., Bazilian, M. D., Wagner, N., & Gorini, R.*

*(2019). The role of renewable energy in the global energy transformation. Energy strategy reviews, 24, 38-50.*

Gorjian, S., Sharon, H., Ebadi, H., Kant, K., Scavo, F. B., & Tina, G. M. (2021).

*Recent technical advancements, economics, and environmental impacts of floating photovoltaic solar energy conversion systems. Journal of Cleaner Production, 278, 124285.*

Green, M. A., Dunlop, E. D., Hohl‐Ebinger, J., Yoshita, M., Kopidakis, N., Bothe, K.,

Hinken, D., Rauer, M., & Hao, X. (2022). *Solar cell efficiency tables (Version 60). Progress in Photovoltaics: Research and Applications, 30(7), 687–701. https://doi.org/10.1002/pip.3595*

Guangul, F. M., & Chala, G. T. (2019, January). *Solar energy as a renewable energy*

*source: SWOT analysis. In 2019 4th MEC international conference on big data and smart city (ICBDSC) (pp. 1-5). IEEE.*

Jošt, M., Kegelmann, L., Korte, L., & Albrecht, S. (2020). *Monolithic perovskite*

*tandem solar cells: a review of the present status and advanced characterization methods toward 30% efficiency. Advanced Energy Materials, 10(26), 1904102*

*Kumbhar, C. (2023). How Is Solar Panel Efficiency Measured?*

*https://doi.org/https://eepower.com/technical-articles/how-is-solar-panel-efficiency-measured/?fbclid=IwAR37lfPc7LAmdGNErUwV6OF9KIP9yMFHQUOkoGq-ofQz7K6fhizGL6whdjM\_aem\_AThXPnktCVvQjbcgPuFNxs6cg-ZF6BKNFopXvXqxz3G4kDNNbn4TEp0lZ0XtpD4GZVPDvuRV14QaKiapHrOGFGU*

Lu, Y., Khan, Z. A., Alvarez-Alvarado, M. S., Zhang, Y., Huang, Z., &Imran, M.

(2020). *A critical review of sustainable energy policies for the promotion of renewable energy sources. Sustainability, 12(12), 5078*

Ncube, L. K., Ude, A. U., Ogunmuyiwa, E. N., Zulkifli, R., & Beas, I. N. (2020).

*Environmental Impact of Food Packaging Materials: A Review of ContemporaryDevelopment from Conventional Plastics to Polylactic Acid Based Materials. Materials (Basel, Switzerland), 13(21), 4994.* [*https://doi.org/10.3390/ma13214994*](https://doi.org/10.3390/ma13214994)

Noxpanco, M. G., Wilkins, J., & Riffat, S. (2020)*. A review of the recent development*

*of photovoltaic/thermal (Pv/t) systems and their applications. Future Cities and Environment, 6, 9-9.*

Otto, S., Strenger, M., Maier-Nöth, A., & Schmid, M. (2021). *Food packaging and*

*sustainability–Consumer perception vs. correlated scientific facts: A review. Journal of Cleaner Production, 298, 126733.*

Seif, R., Salem, F. Z., & Allam, N. K. (2023). *E-waste recycled materials as efficient*

*catalysts for renewable energy technologies and better environmental sustainability. Environment, Development, and Sustainability, 1-36.*

Xu, Y., Lin, Z., Wei, W., Hao, Y., Liu, S., Ouyang, J., & Chang, J. (2022). *Recent*

*Progress of Electrode Materials for Flexible Perovskite Solar Cells. Nano-Micro Letters, 14(1). https://doi.org/10.1007/s40820-022-00859-9*

#### Table 1: Flammability and Durability of the Junk Food Silver Packet

#### Table 2: Results of the most effective dimension making of junk food silver packet as solar panel

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