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Effects of Drying Temperature on Physicochemical Properties, Bioactive Compounds, Antioxidant, and Antibacterial Activities of Three Sweet Potato Cultivars

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Abstract

This study investigates the impact of drying temperature (60–100°C) on the physicochemical properties, bioactive compounds, antioxidant, and antibacterial activities of three sweet potato cultivars: yellow (HRDI Sp-74), orange (HRDI Sp-72), and purple (HRDI Sp-61). Using a completely randomized design, the results revealed that while drying temperature did not affect yields, it reduced the lightness (L*) of the cultivars. Among them, HRDI Sp-61 exhibited the highest protein content (6.35 g/100g, $p \leq 0.05$), whereas HRDI Sp-72 showed the highest phenolic compound content (409.88 mg GAE/100 g powder), which was in line with DPPH antioxidant activity. All dried sweet potato extracts displayed antibacterial activity against *Escherichia coli,* with HRDI Sp-61 demonstrating the most significant inhibitory effects (10.50 and 10.07 mm zones of inhibition).

Introduction

Over the years, sweet potato (*Ipomoea batatas* [L.] Lam) has garnered significant attention and research for its various health-beneficial properties and components, such as bioactive carbohydrates, proteins, and bioactive compounds (Alam, 2021). This versatile is widely cultivated and consumed in both tropical and temperate regions around the globe, especially in Asia and Africa. According to the Food and Agriculture Organization (FAO), global sweet potato production reached approximately 107 million metric tons in 2021. China remains the largest producer, contributing over 60% of the total production. The consumption of sweet potatoes has been on the rise, particularly in Asia and Africa, where they serve as a staple food. (Alam et al., 2016; FAOSTAT, 2020). Sweet potato consumption in the United States has seen a significant increase, with an average per capita consumption of about 4.5 pounds in recent years. This rise is attributed to growing awareness of their health benefits, such as high fiber content and richness in vitamins (USDA Economic Research Service. 2022). Similar trends have been observed in Thailand, where sweet potatoes are also increasingly appreciated for their nutritional value. Sweet potatoes exhibit a remarkable diversity in color. When the outer shell is removed, the inner flesh reveals a spectrum of hues, including white, cream, yellow, orange, pink, red, and purple. Similarly, the flesh itself can vary in color, presenting shades such as white, yellow, orange (similar

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to egg yolk), and purple. (Rodríguez-Mena et al., 2023; Selokela et al., 2022; Yang et al., 2020). The pigments in sweet potatoes are all bioactive compounds with antioxidant abilities, offering potential for use in various food functions. Carotenoids contribute to orange and yellow colors, flavonoids to white, orange, yellow, and red hues, while anthocyanins provide a range of colors from yellow to purple-black, depending on the type and pH range (Rodríguez-Mena et al., 2023).

Numerous studies have analyzed the health benefits of consuming sweet potatoes, highlighting their rich content of essential nutrients such as beta-carotene, vitamin C, vitamin B6, dietary fiber, and phenolic compounds, which contribute to their diverse colors. Sweet potatoes also contain many vital minerals and antioxidants, which can help prevent diabetes, reduce inflammation, lower cancer risk, prevent heart disease, and combat obesity (Rodríguez-Mena et al., 2023). Chiang Mai Province is a key sweet potato growing area, largely due to the efforts of the Royal Project Foundation, along with the Mok Cham Royal Project Development Center and Mae Tha Nuea Royal Project Development Center in Samoeng, Fang, and Mae On Districts. In 2018, sweet potatoes were cultivated over a total area of 25 rai, yielding 194,518.40 kg of produce. Production has shown a tendency to steadily increase. Typically, the Krok Nga Luang Foundation purchases the produce directly; however, only 55% of the harvest was purchased, leaving 45% or 87,533.28 kg of production in the plantation area. It is evident that there is a loss of commercial value. Therefore, guidelines for processing sweet potato powder and studying its potential is a productive way to add value to ungraded sweet potatoes. This approach also offers a means to create careers for farmers who grow sweet potatoes.

When the research team visited agricultural groups in Samoeng, Fang, and Mae On districts in Chiang Mai province, they found that the majority of sweet potatoes were categorized into three varieties based on color: purple, orange (egg color), and yellow. The issue of out-of-grade sweet potatoes was identified as a major problem, leading to pollution due to the discarded, spoiled, or rotten sweet potatoes left in the plantations. Consequently, this situation results in a significant economic loss. Furthermore, a survey of farmers' establishments and processing plants revealed the use of hot air-drying ovens. These ungraded sweet potatoes are processed into dried sweet potato powder. As a result, value was added to downgraded sweet potatoes, providing an efficient solution to the agricultural waste problem. This research led to the production of 3-colored sweet potato powder and the study of its properties, demonstrating the potential of the developed powder for future food applications.

This study underscores the potential of processing sweet potato powder while preserving its nutritional properties, offering a sustainable approach to enhancing agricultural productivity. Numerous studies have examined the impact of drying conditions on sweet potato characteristics, focusing on changes in color, texture, and the stability of bioactive compounds like anthocyanins across different varieties. These findings highlight the importance of optimizing drying techniques to maintain both the nutritional value and appearance of sweet potato powders.

Several factors, including drying temperature, duration, and varietal differences, influence the physicochemical properties of sweet potato powder. Research indicates that higher drying temperatures tend to reduce brightness (L^* value) while affecting redness (a^*) and yellowness (b^*) (Orikasaet et al., 2010). Non-enzymatic browning, particularly at elevated temperatures, can lead to color changes due to interactions between sugar and amino acids (Buera et al., 1987). Additionally, heat exposure can degrade pigments like anthocyanins and flavonoids, altering the functional properties of the final product (Yue & Xu, 2008).

Analyzing the nutritional content and functional potential of sweet potato powder provides scientific validation for its use in food processing and product development. This research focuses on three sweet potato varieties (purple, orange, and yellow), highlighting their potential as functional ingredients and exploring their applications in innovative food products. The study also addresses sustainability concerns by reducing waste and promoting economic benefits for local farmers, aligning with broader efforts to improve agricultural practices and resource utilization.

Materials and methods

This study aims to analyze the physical, chemical, and microbial properties of three sweet potato cultivars (purple, orange, and yellow) under different drying temperatures using a Completely Randomized Design (CRD) experiment. The details on sample preparation and the subsequent analysis are illustrated in Fig 1.

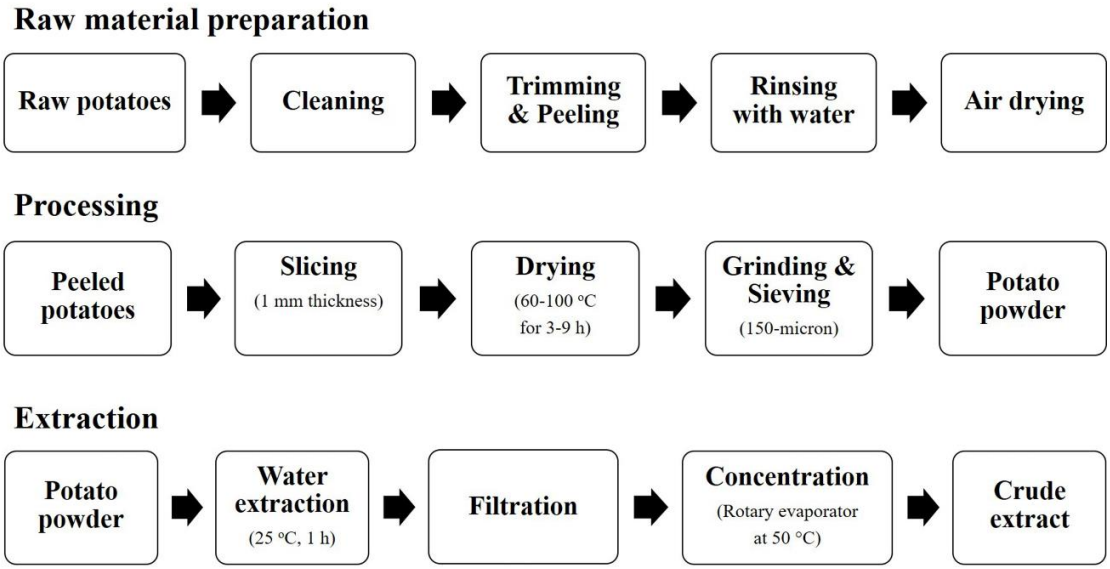

Fig. 1 Flow chart of raw material preparations, potatoes processed into powder, and crude extract preparation

1. Sample preparation

Three varieties of sweet potatoes-yellow (HRDI Sp-74), orange (HRDI Sp-72), and purple (HRDI Sp-61)-were used as raw materials. Samples of downgraded sweet potatoes (mixed sizes, weighing less than 100 g per head, unattractive in shape, cracked, broken, and with bite marks from animals and insects making them unsellable as fresh sweet potatoes) were harvested from Samoeng and Mae Wang districts during August 2023. These samples were processed within 24 h by thoroughly washing and cleaning the soil, cutting off rotten or damaged parts, and peeling. After rinsing with water again, they were dried in the shade on a wire rack until drained.

2. Optimization of temperature for producing 3-colored sweet potato powder and its physical properties

The prepared sweet potatoes were sliced to a thickness of 1 mm. using a slicer and then dried at three different temperatures—60°C, 80°C and 100°C—in a vacuum drying oven (VD 53, Binder, Germany) until the water activity (a_w) was less than 0.30. According to the study, it took three, four and nine h, respectively. After that, it was ground with a dry herb grinder (model PG500, Spring Green Evolution Company, Thailand) for one minute and then sieved through a stainless-steel sieve (BMM-301, BOS MALL) with a mesh size of 150 µm. The percentage of yield and color values were calculated using a Chroma-Meter (CR-400, Konica Minolta Optics Inc., Tokyo, Japan) with the CIELAB color system to select appropriate conditions for preparing sweet potato powder for further study. The sweet potato powers were stored in plastic bags at room temperature and humidity until used.

3. Chemical composition and antioxidant properties of 3-colored sweet potato powders

The 3-colored sweet potato powders, obtained by drying at 60°C for 9 h, were analyzed for their basic chemical composition, including protein, moisture, fat, ash, carbohydrates, energy, and energy derived from fat (AOAC., 2000). Additionally, the total phenolic content was measured following the method of Waterman and Mole (1994), and the antioxidant activity was evaluated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, as described by Brand-Williams et al. (1995).

4. Antimicrobial activity of water-soluble sweet potato extracts

The sweet potato powder sample was extracted with distilled water at a ratio of one-part sweet potato powder to four parts distilled water. The mixture was then concentrated using a rotary evaporator (R-300, BUCHI, Switzerland) at 50°C under reduced pressure for 2 h to remove excess water. The obtained water-soluble extractives were diluted with distilled water to six concentration levels. The diluted crude extract was then used to study its ability to inhibit the growth of pathogenic microorganisms, including Escherichia coli and Staphylococcus aureus, by measuring zone formation

through agar disk diffusion method (Rani et al., 2021). Dimethyl sulfoxide (DMSO) was used as negative control, while Tetracycline antibiotic was used as a positive control.

5. Statistical analysis

The experiments were performed 3 times, and the data were used to calculate the average and standard deviation. The results were then subjected to analysis of variance (ANOVA) to compare the means using Duncan's New Multiple Range Test. Statistical difference was established at $p \leq 0.05$.

Results and discussion

Three varieties of sweet potatoes—yellow (HRDI Sp-74), orange (HRDI Sp-72), and purple (HRDI Sp-61)—were processed into sweet potato powder by drying at a temperature of 60°C, 80°C, and 100°C. These were then analyzed for physical properties (Table 1). The results of the study indicated that drying at different temperatures and using different varieties of sweet potatoes did not affect the yield of sweet potato powder.

The yield percentage is between 88.08 and 94.01% ($p>0.05$), indicating that drying temperatures did not significantly affect the final product weight. However, the variety of sweet potato had a direct impact on color values. Although yields remained relatively stable across different drying temperatures, the quality, particularly in terms of color changes, was influenced.

The findings of this study support previous research indicating that drying at 30 to 60°C do not significantly alter yield (Orikasa et al., 2010) and confirm this trend even at higher temperatures (60 to 100 °C). This stability is due to the initial reduction of water content rather than the drying temperature (Onwude et al., 2018), as reflected in the consistent yield percentages across cultivars.

Each variety of sweet potato exhibited different color values ($p \leq 0.05$). The yellow variety (HRDI Sp-74) had the highest brightness value (L*), ranging from 67.54 to 74.74, consistent with Shih et al. (2009), who studied the drying of yellow and orange sweet potatoes. The orange variety (HRDI Sp-72) had brightness values (L^*) ranging from 61.27 to 65.83, while the purple variety (HRDI Sp-61) ranged from 47.13 to 57.76. It was observed that samples dried at higher temperatures had lower brightness values (L^*) compared to those dried at lower temperatures.

Redness values (a^*) tended to decrease in orange sweet potatoes (HRDI Sp-72) and purple sweet potatoes (HRDI Sp-61), but increased in yellow sweet potatoes (HRDI Sp-74) as the drying temperature rose. For the yellowness value (b), there was no difference between the sweet potatoes dried at 60°C and 80°C. However, the sweet potatoes dried at 100°C showed a significantly higher yellowness value ($p \leq 0.05$) when comparing samples of the same variety.

The increase in yellowness value might be attributed to non-enzymatic browning. High baking temperatures likely caused the sugars in sweet potatoes to react with amino acids, forming brown complex compounds. These compounds typically result in a decrease in brightness value (L^*) and an increase in redness value (a^*).

Related studies indicate that drying temperatures significantly influence Maillard reaction products, leading to color changes in sweet potatoes. Elevated temperatures (e.g., 80–100°C) accelerate these reactions, increasing browning and reducing brightness (L^*) For instance, Przybył et al. (2022) observed L* values dropping from 83.41 at 60°C to 75.53 at 90°C. Additionally, drying at higher temperatures can enhance sensory attributes and carotenoid stability, although phenolic compounds may degrade (Gonçalves et al., 2023).

This aligns with our findings of color shifts due to pigment degradation and browning at increased temperatures. However, the combined analysis of the red color value (a^*) of sweet potato powder indicated an increased in redness in the yellow sweet potato (HRDI Sp-74) (Khongla et al., 2024). This could be attributed to the original pigments in the orange (HRDI Sp-72) and purple (HRDI Sp-6), such as flavonoids and anthocyanin, which are substances that contribute to the red color (a^*) in sweet potatoes (Laveriano-Santos et al., 2022)

When exposed to high heat, these substances are destroyed or undergo structural changes, resulting in a color shift. This causes the red value (a^*) to decrease as the drying temperature increases. According to Ruttarattanamongkol et al. (2015), drying at high temperatures causes the properties of dried sweet potatoes to become darker. Therefore, the lowest drying temperature, 60°C, was selected for studying the chemical composition. This temperature preserved the overall color profile better than higher temperatures, despite requiring a longer drying time compared to 80°C and 100°C. The antioxidant ability and the capacity to resist further growth of pathogenic microorganisms were also evaluated.

Table 1 Quantity of output obtained and color characteristics of sweet potatoes powder

Cultivar	Drying temperature (°C)	Water activity (a_w)	Yield^{ns} (%)	Color (CIELAB)		
				*L**	*a**	*b**
Purple (HRDI Sp-61)	100	0.30±0.02^{bc}	93.41±2.33	47.13±1.28^{e}	4.59±0.33^{e}	18.64±0.95^{d}
	80	0.28±0.01^{cd}	94.01±3.14	52.57±3.14^{d}	12.37±0.12^{c}	4.10±1.15^{e}
	60	0.34±0.02^{b}	91.82±2.91	57.76±1.07^{c}	10.88±0.69^{d}	6.49±1.69^{e}
Yellow (HRDI Sp-74)	100	0.30±0.01^{cd}	90.13±3.12	67.54±4.13^{ab}	0.43±0.41^{f}	22.87±2.17^{b}
	80	0.34±0.01^{b}	91.52±2.87	72.05±7.12^{a}	-0.77±0.31^{g}	17.59±2.47^{c}
	60	0.30±0.00^{c}	93.60±1.95	74.74±6.00^{a}	-2.21±0.26^{h}	20.27±2.20^{c}
Orange (HRDI Sp-72)	100	0.37±0.00^{a}	91.92±3.24	61.27±1.76^{b}	12.29±0.22^{c}	30.13±0.46^{a}
	80	0.31±0.02^{b}	90.31±5.14	63.49±0.76^{b}	16.51±0.50^{b}	26.43±1.11^{b}
	60	0.28±0.02^{cd}	88.08±2.17	65.83±3.10^{b}	20.32±1.19^{a}	26.61±1.15^{b}

Remark: Different letters in each column mean a significant difference ($p \leq 0.05$); ns means no significant difference ($p > 0.05$).

Fig. 2 Sweet potatoes powder from three varieties: purple sweet potato (HRDI Sp-61), yellow sweet potato (HRDI Sp-74), and orange sweet potato (HRDI Sp-72)

When the 3 varieties of dried sweet potatoes powder that were dried at 60°C (Fig. 2) were analyzed for basic chemical components (Table 2), it was discovered that the 3 types of sweet potatoes had no statistically significant difference in fat content ($p > 0.05$). The fat content samples ranged between 0.85 and 1.85 g/100 g.

The protein and moisture content of the yellow (HRDI Sp-74) and orange (HRDI Sp-72) sweet potatoes powder varieties were not statistically different ($p > 0.05$). However, the purple sweet potato (HRDI Sp-61) had higher protein and ash content than the other two varieties ($p \leq 0.05$).

On the other hand, when considering phenolic compounds, it was found that orange sweet potato (HRDI Sp-72) had the highest amount of phenolic compounds, followed by yellow sweet potato (HRDI Sp-74) and the purple sweet potato (HRDI Sp-61), respectively ($p \leq 0.05$). This trend was consistent with antioxidant capacity (DPPH), although there was no significant difference between orange sweet potato (HRDI Sp-72) and yellow (HRDI Sp-74).

Interestingly, there are no significant differences in total energy, carbohydrate, and protein content between the yellow and orange sweet potato cultivars. However, the energy content excluding fat in yellow sweet potatoes is significantly lower than in orange varieties. This suggests that yellow sweet potatoes may contain a higher proportion of complex carbohydrates.

This finding aligns with previous research by Khongla et al. (2024), which reported that yellow sweet potatoes have the highest fiber content (5.6%) compared to purple (3.9%) and orange sweet potatoes (3.6%). These results indicate that yellow sweet potatoes might offer enhanced dietary fiber benefits, supporting their potential role as a nutritious carbohydrate source.

Crude extracts from three sweet potato varieties—purple (HRDI Sp-61), yellow (HRDI Sp-74), and orange (HRDI Sp-72)—were prepared at a concentration of 500 mg/mL. These extracts were dissolved with Dimethyl Sulfoxide (DMSO) and then subjected to two-fold serial dilution to obtain final concentrations of 500, 250, 125, 62.5, 31.25, and 15.62 mg/mL. Each concentration of extract was then tested for antibacterial activity against *Escherichia coli* using the agar well diffusion method to assess its ability to inhibit the growth of pathogenic bacteria.

Table 2 Basic chemical composition and antioxidant capacity of 3 colored sweet potatoes dried at 60°C for 9 h

Basic chemical composition and antioxidant capacity	Cultivar		
	Purple (HRDI Sp-61)	Yellow (HRDI Sp-74)	Orange (HRDI Sp-72)
Protein (g/100 g)	6.35±1.53^{a}	3.70±0.98^{b}	3.82±1.24^{b}
Moisture content (g/100 g)	8.62±1.12^{a}	7.08±1.23^{b}	6.72±1.09^{b}
Fat^{ns} (g/100 g)	0.85±0.36	1.01±0.73	1.85±0.82
Ash (g/100 g)	3.22±0.03^{b}	2.33±0.12^{c}	3.47±0.08^{a}
Carbohydrate (g/100 g)	80.96±1.35^{b}	85.88±1.33^{a}	84.14±1.25^{a}
Energy (kcal/100 g)	356.89±0.38^{b}	367.41±0.82^{a}	368.49±1.03^{a}
Energy without fat (kcal/100 g)	7.65±0.38c	9.09±0.87^{b}	16.65±2.85^{a}
Total Phenolic Compounds (mg GAE/100 g powder)	313.40±9.88^{b}	319.72±15.96^{b}	409.88±0.96^{a}
Antioxidant Capacity, DPPH (%inhibition)	52.06±2.15^{b}	68.94±1.86^{a}	65.11±2.43^{a}

Remark: Different letters in each row mean a significant difference ($p \leq 0.05$). ns means no significant difference ($p > 0.05$).

The tetracycline solution consistently shows much higher inhibition, as expected for a positive control. Significant differences were observed among the sweet potato powders at certain concentration levels, particularly at higher concentrations. At 500 and 250 mg/mL, the inhibition zones for the purple, yellow, and orange varieties showed significant differences compared to the lower concentrations. At concentrations of 125 mg/mL and below, no significant differences were observed, indicating uniform antibacterial activity.

As shown in tables 3 and 4, the extract from the purple sweet potato variety (HRDI Sp-61) at a concentration of 500 mg/mL demonstrated the highest efficiency in inhibiting the growth of *Escherichia coli,* with an inhibition zone of 10.07 mm. As for the secondary results, the efficiency of inhibiting infection from orange sweet potato extract (HRDI Sp-72) and yellow sweet potato extract (HRDI Sp-74) at a concentration of 500 mg/mL ($p \leq 0.05$) yielded inhibition zones of 10.22 and 8.50 mm, respectively. The purple sweet potato extract (HRDI Sp-61) at the same concentration provided the highest efficacy in inhibiting bacterial growth, with an inhibition zone of 10.07 mm.

The second result was the efficiency of inhibiting germs from extracts of yellow sweet potatoes (HRDI Sp-74) and extracts from orange sweet potatoes (HRDI Sp-74) at a concentration of 500 mg/mL. The results showed an inhibition zone of 9.86 and 8.03 mm, respectively.

The ability of the different powdered sweet potato extracts to inhibit 2 different types of microorganisms might be due to their phytochemical composition. The different types of sweet potatoes (Guclu et al., 2023) influenced the efficiency of inhibiting the growth of each type of microorganism. This is true even when considering the various chemical components and antioxidant abilities. The ability to inhibit pathogenic bacteria varies among dried sweet potato powders from each variety, which have different volumes and effectiveness.

The antibacterial activity of sweet potato extracts against *E. coli* and *S. aureus* differs by cultivar due to variations in phytochemical composition. According to Kim et al. (2019), purple sweet potatoes contain higher levels of phenolic acids compared to yellow and orange varieties. Alongside anthocyanins, which are recognized for their antimicrobial properties (Cisowska, 2011), these compounds contribute to the strong antibacterial activity observed in purple sweet potatoes against both gram-positive (*S. aureus*) and gram-negative (*E. coli*) bacteria.

Orange sweet potatoes, which are rich in carotenoids, demonstrate higher effectiveness against *E. coli.* This effectiveness may be due to carotenoids disrupting the cell membrane integrity of this gram-negative bacterium. However, their efficacy is lower against *S. aureus,* likely because *S. aureus* can adapt by enhancing its membrane integrity and rigidity through carotenoid interaction, thereby increasing resistance to antimicrobial agents (Manrique-Moreno et al., 2022).

In contrast, yellow sweet potatoes, with lower levels of carotenoids, exhibit greater activity against *S. aureus* than orange sweet potatoes. This highlights the complex roles of pigments like anthocyanins and carotenoids, which can both enhance and inhibit antimicrobial activity. Overall, the results suggest that anthocyanins, carotenoids, and phenolic acids each contribute differently to antibacterial effectiveness, with their impacts depending on bacterial cell wall structure and the distinct phytochemical profile of each sweet potato cultivar.

Furthermore, food processing can preserve nutrients, add beneficial properties, and enhance food color and flavor. Therefore, using sweet potato powder from all three varieties remains a viable option healthy, alternative ingredients.

Measurements of inhibition zones are recorded as the diameter of the clear area in mm, including the disk (6 mm). Zones with no measurable inhibition are reported as "0 mm". The measurements are taken edge-to-edge across the zone of inhibition, passing through the center of the disk.

Table 3 Results of inhibiting *Escherichia coli* from aqueous extracts from 3 colors of sweet potato powder using the agar well diffusion method

Concentration (mg/mL)	Diameter of inhibition zone (mm)		
	Purple (HRDI Sp-61)	**Yellow** (HRDI Sp-74)	**Orange** (HRDI Sp-72)
500	10.50 ± 1.53^{Ab}	8.50 ± 1.10^{Bb}	10.22 ± 1.06^{Ab}
250	8.00 ± 0.83^{Ac}	6.44 ± 1.13^{Bc}	7.05 ± 0.55^{Bc}
125	0.00±0.00	0.00±0.00	0.00±0.00
62.5	0.00±0.00	0.00±0.00	0.00±0.00
31.25	0.00±0.00	0.00±0.00	0.00±0.00
15.62	0.00±0.00	0.00±0.00	0.00±0.00
10% DMSO	0.00±0.00	0.00±0.00	0.00±0.00
Tetracycline solution	23.50 ± 1.05^{a}	22.81 ± 1.00^{a}	22.74 ± 0.85^{a}

Remark: Lowercase letters within each column indicate significant differences among concentration levels ($p\leq0.05$), while uppercase letters within each row represent significant differences ($p\leq0.05$) among the 3 sweet potato varieties.

Measurements of inhibition zones are recorded as the diameter of the clear area in mm, including the disk (6 mm). Zones with no measurable inhibition are reported as "0 mm". The measurements are taken edge-to-edge across the zone of inhibition, passing through the center of the disk.

Table 4 Results of inhibiting *staphylococcus aureus* from aqueous extracts from 3 colors of sweet potato powder using the agar well diffusion method

Concentration (mg/mL)	Diameter of inhibition zone (mm)		
	Purple (HRDI Sp-61)	**Yellow** (HRDI Sp-74)	**Orange** (HRDI Sp-72)
500	10.07 ± 0.84^{Ab}	9.86 ± 1.00^{Ab}	8.03 ± 1.00^{Bb}
250	9.50 ± 1.70^{Ac}	7.65 ± 0.85^{Bc}	7.45 ± 1.50^{Bc}
125	0.00±0.00	0.00±0.00	0.00±0.00
62.5	0.00±0.00	0.00±0.00	0.00±0.00
31.25	0.00±0.00	0.00±0.00	0.00±0.00
15.62	0.00±0.00	0.00±0.00	0.00±0.00
10% DMSO	0.00±0.00	0.00±0.00	0.00±0.00
Tetracycline solution	31.40 ± 1.10^{a}	32.11 ± 0.90^{a}	32.55 ± 0.70^{a}

Remark: Lowercase letters within each column indicate significant differences among concentration levels ($p\leq0.05$), while uppercase letters within each row represent significant differences ($p\leq0.05$) among the 3 sweet potato varieties.

Conclusion

This study highlights the impact of drying temperatures (60–100°C) on the physicochemical properties, bioactive compounds, and antimicrobial activities of 3 sweet potato cultivars. Drying at 60°C was found to be optimal for preserving color and quality, although it required a longer drying time. HRDI Sp-61 demonstrated the highest protein content, while HRDI Sp-72 showed the greatest phenolic content and antioxidant activity. Additionally, HRDI Sp-61 exhibited the strongest antibacterial effects at 500 mg/mL against *E. coli* and *S. aureus*.

Future studies should explore alternative drying methods, such as freeze-drying or vacuum-drying, to further preserve bioactive properties and enhance efficiency. Further investigation into the molecular mechanisms behind bioactive retention during drying could also provide valuable insights.

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