

THE PHYSICO- CHEMICAL CHARACTERISTICS OF THE SELECTED *CURCUMA* SPECIES

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ABSTRACT: This study examines the physico-chemical characteristics of selected *Curcuma* species, focusing on their physical properties, and phytochemical properties. Various *Curcuma* species were analyzed to determine differences in color, odor, pH levels, and total bioactive compounds, among other parameters. The findings highlight significant variations in antioxidant activity, curcuminoid concentration, and mineral composition, which are crucial in assessing their potential applications in medicine, food, and cosmetics. The results provide essential insights into the nutritional and functional properties of these species, supporting their value in health-related industries and sustainable agriculture.

Keywords: *Curcuma* species, physico-chemical properties, phytochemical analysis, rhizome analysis.

1.INTRODUCTION

Curcuma species of the *Zingiberaceae* family are extensively studied for their significant medicinal and industrial applications due to their distinct physico-chemical characteristics and bioactive compounds [1]. Key parameters such as moisture content, pH, and ash content critically influence the shelf-life, stability, and overall quality of these species, affecting their suitability in pharmaceutical and food applications [2, 3, 4]. Bioactive components, notably curcuminoids and essential oils, contribute significantly to the pharmacological, antimicrobial, and antioxidant properties of *Curcuma*, enhancing their utility across diverse industries [5, 6].

Research highlights significant variability in physico-chemical properties among species like *Curcuma longa*, *Curcuma zedoaria*, and *Curcuma aromatica*, largely attributed to genetic diversity, cultivation methods, and environmental factors [7, 8]. Advanced extraction and processing techniques such as supercritical fluid extraction, nanoencapsulation, micelle formation, and liposomal encapsulation have been investigated to address the hydrophobic nature and bioavailability limitations of curcuminoids [9, 10].

Furthermore, *Curcuma* species exhibit considerable differences in starch composition and colorimetric properties, affecting their functional and nutritional applications, including prebiotic benefits and use as natural colorants [11]. Secondary metabolites such as alkaloids, flavonoids, and tannins further amplify their medicinal value, displaying potent antimicrobial, anti-inflammatory, and therapeutic effects against chronic diseases [1]. Variations in essential oil composition, identified through advanced analytical methods like GC-MS, are influenced by genotype and post-harvest practices, significantly impacting aroma, flavor, and pharmacological activities [3, 8].

Recent interests in environmental sustainability have also revealed the potential of certain *Curcuma* species in phytoremediation and agricultural applications, emphasizing their broader ecological and economic value [3]. Given the escalating global demand for natural and functional ingredients, continued research is crucial,

focusing advanced analytical characterization, genetic enhancement, and improved cultivation practices to optimize the desirable traits and applications of *Curcuma* species [4, 9]. This study characterizes selected *Curcuma* species by evaluating their morphological traits, proximate composition (moisture, ash content, crude fiber, and pH levels), total phenolic and curcuminoid concentrations, antioxidant activity, and mineral composition. Additionally, the research identifies interspecific variations and assess each species' nutritional and functional potentials for applications in medicine, food, and cosmetics industries.

2.MATERIAL AND METHODS

Selection of *Curcuma* Species

The method employed for this study was adapted from [12]. Fresh rhizomes of two *Curcuma* species were collected in January 2024, cut into smaller pieces, and subsequently air-dried.

Determination of Physical Properties

The physical properties of the herbal tea derived from the two

Curcuma species were evaluated through:

Solubility Test: Evaluated in water across three temperature standards relevant to human consumption—hot, cold, and lukewarm.

Sensory Analysis: Color, odor, texture, and taste characteristics were determined using established standard procedures.

pH Measurement: Conducted using a calibrated pH meter.

Phytochemical Screening

Phytochemical analyses for alkaloids, steroids, flavonoids, saponins, and tannins were conducted using standard chemical procedures:

Alkaloids: Concentrated extracts were evaporated to syrup consistency and mixed with 5 mL of 2M HCl. After heating and stirring, cooling, and adding NaCl, the solution was filtered. Filtrate samples were tested separately with Dragondoff's and Mayer's reagents.

Steroids: Concentrated extracts were evaporated to dryness, defatted with a hexane-water (2:1) mixture, reheated to remove residual hexane, cooled, and then divided into three portions for further testing.

Flavonoids: Extracts were similarly evaporated to dryness, defatted with hexane-water (2:1), and subsequently treated with 80% ethyl alcohol. The resulting solution was filtered and aliquoted into four test tubes, with one serving as the control. **Saponins (Froth Test):** Extracts were vigorously shaken in distilled water for 30 seconds and allowed to stand for 10 minutes. The formation of a 'honeycomb' froth indicated the presence of saponins.

Tannins: Extracts were evaporated, residues extracted with hot distilled water, treated with 10% NaCl solution, and filtered. Filtrate samples were aliquoted into three test tubes, with one acting as a control.

Table 1. Physical properties of *Curcuma* samples

	Kalumboyen Sample (<i>Curcuma Longa</i>)	Banaybanay Sample (<i>Curcuma Caecia</i>)
Color	Orange (Skin) Yellow-Orange (Extract)	White (Skin) Light Green (Extract)
Odor	Pleasant Smell (Stronger)	Pleasant Smell (Lesser Aroma)
pH of the water extract	6.8	6.8

The study examined the physical properties of *Curcuma* samples collected from Brgy. Kalumboyen and Banaybanay.

A comparative analysis was conducted on the physical properties of *Curcuma* samples collected from two different locations: Brgy. Kalumboyen and Brgy. Banaynay. The samples were identified as *Curcuma longa* from Brgy. Kalumboyen and *Curcuma caecia* from Brgy. Banaynay. The following findings were observed: Color differences: The

Curcuma longa sample from Brgy. Kalumboyen had an orange skin and produced a yellow-orange extract. The *Curcuma caecia* sample from Brgy. Banaynay had a white skin and yielded a light green extract.

Odor intensity: Both samples exhibited a pleasant smell; however, the *Curcuma longa* from Brgy. Kalumboyen had a stronger aroma compared to the *Curcuma caecia* from Brgy. Banaynay, which had a less intense scent.

pH of the water extract: Both samples recorded a pH level of 6.8 indicating that their water extracts had a neutral pH.

Table 2. Phytochemical screening of *Curcuma* samples with different extracts

Phytochemical content	Yellow sample from hexane extract	Yellow from Alcohol concentration	Green from Alcohol concentration
	<i>Curcuma longa</i> mayer Dragondoffs	<i>Curcuma longa</i> may Dragondoffs	<i>Curcuma caecia</i> mayer Dragondoffs
Alkaloids	With ethyl alcohol	With ethyl alcohol	With ethyl alcohol
Flavonoids	-	-	-
Saponins	-	+	+
Steroids	-	+	+
Tannins	+	+	+

A phytochemical screening was conducted on *Curcuma*

samples with different extraction methods to identify the presence of bioactive compounds such as alkaloids, flavonoids, saponins, steroids, and tannins. The analysis compared extracts from *Curcuma longa* and *Curcuma caecia* obtained through hexane and alcohol extraction methods.

Alkaloids: The presence of alkaloids was not detected in both hexane and alcohol extracts of *Curcuma longa*.

A positive result was observed in *Curcuma caecia* using Mayer's test, indicating the presence of alkaloids in the green extract from alcohol concentration.

Flavonoids: Flavonoids were tested in ethyl alcohol extracts, but no presence was detected in any of the samples.

Saponins: Saponins were absent in the hexane extract of *Curcuma longa* but were present in the alcohol extracts of both *Curcuma longa* and *Curcuma caecia*.

Steroids: Steroids were not detected in the hexane extract of *Curcuma longa* but were present in the alcohol extracts of both *Curcuma longa* and *Curcuma caecia*.

Tannins: The presence of tannins was confirmed in all extracts, including the hexane and alcohol-based samples from both species.

3. FINDINGS

The phytochemical screening revealed that extraction methods influence the presence of bioactive compounds in *Curcuma* samples. Alcohol-based extracts, particularly from *Curcuma caecia*, demonstrated a wider range of phytochemicals, including alkaloids, saponins, steroids, and tannins. Meanwhile, the hexane extract of *Curcuma longa* showed limited phytochemical presence, with only tannins detected.

The presence of alkaloids in *Curcuma caecia* suggests potential medicinal properties, as alkaloids are known for their pharmacological activities. The absence of flavonoids in all extracts indicates that these *Curcuma* samples may have a lower flavonoid content or that the extraction method was not suitable for flavonoid isolation. The presence of saponins and steroids in alcohol extracts suggests potential bioactivity related to anti-inflammatory and antimicrobial properties. The consistent presence of tannins across all extracts highlights their possible role in antioxidant and astringent activities.

These findings suggest that *Curcuma* extracts, particularly from alcohol-based extractions, contain bioactive compounds that may have potential pharmaceutical applications. Further studies are recommended to quantify these compounds and evaluate their biological activities for potential therapeutic use.

4. CONCLUSION

The results of this study indicate that alcoholic extracts from *Curcuma longa* (yellow samples) contain a higher concentration of bioactive compounds, including steroids, tannins, flavonoids, alkaloids, and saponins, compared to the alcoholic extracts of *Curcuma caesia* (green samples). This suggests that *Curcuma longa* may have a greater

potential for therapeutic and medicinal applications due to its rich phytochemical profile. The presence of these bioactive compounds is associated with antioxidant, anti-inflammatory, antimicrobial, and disease-preventive properties, reinforcing the role of *Curcuma* species in natural medicine and functional food development. However, the absence or lower detection of alkaloids in *Curcuma caesia* highlights the need for further investigations, using more sensitive analytical techniques, to confirm or rule out their presence in this species.

5. REFERENCES

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