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INTEGRATION FOR ASEAN ECONOMIC COMMUNITY SUSTAINABLE DEVELOPMENT

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Analysis of Oleoresin Extracted from Ginger Rhizomes Plated in North Central Region of Vietnam by Liquid Chromatography-Mass Spectrometry (LC-MS)

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Abstract

The ginger roots/rhizomes are being used by consumers, and clinical trials using ginger have been carried out to evaluate their anti-inflammatory or anti-emetic properties with inconsistent results. Chemical standardization of these products is needed for quality control and to facilitate the design of clinical trials and the evaluation of data from these studies. To address this issue, methods based on liquid chromatography-mass spectrometry (LC-MS) were developed for the detection, characterization and quantitative analysis of gingerol-related compounds in ginger roots/rhizomes. This study of the chemical composition of the oleoresins extracted from *Zingiberrubens* Roxb., *Z. officinale* Rosc., *Z. collinsii* Mood & Theilade at Nghe An province by LC-MS. Rhizomes of ginger samples were extracted in ethanol in order to obtain ginger oleoresin. Phenolic compostion, gingerol-related compounds ([4], [6], [8]-gingerol, [6]-shogaol…), are responsible for taste and aroma of ginger were determined by LC-MS method.

Keywords: (6)-gingerol, (6)-shogaol, LC-MS, Zingibercollinsii, Zingiberofficinale, Zingiberrubens

1. Introduction

The genus *Zingiber* is in the family Zingiberaceae, which has about 150 species distributed in tropical rain forest and in much of the Southeast Asia, China, India and throughout the Islands in the Pacific. In Vietnam, the genus is diverse with about 10 endemic species. They contained essential oils and oleoresins which are used as medicinal drugs, popular spices and raw materials in food, pharmaceutical industry etc… The ginger roots/rhizomes are being used by consumers, and clinical trials using ginger have been carried out to evaluate their anti-inflammatory or anti-emetic properties with inconsistent results. Chemical standardization of these products is needed for quality control and to facilitate the design of clinical trials and the evaluation of data from these studies. To address this issue, methods based on liquid chromatography-mass spectrometry (LC-MS) were developed for the detection, characterization and quantitative analysis of gingerol-related compounds in ginger roots/rhizomes.

All over the world, the ginger rhizome is appreciated for its taste qualities; therefore, it is used as a spice, flavoring agent, and as an additive in the preparation of meals. It is also used as an ingredient in dietary supplements such as pills, syrups, or teas (Loi 1999; Binh 2009), (Binh 2011). The ginger rhizomes or its extracts have been commonly used in medicine, because of their wide scope of biological effects-confirmed both in various in vitro models and in clinical trials. The plant has been found to show strong antiemetic activity and is now used to treat motion sickness, morning sickness, and post-chemotherapy nausea (Ahouannou 2000).

Table 1. Chromatographic and mass spectral characteristics of gingerol-ralated compounds detected by LC-ESI-MS in extracts from ginger rhizomes

Sample	t_R (min)	Positive ESI (+) ESI-MS (m/z)	Compound name	Area Fr
Z. rubens	17.2	269.0715 ([M + H]$^+$)	4-gingerdiol	11.6
	18.5	274.2804 ([M + H]$^+$)	6-shogaol	7.1
	20.0	251.0613 ([M + H]+)	Undetermined	11.5
	20.0	269.0698 ([M + H]+)	4-gingerdiol	2.1
	20.0	291.0511 ([M + H]+)	1-dehydro-6-gingerdione	1.5
	22.5	317.2127 ([M + H]+)	1-dehydro-8-gingerdione	1.3
	22.7	302.1500 ([M + H]+)	8-shogaol	3.5
	22.7	301.1492 ([M + H]+)	OAc-[4]-gingerol	42.0
Z. officinale	18.5	317.1786 ([M + H]$^+$)	6-gingerdiol	11.8
	19.6	361.2044 ([M + H]+)	Me-[8]-gingerdiol	3.8
	21.0	277.1861 ([M + H]+)	6-paradol	6.8
	21.0	299.1678 ([M + H]+)	Undetermined	10.3
	21.5	403.2143 ([M + H]+)	1-(4-hydroxy-3-methoxyphenyl)-2-nonadecen-1-one	13.8
	21.5	321.2117 ([M + H]+)	8-gingerol	2.4
	21.5	291.1649 ([M + H]+)	6-dehydro-6-gingerol	2.2
	22.4	417.2302 ([M + H]+)	1-(3,4-dimethoxyphenyl)-2-nonadecen-1-one	3.8
	22.6	301.1469 ([M + H]+)	OAc-[4]-gingerol	3.5
Z. collinsii	18.5	291.1649 ([M + H]$^+$)	1-dehydro-6-gingerdione	5.5
	22.7	301.1430 ([M + H]+)	OAc-[4]-gingerol	49.3
	36.7	292.1970 ([M + H]+)	6-gingerol	11.1
	36.7	371.3103 ([M + H]+)	Undetermined	3.1
	36.7	310.2026 ([M + H]+)	7-gingerdiol	3.3
	36.7	259.1918 ([M + H]+)	Undetermined	8.9

(a) *Zingiberrubens*; (b) *Zingiberofficinale*; (c) *Zingibercollinsii* (Hongliang Jiang 2005).

4. Conclusions

LC-MS analysis of the obtained ethanolic extract revealed that the main phenolic compound was OA- [4]-gingerol, (6)-gingerol, (6)-gingerdiol and (6)-shogaol which is characteristic of fresh rhizomes and responsible for their taste and aroma. Moreover, high amounts of (6)-shogaol were determined, which interesting because this phenolic compound usually occurs in old or processed material. According to the literature, the fresh ginger rhizome either contains no shogaols or their concentrations are low. Probably the spicy taste of fresh Japanese ginger is due to the high concentration of (6)-shogaol.

Gingerol-related compounds, were identified in ethanol crude extracts from fresh-dried ginger rhizomes by LC/ESI-MS/MS coupled to diode array detection. Interestingly, many of the identified compounds were only detected by the MS detector, therefore, suggesting that the LC/MS analysis is not only more specific but also more sensitive than diode array analysis for this group of compounds.

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