Phenolic antioxidative activity of banana (Musa sapientum L.) peel extract

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Abstract
Phenolic content and antioxidant activity of extract from banana (Musa sapientum L.) peel were evaluated. The banana peel extract was obtained by microwave-assisted extraction. Influences of extraction factors including microwave power and duration were investigated. Folin-Ciocalteu method was used to assess the phenolic content. Radical scavenging assay (using DPPH and ABTS) and ferric reducing antioxidant power (FRAP) assays were used to evaluate the antioxidant capacity. Duration of 30 min resulted in higher phenolic content of 10.77 mg-gallic acid equivalent (GAE)/g-sample and greater antioxidant activities of 8.21, 13.80 and 8.42 mg-Trolox equivalent antioxidant capacity (TEAC)/g-sample for DPPH, ABTS and FRAP assays, respectively. Lower phenolic antioxidant activity was observed for the extraction duration of 15 and 45 min. Study on effect of microwave power revealed that lower power resulted in higher extraction efficiency. An extraction using 360 Watt exhibited highest phenolic content (11.64 mg-GAE)/g-sample) and antioxidant activities of 8.64, 14.28 and 8.64 mg-TEAC/g-sample for DPPH, ABTS and FRAP assays, respectively. Our result indicated banana peel as a potential source of phenolic antioxidant, offering a possibility to obtain value-added products from banana waste.

Keywords: Antioxidant, banana peel, microwave-assisted extraction, phenolic

Introduction and Objective
A vast number of plants have been explored to be a new source of bioactive compounds. Natural antioxidative compounds are generally considered as safe and scientifically proven for protection against various diseases (1). Therefore, the antioxidants from various plants have attracted the attention of many industries, especially in food, cosmetic and pharmaceutical. Recently, a lot of agricultural wastes have been investigated as they are potential sources for antioxidant extraction. Banana (Musa sapientum L.) is one of the most popular fruits in Thailand and applied in many recipes of Thai cuisine. Consumption of banana fruit produces a lot of banana peel wastes. There has been reported that banana peel showed stronger antioxidant activity than the pulp extract (2). Gallocatechin, anthocyanin, cyanidin and other phenolic compounds have been found in banana peels (3). However, previous reports have extracted the antioxidant from banana peels by using simple solvent extraction. Therefore, the aim of this study is to use the microwave in antioxidant extraction from banana peel wastes. Extraction duration and microwave power affecting on extraction efficiency were also investigated.

Materials and Methods
Banana peels were collected from banana deep fire shop in Muang, Chiang Rai province, Thailand. The samples were dried by using hot air oven at 55°C for 16 h and then powdered by a hammer mill prior to further study. Phenolic antioxidant in banana peels was extracted by 50% ethanol using microwave-assisted extraction with ratio of sample to solvent fixed at 1:5 w/v. The extraction procedure was operated by varying microwave power at 360, 630 and 900 W and duration of 15, 30 and 45 min. The mixtures were filtered through filter paper to collect the extract for further analysis.

Extractable phenolic content (EPC), radical scavenging activity of the banana peel extract were evaluated by using the Folin-Ciocalteu method, DPPH and ABTS radical scavenging activity and FRAP assays, respectively (4).
Table 1. Extractable phenolic content and antioxidant capacity of banana peel extract.

<table>
<thead>
<tr>
<th>Extraction condition</th>
<th>EPC (mg GAE/g)*</th>
<th>DPPH</th>
<th>ABTS</th>
<th>FRAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power (Watt)</td>
<td>Duration (min)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>360</td>
<td>30</td>
<td>11.64 ± 0.46b</td>
<td>8.64 ± 0.65a</td>
<td>14.28 ± 0.56b</td>
</tr>
<tr>
<td>630</td>
<td>30</td>
<td>10.77 ± 0.22a</td>
<td>8.21 ± 0.24a</td>
<td>13.80 ± 0.81a</td>
</tr>
<tr>
<td>900</td>
<td>30</td>
<td>10.37 ± 0.31b</td>
<td>8.38 ± 0.64a</td>
<td>13.74 ± 0.11a</td>
</tr>
<tr>
<td>630</td>
<td>15</td>
<td>8.61 ± 0.53a</td>
<td>7.01 ± 0.78a</td>
<td>12.08 ± 0.01a</td>
</tr>
<tr>
<td>630</td>
<td>30</td>
<td>10.77 ± 0.22a</td>
<td>8.21 ± 0.24a</td>
<td>13.80 ± 0.81a</td>
</tr>
<tr>
<td>630</td>
<td>45</td>
<td>8.56 ± 0.36a</td>
<td>7.95 ± 0.02b</td>
<td>12.02 ± 0.23a</td>
</tr>
</tbody>
</table>

*Values are means ± S.D. (n=5). Superscripts of lower case in each extraction condition indicate significantly different (P<0.05).

GAE: gallic acid equivalent, TEAC: trolox equivalent antioxidant capacity.

Results and Discussion

The EPC of banana peel extract ranged from 8.56-10.77 mg GAE/g sample. The highest value was obtained from the extraction condition of 360 W for 30 min. This condition also provided the highest radical scavenging capacity and reducing power of 8.64, 14.28 and 8.64 TEAC/g sample for DPPH, ABTS and FRAPS assays, respectively (P<0.05). Homogenization of dry banana peel with 50% ethanol for 120 min showed radical scavenging capacities of 11 and 32 mg TEAC/g sample when determined with DPPH and ABTS assays, respectively (3).

Study on the effect of microwave power on phenolic antioxidant extraction from banana peel showed that the power of 360 W gave the highest EPC, radical scavenging capacity and reducing power, while higher power including 630 and 900 W exhibited significantly lower efficiency (Table 1). This result was agreed with previous report that increasing of microwave power decreased the phenolic extraction ability (5).

Effect of duration on extraction of phenolic compounds from banana peel also showed in Table 1. It was observed that when a microwave power was constant at 630 W, 30 min of extraction duration offered higher amount of EPC and antioxidant capacity. Significant lower efficacy was found in lower and higher duration (15 and 45 min, respectively). There has been documented that extraction with microwave less than 30 min possibly resulted in lower releasing of phenolic compound due to a few slight ruptures on the surface of the sample (6) and also extraction time higher than 30 min might cause degradation of major phenolic antioxidant content in the sample.

This study has demonstrated that banana peel could be a substantial source for phenolic antioxidant extraction. It is also showed that microwave-assisted extraction possibly is a powerful method for natural active compound extraction.

References