

## Evaluation of cosmetic bioactivities from Zingiberaceae rhizome extracts

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### Abstract

Nowadays, there is an increasing interest in finding anti-wrinkle and whitening agents from natural sources. The present study aims to evaluate extractable phenolic content (EPC), antioxidant and antityrosinase activities of five Zingiberaceae rhizome plants; *Alpinia galangal* (AG), *Boesenbergia rotunda* (BR), *Curcuma longa* (CL), *Zingiber cassumunar* (ZC) and *Zingiber officinale* (ZO). The ethanolic extracts (95% ethanol) from different rhizomes were obtained using microwave-assisted method (630 W, 30 min). The results revealed that all extracts provided both antioxidant and antityrosinase activities. The ZO extract contained the highest extractable phenolic compounds (EPC) (12.90 mg gallic acid equivalent (GAE)/g). The ZO extract also reflected the highest antioxidant activities ( $P < 0.05$ ) assessed by DPPH radical scavenging activity, ABTS radical scavenging activity and ferric reducing antioxidant power (FRAP) with the values of 6.53, 46.62 and 21.71 mg TEAC/g, respectively. The tyrosinase inhibitory activity of the ZO extract (43.31 mg kojic acid equivalent (KAE)/g) was greater than the CL and BR extracts (35.83 and 20.14 mg KAE/g, respectively) ( $P < 0.05$ ). Moreover, antioxidant and antityrosinase activities were highly correlated with phenolic content. This study recommends that five Zingiberaceae rhizomes, especially *Zingiber officinale*, could be used as a natural source to be claimed as anti-wrinkle and whitening agents for application in cosmetic products.

**Keywords:** antioxidant, antityrosinase, phenolic compound, rhizome, Zingiberaceae

### Introduction and Objective

Nowadays, the development of cosmetic products such as whitening and anti-aging have focused on the plant extracts that provides the natural active ingredients. Finding new plant sources is useful in order to decrease the import of active ingredients used as antioxidants and also promote the application of Thai traditional plants.

Zingiberaceae family has been reported that possess high amount of phenolic compounds and exhibit high antioxidant properties (Vankar et al., 2006) and also exhibit tyrosinase activity. In the present work, we screened five species of Zingiberaceae plants for biological activity using different methods including extractable phenolic content (EPC), 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay, 2,2-azinobis-(3-ethyl-benzothiazoline-6-sulfonic acid) (ABTS) free radical scavenging assay, ferric reducing antioxidant power (FRAP) assay and tyrosinase inhibition activity.

### Materials and Methods

Five rhizomes collected from Chiang Rai province, Thailand were dried by using hot air oven at 55°C for and then powdered prior to be studied. Dried-powdered rhizomes (5 g) were extracted with 95% ethanol (30 mL) as extracting solvent. The extraction procedure was operated by using microwave at 630 W for 15 min. The extracts were filtered prior to be further analyzed.

The extracts were evaluated for extractable phenolic content (EPC) by using the Folin-Ciocalteu method (Kahkonen et al., 1999). For antioxidant activities, DPPH radical scavenging activity, ABTS radical scavenging activity and ferric reducing antioxidant power (FRAP) assays were used to evaluate according to the method described by Blois (1958), Arnao et al. (2001) and Chu et al. (2000), respectively. The tyrosinase inhibition activity of the extracts was investigated by the procedure described by Momtaz et al. (2008).

**Table 1.** Extractable phenolic content, antioxidant and tyrosinase inhibitory activities of Zingiberaceae rhizomes.

Plant samples	Extractable phenolic content (mg GAE/g)*	Antioxidant capacity (mg TEAC/g)*			Tyrosinase inhibition activity (mg KAE/g)*
		DPPH	ABTS	FRAP	
<i>Zingiber officinale</i>	12.9 ± 0.57 <sup>a</sup>	6.53 ± 0.36 <sup>a</sup>	46.6 ± 2.45 <sup>a</sup>	21.7 ± 1.35 <sup>a</sup>	43.3 ± 2.83 <sup>a</sup>
<i>Alpinia galangal</i>	5.20 ± 0.08 <sup>d</sup>	2.25 ± 0.04 <sup>c</sup>	23.5 ± 0.21 <sup>c</sup>	5.08 ± 0.11 <sup>d</sup>	17.6 ± 0.78 <sup>d</sup>
<i>Curcuma longa</i>	8.92 ± 0.08 <sup>c</sup>	5.56 ± 1.10 <sup>a</sup>	41.4 ± 0.74 <sup>b</sup>	12.7 ± 2.21 <sup>b</sup>	35.8 ± 1.29 <sup>b</sup>
<i>Zingiber cassumunar</i>	10.1 ± 0.09 <sup>b</sup>	3.36 ± 0.09 <sup>b</sup>	30.2 ± 0.36 <sup>c</sup>	13.8 ± 0.14 <sup>b</sup>	15.4 ± 3.62 <sup>d</sup>
<i>Boesenbergia rotunda</i>	4.55 ± 1.09 <sup>d</sup>	1.40 ± 0.08 <sup>d</sup>	26.6 ± 0.31 <sup>d</sup>	3.63 ± 0.35 <sup>c</sup>	20.1 ± 1.37 <sup>c</sup>

\*Values are means ± S.D. (n=5).

<sup>a-e</sup>Means the column followed by different letters are significantly different (P<0.05).

## Results and Discussion

Five Zingiberaceae rhizomes (AG, BR, CL, ZC and ZO) have been evaluated for their extractable phenolic contents, antioxidant activities based on DPPH radical scavenging, ABTS radical scavenging and FRAP assays and tyrosinase inhibition activity.

From the Table 1, the extractable phenolic contents of the Zingiberaceae rhizome extracts varied between 4.55 to 12.9 mg GAE/g. The DPPH radical scavenging activity, ABTS radical scavenging activity and FRAP values of all extracts were ranging from 1.40 to 6.53 mg TEAC/g, 23.5-46.6 mg TEAC/g and from 3.63-21.7 mg TEAC/g, respectively. It was found that the ZO extract not only contained the highest amount of extractable phenolic compounds (P<0.05) but also possessed strong antioxidant properties compared with the others in all determined assays. The rhizome of ZO was also reported in the previous studies that possess strong radical scavenging property (Stoilova *et al.*, 2007). For the tyrosinase inhibition assay, the extracts exhibited the activity in the range of 15.4 and 43.3 mg KAE/g while the rhizome extract of ZO possessed the strongest tyrosinase inhibition activity (P<0.05). There was a correlation between the extractable phenolic content and tyrosinase inhibition activity.

The plants in Zingiberaceae family have been reported that possess high amount of phenolic compounds and exhibit moderate to good antioxidant properties (Vankar *et al.*, 2006). These Zingiber species are believed that produce and transport antioxidant compounds to accumulate in rhizomes as its more potent antioxidant activity than the other parts (Habsah *et al.*, 2000). There are many literatures that report the correlation between antioxidant properties and phenolic compounds.

This study has demonstrated that Zingiberaceae rhizomes, especially *Zingiber officinale*, possessed high phenolic contents, antioxidant and antityrosinase properties. Thus, they can be considered as a natural source of anti-wrinkle and whitening agents for cosmetic applications.

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