Extended Abstract

International Symposium of Sabaragamuwa University of Sri Lanka

(ICSUSL) - 2017

Analysis of Polycyclic Aromatic Hydrocarbons to determine the best firewoods for fish smoking

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1. Abstract

Firewood smoking is one of the traditional preservation techniques, still widely is being used in vari Lanka. It is commonly used to obtain desired flavors in certain products (ham, bacon and sausage). V fire woods are being used to generate smoke, which contains at least 100 Poly Aromatic Hydrocarb their alkylated derivatives. USEPA and EU listed 16 PAHs as hazardous compounds. Benzo[a]pyrene (B as a marker of the carcinogenic PAHs in smoke.

This study investigated the PAHs content in smoke of selected firewoods aiming to find out suitable f food smoking. Nine commonly use, wood variety such as coconut (*Cocos nucifera*) husk, coconut f (*Borassus flabellifer*), cinnamon (*Cinnamomum celanicus*), mango (*Mangifera indica*), jak (*Artocarpus* neem (*Azadirachta indica*), portia (*Thespesia populnea*) and weera (*Drypetes sepiaria*) from norther parts of Sri Lanka were selected for the study. A mixture of acetonitrile, acetone and toluene was use PAHs from smoke. In the PAHs analysis different PAHs were separated using an Agilent ZORBAX column.

According to the analysis, naphthalene, acenapthylene, acenapthene, fluorene, phenanthrene, anthracen pyrene, benzo(a)anthracene, benzo(a)pyrene and benzo(k)fluoranthene were identified. Among them n prominent to all selected woods. Particularly palmyrah, jak and weera have considerable amount 67.37mg/L, and 38.55mg/L of naphthalene respectively. Probable carcinogenic compounds identified such as Benzo(a)anthracene (1.55mg/L,0.2mg/L), benzo(a)pyrene (1.18 mg/L,6.45mg/L) and benzo (0.41 mg/L,1.55mg/L) were detected in palmyrah and coconut husk smoke. Based on the findings amo woods tested, margosa, mango and portia can be selected as the best firewoods for smoking of fish.

Keywords: PAHs, smoked food, wood smoke.

2. **Introduction and research problem/issue**

Food preservation becomes necessary step in order to increase its shelf life and maintain its nutritiona and flavor (Ghaly, Dave, Budge, & Brooks, 2010).One such preservation method is the smoking of foo wood smoke, that has been used for centuries.

The composition of wood smoke is very complex; more than 400 volatile substances have been ide smoke. Among them nitrogen oxides, Polycyclic Aromatic Hydrocarbons (PAHs), phenolic comp carbonylic compounds, aliphatic carboxylic acids, and tar compounds are more (Fallis, 2013). Par components gives the characteristics color and flavor to the smoked product. Some compounds are res anti-oxidizing effect and bactericidal effect. Certain carcinogenic components of wood smoke – derivatives of PAH associated with smoked foods create potential health hazard (Stołyhwo & Sikorski The PAHs refers to a ubiquitous group of several hundred chemically-related, environmentally pe compounds having various structures and varied toxicity (Rengarajan *et al*., 2015). Those are the by-pr incomplete combustion of organic compounds (Kido *et al*., 2011) . Atmospheric partitioning of PA between the particulate and the gaseous phases strongly influences their fate and transport in the atmo way they enter into the human body (Stumpe-Vīksna *et al*., 2008).

The US-EPA and EU lists sixteen of these PAHs as hazardous compounds. Among these according evidence both the International Agency for Research on cancer (IARC) and US EPA classified a num carcinogenic to human. The EPA has classified seven PAH compound a probable human carcinogen three ring PAHs are non-carcinogenic, while several of the four, five and six ring PAHs are carcinogen Benzo(a) pyrene is the most potent carcinogen among the PAHs (Pule *et al*., 2012).

Therefore selection of wood smoke for food smoking is very important.

3. Research Methodology

Selection and collection of raw materials (firewoods) were carried out in Northern and Southern part Selection was carried out according to their availability, abandancy and cost of the firewoods.Some su

Cocos nucifera(Coconut husk and Coconut frond), *Borassus flabellifer* (Palmyrah), *Cinnamo* (Cinnamon), *Azadirachta indica* (Neem), *Mangifera indica*(Mango) , *Artocarpus heterophyllus* (J *sepiaria* (Weera), *Thespesia populnea* (Portia).

In the preparation, the firewoods were cut into small same size pieces using a wood cutter. After that using the drier to maintains uniform moisture conditions among all the wood samples.

The smoke collecting apparatus consist of smoker, ash trap, PAH trap and vacuum pump was use to particles.

The smoker was prepared with controlled conditions to control the flame, smoking temperatu density/mass. Approximately one kilogram of the wood samples were used for smoldering with one hou extraction was carried out by using the 6:3:1 ratio mixture of acetonitrile, acetone and toluene. Agilen HPLC (Agilent, USA) equipped with a quaternary gradient pump, Diode array (220 nm) and Fluore (Ex 260, Em 350 nm, 420 nm, 440 nm and 500 nm) and Thermostated column compartment was use analysis. Chromatographic separation was achieved with a ZORBAX Eclipse

PAH (4.6 mm × 250 mm, 5 µm; Agilent, USA) analytical LC column & ZORBAX Eclipse PAH (mm, 5 µm) guard column. Mobile phase consisted of water (A) and acetonitrile (B) in gradient elusion of 2 mL/min & total run time of 27.5 minutes. Injection volume was 1.0 µL. Column compartment w at 25 °C.

4. Results and findings

Eleven different types of PAHs with different quantities were identified from different wood samples (tabl According to the analysis, naphthalene, acenapthylene, acenapthene,fluorene, phenanthrene, anthracene, fluoran pyrene, benzo(a)anthracene, benzo(a)pyrene and benzo(k)fluoranthene were identified. Among them naphthalen prominent to all selected woods. US-EPA states that Naphthalene as one of the carcinogenic compounds but the of carcinogenicity is not well established. Palmyrah, jak and weera have considerable amounts, 198.89 67.37mg/L, and 38.55mg/L of naphthalene respectively. Coconut fronds and coconut husk had the highest amo PAHs (212.13 mg/L and 115.51 mg/L) compare to the other wood smoke. Probable carcinogenic compounds s benzo(a)anthracene (1.55mg/L,0.2mg/L), benzo(a)pyrene(1.18mg/L,6.45mg/L) and benzo(k)fluora (0.41mg/L,1.55mg/L) were detected only in palmyrah and coconut husk smoke. Benzo(a)anthracen

Benzo(k)fluoranthene which also considered as probable carcinogenic PAHs, were detected only in palmyrah s The benzo[a]pyrene (Bap) is regarded as a marker of the carcinogenic PAHs in smoke. EU alloved max acceptable

level of B(a)P in smoked food is 0.031µg/kg. Among the studied wood samples palmyrah smoke con the B(a)P, which was about 1180 µg/kg. Therefore there is a great possibility for the accumulation of B(a)p in sm food process with palmyrah smoke. During the study the optimization of PAHs extraction from the wood smo adopting the smoke collecting apparatus with the suitable solvent mixture may be one of the limitations. It overcome by selecting other methods to trap the smoke as well as to extract the PAHs from the smoke. Table 01.

in different wood smoke

Wood species	PAH compounds	Quantity (mg/L)
Coconut husk	Naphthalene	36.61
	Acenapthylene	16.88
	Acenapthene	1.89
	Fluorene	10.29
	Phenanthrene	22.13
	Anthracene	13.54
	Fluoranthene	4.73
	Pyrene	1.24
	Benzo(a)anthrac ene	0.2
	Benzo(k)fluorant hene	1.55
	Benzo(a)pyrene	6.45
Coconut frond	Napthalene	198.89
	Phenanthrene	2.54
	Anthracene	4.72
	Fluorene	5.98

	Palmyrah	Naphthalene	11.47		
Benzo (a)					
	anthracene	1.56			
	Benzo (k) fluoranthene	0.41	Benzo (a) pyrene	1.18	
	Cinnamon	Fluorene	60.36		
	Phenanthrene	34.94			
Mango	Naphthalene	28.72	Fluorene	5.97	

5. **Conclusions, implications and significance**

Naphthalene is most commonly available PAH in the wood smoke among the nine wood varieties s husk, coconut frond, palmyrah, cinnamon, mango, margosa, jak, weera and portia. Among these nine coconut frond has highest amount of PAHs (212.13 mg/L) than others. Most probable carcinogenic benzo (a) pyrene, benzo (a) anthracene and benzo (k) flouranthene are available in Coconut husk and Pa mango, margosa and portia can be selected as safe fire woods among these nine woods for smoking of

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