The Use of the Lemon Pepper as a New Flavoring in Culinary Preparation

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Abstract: Lemon pepper (*Zanthoxylum acanthopodium* DC.) is a perennial plant of Rutaceae family belong to endemic plant in North Sumatera region, which fruit has been traditionally used as flavouring agent for traditional cuisine. Its berry fruits are known to be excellent ingredient, for they give an extraordinary flavour as results of typical fragrance which comes after crushing the fruits, and a spicy bitter and burning taste when eaten. Lemon pepper still has a vast unexploited potential in creative cooking. In this work, we reviewed the vernacular names, medicinal properties and traditional uses of lemon pepper and we explored some alternative culinary uses for this aromatic plants.

1 INTRODUCTION

Lemon pepper (*Zanthoxylum acanthopodium* DC.) a medicinal and aromatic fruit from the family of Rutaceae is a famous spice to native Toba-Batak population. Local name of this plant is *andaliman*. These perennial plants are growing in tropical and temperate regions and commonly found throughout Central, South, Southeast and East Asia (Gupta and Mandi, 2013). In Indonesia, *Zanthoxylum acanthopodium* DC. is only found and naturally grown in the Toba forest at altitudes of above 1500 m in North Sumatera province.

The following is the taxonomy of lemon pepper:

Kingdom : Plantae
Division : Spermatophyta
Sub-division : Angiospermae
Class : Dicotyledoneae
Sub-class : Rosidae
Order : Sapindales
Family : Rutaceae
Genus : *Zanthoxylum*
Species : acanthopodium – DC

Zanthoxylum acanthopodium DC. is a perennial thorny shrub or small tree with dense foliage and prickly trunk and branches bearing edible fruits and leaves with a strong and pungent taste resembling the flavour of lemon, anise or mint. Young fruits are rounded and green, and the seed inside are shining black. Its fruits, seeds and leaves are edible.

Figure 1: *Zanthoxylum acanthopodium* DC.

Like many other plants of Zanthoxylum genus, which consist about 250 species spreading all over the world, the species of *acanthopodium* or lemon pepper has been traditionally used as medicine. By local inhabitants of Himalayan region lemon pepper have been traditionally used for treatment in the case of gastritis (Yonzone and Rai, 2016).

Fruits of most *Zanthoxylum* are rich in oil containing large amounts of alkaloids and saturated fatty acids. Majumder et al (2014) found at least 21 compounds in lemon pepper oil. They found that predominant essential oil composed by eucalyptol, limonin, carene and methyl-cinnamate, which demonstrated promising antibacterial activity against *Staphylococcus aureus.* Later, Julistiono *et al.* (2018) reported that lemon pepper possesses

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antimycobacterial activity against *Mycobacterium smegmatis*. Meanwhile, Yanti *et al*. (2011) found that the extract of dried fruit by using ethanol possessed anti-inflammatory activity after showing a significant inhibition of selected inflammatory biomarker.

Lemon pepper fruits are known to be an excellent ingredient owing to their extraordinary flavour as results of typical fragrance which comes after crushing the fruits, and a spicy bitter, stinging and burning taste when eaten. The use of aromatic plant in food preparation as a spice due to their aroma and/or taste attributable to chemical compounds. Moektiwardoyo et al. (2014) identified 29 compounds in the essential oil of lemon pepper's fruits. Amongst them, geranyl acetate, β-citroneol, nerol, limonene, geraniol, caryophyllene, citronellyl acetate and α-pinene were the predominant compound of the fruit oil, which contributed to the aroma of lemon pepper.

Since classical times, the *Zanthoxylum acanthopodium* DC. plant or *andaliman* has existing culinary uses in Batak community lived in Toba region. It is traditionally used in various traditional cuisine such as *naniarsik*, *naniura*, *napinadar* and *namargota*. Apart from its contribution to the flavour, in food system, compounds in essential oils of the fruits of lemon pepper possessing notable antioxidant activity. Volatile oil extracted from fruits contains mainly limonene, citronellol, geraniol and β-myrcene, together with other minor components. Those essential oils had antioxidant activity by acting as a radical scavenger (Cahyana and Mardiana, 2003). Similarly, Suryanto *et al.* (2004) extracted the phenolic compound from the fruits by using three different solvents namely hexane, acetone, and ethanol, and they found all three types of fruit extract had shown antioxidant activities.

Despite the long-standing use of these lemon pepper, the lemon pepper still has potential in creative cooking. Until now, the use of lemon pepper in food has been limited to fresh fruit. Meanwhile, dried spice of lemon pepper has potentially big market share since the fresh harvested fruits are very susceptible to fungi and have a short storage life.

The present study was conducted to promote research aiming at the development of lemon pepper in culinary preparation that is possible to realize. In this study, they are represented by example of lemon pepper as a flavouring agent for noodle and meatballs. Initial stage of this study was to investigated drying temperature to produce dried lemon pepper powder.

2 MATERIALS AND METHODS

2.1 Fruit Materials

The fruit materials used in this study were purchased at a local market, and transported directly to the Laboratory of Agriculture Products Technology, University of HKBP Nommensen, Medan where this study was conducted. Lemon pepper fruits were sorted manually as to separate fruits from dirt, leaves and stems, washed and drained.

Figure 2: Mature fruit of *Z. acanthopodium* DC.

2.2 Drying Process

Drying of fruits was carried out through the use of hot air at four levels of temperature (40, 50, 60 and 70ºC). Fresh fruits were dried to constant weight in an oven. The dehydrated product was grounded until a powder was obtained by using sieve of 80 mesh. The spice was packed in glass jars closed with airtight cap and stored in refrigerator without light, and subjected to analysis. The moisture content was determined according to AOAC method by using hot air oven at a temperature of 105ºC. Sensorics evaluation on the intensity of aroma and taste was carried out involving 10 trained panellists selected from students in the department of Agriculture Products Technology.

2.3 Cuisine Application

To expand the use of lemon pepper/andaliman, we began to investigate the possible use of the ground dried fruit (powder) of lemon pepper as flavouring agent to noodle and meat ball. The lemon pepper powder was produced according to the best drying method investigated in 2.2 above.

2.3.1 Lemon Pepper-flavoured Noodle

To prepare noodle at laboratory condition, the mixture of 250g wheat flour, 5g

carboxymethylcellulose, 1 egg and water was combining manually to form dough. The dough was then sheeting, combining of sheets, resting, rolling and cutting, followed by boiling and drained. Three levels of lemon pepper powder, 0,5%, 1% and 1,5% (flour based) were applied for investigation.

The sensory assessment includes tasting of lemon pepper-flavoured noodle for the intensity of the taste and aroma, followed by overall acceptance using the structure 5-point hedonic scale. Evaluation session was held at room temperature and normal lighting condition involving 12 trained panelists.

2.3.2 Lemon Pepper-flavoured Meatball

To prepare meatballs at laboratory condition, to 1 kg chicken meat, were added tapioca flour 500g, garlic 50g, salt 20g and water 200 g. Lemon pepper was firstly added during the mincing of meat. Minced meat, flour, salt and garlic were mixed to form batter. The batter was then formed into small ball-shapes in size of 2-2,5 cm diameter, then cooked in boiling water until the meatballs were floated. The meatballs were then drained, cooled and packed before use. Lemon pepper powder in the amount of 1, 2, 3, 4 and 5% of the total mass formulation were applied for investigation.

The meatballs were subjected to sensory evaluation for colour, aroma, taste, toughness and overall acceptability using hedonic scale rating 1-7 to assess the differences. Sensory acceptability of lemon pepper-flavoured meatballs was conducted using the structure 7-point hedonic scale. Thirty untrained assessors comprising student of Faculty of Agriculture participated in this study.

3 RESULT AND DISCUSSION

3.1 Drying Temperature

Drying temperature significantly affected water content, aroma and taste of the lemon pepper powder. The initial average moisture content of fresh lemon pepper was 67-70%. The moisture content of dried products was 15.20%, 13.48%, 12.54% and 14.20% when drying process took place at a temperature of 40, 50, 60 and 70°C respectively. The higher drying temperature led to a significantly lower water content. However, it was not the case at drying temperature of 70°C, for no significant different between moisture content of lemon pepper powder when drying at 40°C and 70°C. It is possibly the case hardening took place at the level of temperature above 60°C and led to a higher amount of water retained in the fruit during drying time.

The dried product was characterized by a brown colour. The darkening of the colour of dried sample could be due to high temperature during dehydration in addition to black colour of the lemon pepper seeds.

Figure 3: Lemon pepper powder.

Lemon pepper powder retained the intensity of its native aromas after the drying process. According to Prusinowska and Smigielski (2015) drying method affect the losses of essential oils and antioxidant in herbs and spices, and they found that freeze drying more essential oil of dried herbs in comparing to sun drying and oven hot air drying. Our experiment indicates that the range of temperature 40–70°C by using a hot air oven could preserve the native compounds responsible for taste and aroma. However, the intensity of aroma and taste were decreased as drying temperature was increased and a note of woody aroma was appeared in the powder.

Based on sensory evaluation, we decided to apply drying temperature of 60°C to produce lemon pepper powder used as flavouring for subsequent application on food. This is in accordance with the finding of Napitupulu et al. (2020) that oven drying at 54°C for 8h was the most appropriate processing method to preserve the flavour of lemon pepper.

3.2 Cuisine Application

3.2.1 Lemon Pepper-flavoured Noodle

Noodle is one of the famous foods in Indonesia and across Asian countries. Recently, many variations of noodle have been developed by applying substance that bear compound that provided functionalities.

Noodle flavoured with 0,5% lemon pepper had only a slight taste and aroma of lemon pepper, and leave almost no specific sensation of spicy bitter, stinging and burning taste when eaten. Higher concentration of lemon pepper led to a more significant lemon pepper taste and aroma, but only at

the level of 1,5% lemon pepper the natural taste lemon pepper appeared significantly.

Hedonic rating scale showed a similar trend, as the acceptance of panelists increase with the increasing of lemon pepper. The noodle flavoured with 1,5% of lemon pepper was rated as like moderately, while lesser lemon pepper resulted in lower liking scale. The group of panelists, which dominated by Toba-Batak ethnic group who are familiar with the taste and aroma of lemon pepper, may affect the acceptance level. The result indicated that level of lemon pepper could be possible to increase to some level for further study.

Figure 4: Noodle flavoured with 0,5%, 1% and 1,5% lemon pepper.

The application of lemon pepper powder, however, highlighted the colouring effect on noodle. The noodle was darker in comparable to normal light-yellow noodle. Colour of noodle may also affect the acceptance of panelists, and could play as limiting factor for application of higher level of lemon pepper on noodle.

3.2.2 Lemon Pepper-flavoured Meatball

Meatball, known as "*bakso"* in Indonesia, is a popular traditional food. It can be easily found and bought as a food street but also in restaurants. To give variety in taste, this study tried to apply the lemon pepper as flavouring to meatballs.

The sensory evaluation indicated that meatballs flavoured with of 1% of lemon pepper were well accepted. The panelists liked the colour, aroma, taste and toughness of meatballs. However, increasing of level of lemon pepper powder significantly reduce the acceptance of panelists towards the all sensory attributes tested. The colour of meatballs with 5% lemon pepper was not acceptable. The presence of granules of lemon pepper lead to a dull colour of meatballs. Spicy, bitter, stinging and burning taste of lemon pepper become more intense as the level increase, and led to lower acceptability of meatballs. As for the toughness of meatball, the higher concentration of lemon pepper the easier the meatballs to cut when chewed. It lowered the acceptance toward the toughness. The overall acceptance was in line with the trend of acceptability toward each single sensory attribute.

Figure 5: Meatballs flavoured with 1% lemon pepper powder.

Based on this hedonic test, we found that meat balls accepted the most were the ones formulated with 1% lemon pepper powder.

4 CONCLUSIONS

The result demonstrated promising application of lemon pepper as a flavouring agent applied to noodle and meatballs. In order to produce lemon pepper powder, drying fresh fruit of lemon pepper at 60ºC is suitable to preserve natural aroma and taste. The best acceptance as flavouring was found at a level of 1.5% lemon pepper for noodle and at a level of 1% for meatball. Further studies are needed for exploring the potential of lemon pepper as flavouring in more varieties of food.

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