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Profile of volatile organic compounds in kepah (*Polymesoda erosa* Solander, 1786) collected from Jada Bahrin River of Bangka Island, Indonesia

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Abstract. This study aimed to provide information about the profile of volatile organic compounds (VOCs) in kepah (*Polymesoda erosa* Solander, 1786), and also about sediment and water of their habitat in Jada Bahrin River of Bangka Regency, Bangka Island, Indonesia. The analysis of VOCs was carried out using Pyrolysis-GC/MS analysis. A number of volatile organic compounds (VOCs) were measured, including aldehydes, alcohols, aromatic compounds, carbohydrates, carbon dioxide, esters, hydrocarbons, ketones, nitrogenous compounds, oxygen-sulfur compounds, and proteins. We have found that 29 VOCs were detected in kepah meat. Hexadecanoic acid (CAS) (palmitic acid) had the highest concentration, 14.04%. We also found 28 VOCs in the water. Cyclopropane, 1,1-dibromo-2-chloro-2-fluoro- (CAS) 1,1-dibromo-2-chlor had the highest concentration, namely 19.41%. Furthermore, there were 60 VOCs that detected in sediment, with the highest concentration for 1-bromo-3,7,11-trimethyl-dodeca-2,6,10-triene (6.36%).
Key Words: clam, degradation, organic chemical, pyrolysis-GC/MS.

Introduction. Volatile organic compounds (VOCs) are large groups of organic chemical compounds found in many products. They vaporize easily and enter the environment under normal conditions (Yadav & Pandey 2018). VOCs are defined by the US Environmental Protection Agency (U.S. EPA), as organic compounds with low initial boiling point (less than or equal to 250°C) at a standard atmospheric pressure of 101.3 kPa (Cheng et al 2019). Wang et al (2018) define VOCs as volatile organic compounds with higher saturated vapor pressure (greater than or equal to 0.01 kPa at 20°C), low boiling point, and small molecular weight. VOCs include into non-methane hydrocarbons such as alkanes, alkenes, alkynes and aromatic hydrocarbons (NMHCs), oxygen containing organic compounds including aldehydes, ketones, alcohols, ethers and halogenated hydrocarbons (OVOCs), nitrogenous compounds, sulfur compounds and other compounds.

VOCs are ubiquitous in the environment and they may represent health risks. VOCs are derived from natural and human activities. Naturally, VOCs can be produced by macroalgae in response to environmental stresses and also from plants. VOCs generated by anthropogenic activities come from both domestic and industrial processes (Bravo-Linares et al 2010; David & Niculescu 2021). Since the industrial waste around the river could contain some hazardous VOCs that might affect the health of living organisms in the water and can enter the human body via food chain pathways. They can lead to symptoms and pathologies in the respiratory tract, nervous system, skin, kidneys and others. Some VOCs like benzene, 1,3-butadiene, and vinyl chloride are classified by the International Agency for Research on Cancer (IARC) in Group 1 as carcinogenic for humans (Juang et al 2009; Montero-Montoya et al 2018). On the other hand, VOCs in foods provide a flavor fingerprint that help humans recognize appropriate foods and avoid poor or dangerous foods (Dini 2008). The group of VOCs such as ethyl esters, aldehydes, nitrogen compounds, ketones, alcohols, and dimethylsulphone, represent the main aromatic constituents of foods (Genovese et al 2019). Thus, it is important to understand their presence in the environment and especially in our diet and to identify possible sources of VOCs (Vinci et al 2015).

Argente (2016) explains that there are three genera within the Family Corbiculidae, which are distributed worldwide, namely *Batissa*, *Polymesoda*, and *Corbicula*. Hamli et al (2015) explain there are three common species of the genus *Polymesda* from the family Corbiculidae, class Bivalvia that can be found inhabiting the mangrove areas in Southeast Asia, namely *P. erosa*, *P. bengalensis*, and *P. expansa*. The mud or mangrove clam (*Polymesoda erosa* Solander, 1786), with the local name 'kepah' in Bangka Island, is an edible bivalve species. *P. erosa* can be found in intertidal areas, in mangrove substrate and in the fresh and brackish waters of mangrove swamps, estuaries, and larger rivers (Biona et al 2017). Molluscs have high economic value and reproduce easily. In addition, they are highly nutritious and are considered an excellent source of proteins, lipids and minerals. Molluscs are a highly valuable aquaculture resource, and mussels in particular are typical filter feeders, constantly filtering substances out of the surrounding water (Wang et al 2021). *Polymesoda* sp. feed by filtering suspended particles in the water that surrounds them (Mustapha 2020). Bivalves are well known as filter feeders for suspended particles within water columns that may be contaminated with numerous pollutants from anthropogenic activities or natural factors (Yusoff et al 2021). Therefore, they can be a potential source of organic and inorganic environmental pollutants that accumulate in the body and are transmitted to humans through consumption (Ding et al 2021; Mutić et al 2021).

This study aimed to provide information related to the volatile organic compounds from the meat of kepah, sediment and water collected from Jada Bahrin River, Bangka Regency, Bangka Island, Indonesia.

Material and Method. This research took place from May to June 2022. The study was conducted by testing volatile organic compounds from samples (kepah, sediment, and water), collected from Jada Bahrin River, located in Bangka Regency, Bangka Island, Indonesia. We have sampled randomly 20 individuals of kepah, 1.5 L of water, and 100 g of sediment. The habitat of kepah in the area of sampling was represented by the mud around mangrove trees. The identification of kepah was done using as reference www.sealifebase.ca. Collected samples were stored in a cold box with at less than 5^{o}C to prevent the decrease in VOC content. Kepah (0.05 mg), sediment (0.05 mg), and water of river (0.05 mg) were used as samples in this study.

The VOCs were determined using Pyrolysis Gas Chromatography–Mass Spectrometry (pyr-GC/MS) (Peters et al 2018; Bouzid et al 2022). Patoni et al (2022) explain that qualitative and quantitative analysis of volatile compounds was measured using the GCMS Pyrolysis Shimadzu GCMS-QP 2010, with a column length (rt x 5 ms) 60 m, 0.25 mm in diameter and 0.25 m thickness. The initial column oven temperature was held at 50°C for 5 min and increased by 2.5°C min^{-1} to 150°C, and finally with 90°C min^{-1} to 280°C. In pyrolysis, it was set at 600°C. Gas Chromatography was set at a pressure of 101.0 kPa, total flow 46.5 mL min^{-1}, column flow 0.85 mL min^{-1}, with a linear velocity of 23.7 cm sec^{-1}. The ion source temperature and the interface temperature were maintained at 200 and 280°C, respectively, with a split ratio of 1:50 with 1 mL of sample injected. Some VOCs were investigated and presented in chromatograms, while name and retention time (R. time) of total ion chromatography (TIC) was based on peaks of chromatograms. The results of GCMS-Pyrolysis analysis were analyzed and tabulated using the Wiley 7 program.

Results and Discussion. Kepah collected from Jada Bahrin River are presented in Figure 1. 29 VOCs were detected in kepah meat with the highest concentration found at peak 23 with a retention time of 22.975 min for hexadecanoic acid (CAS) (palmitic acid - 14.04%) (Table 1 and Figure 2).

Figure 1. *Polymesoda erosa* from Jada Bahrin River of Bangka Regency, Indonesia; a - collection process; b - kepah after collection; c - kepah in the laboratory.

Table 1
Volatile organic compounds of *Polymesoda erosa* meat from Jada Bahrin River of Bangka Regency, Bangka Island, Indonesia

Peak	*Retention time (min)*	*Concentration (%)*	*Name*
1	7.293	3.47	Nitrogen oxide (N_2O) (CAS) Nitrous oxide
2	7.717	1.76	1,4-oxathiane, 4,4-dioxide (CAS) p-Thioxane sulfone
3	16.138	0.43	2-cyclopenten-1-one, 2-hydroxy-3-methyl- (CAS) Corylon
4	16.723	0.49	Isooctane, (ethenyloxy)- (CAS) Isooctyl Vinyl Ether
5	17.017	0.72	Pentanal (CAS) n-Pentanal
6	17.392	0.40	1,3-pentanediol, 2,2,4-trimethyl- (CAS) 2,2,4-trimethyl-1,3-pentanediol
7	17.640	0.51	Decane, 2,3,5,8-Tetramethyl-
8	18.029	0.53	2-butene-1,4-diol, (Z)- (CAS) cis-Butenediol
9	18.480	0.35	Tetradecane (CAS) n-Tetradecane
10	18.992	0.65	2-undecene, 2,5-dimethyl- (CAS) 2,5-dimethyl-2-undecene
11	19.271	0.61	Pentadecane (CAS) n-Pentadecane
12	19.555	0.61	9-octadecenoic acid (Z)- (CAS) Oleic acid
13	19.767	0.45	Nonadecanol
14	20.017	0.83	Dodecane, 2,6,10-trimethyl- (CAS) Farnesane
15	20.218	1.56	Dodecanoic acid (CAS) Lauric acid
16	20.636	1.79	10-undecenoic acid, octyl ester (CAS) Octyl 10-undecenoate
17	20.892	2.24	Octadecanoic acid (CAS) Stearic acid
18	21.313	2.51	Docosanoic acid (CAS) Behenic acid
19	21.570	5.08	Tetradecanoic acid (CAS) Myristic acid
20	22.011	3.76	Pentadecanoic acid (CAS) Pentadecylic acid
21	22.226	5.34	Pentadecanoic acid (CAS) Pentadecylic acid
22	22.685	3.62	Hexadecanoic acid (CAS) Palmitic acid
23	22.975	14.04	Hexadecanoic acid (CAS) Palmitic acid
24	23.359	5.48	Heptadecanoic acid (CAS) Margaric acid
25	23.639	7.46	Heptadecanoic acid (CAS) Margaric acid
26	24.120	2.83	2(3H)-guranone, 5-dodecyldihydro- (CAS). gamma.-Palmitolactone
27	24.404	8.49	9-octadecenoic acid (Z)- (CAS) Oleic acid
28	24.795	6.29	Hexadecanamide (CAS) Amide 16
29	25.356	3.86	Nonadecanamide

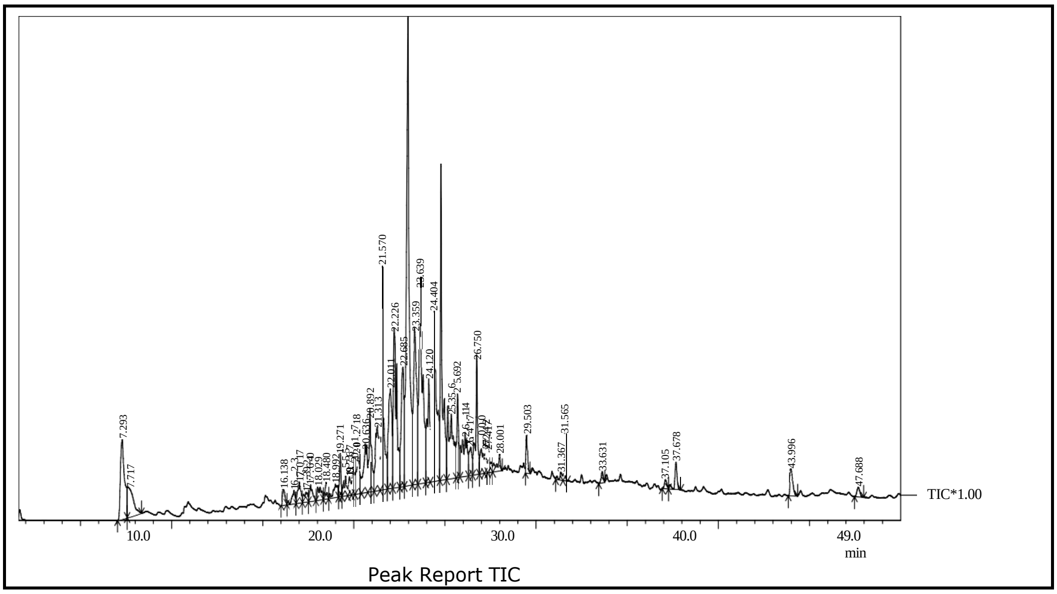

Figure 2. Total chromatogram of *Polymesoda erosa* meat from Jada Bahrin River of Bangka Regency.

In total, 29 VOCs were identified from kepah meat samples. Of these compounds, there were 1 aldehyde, 3 alcohols, 1 aromatic compound (furan), 1 ester, 14 fatty acids, 5 hydrocarbons, 2 ketones, 1 nitrogenous compound, and 1 oxygen-sulfur compound (Figure 3). The fatty acids were the most abundant compounds, including lauric acid, stearic acid, behenic acid, myristic acid, palmitic acid, margaric acid, oleic acid, and derivates such as hexadecanamide and nonadecanamide.

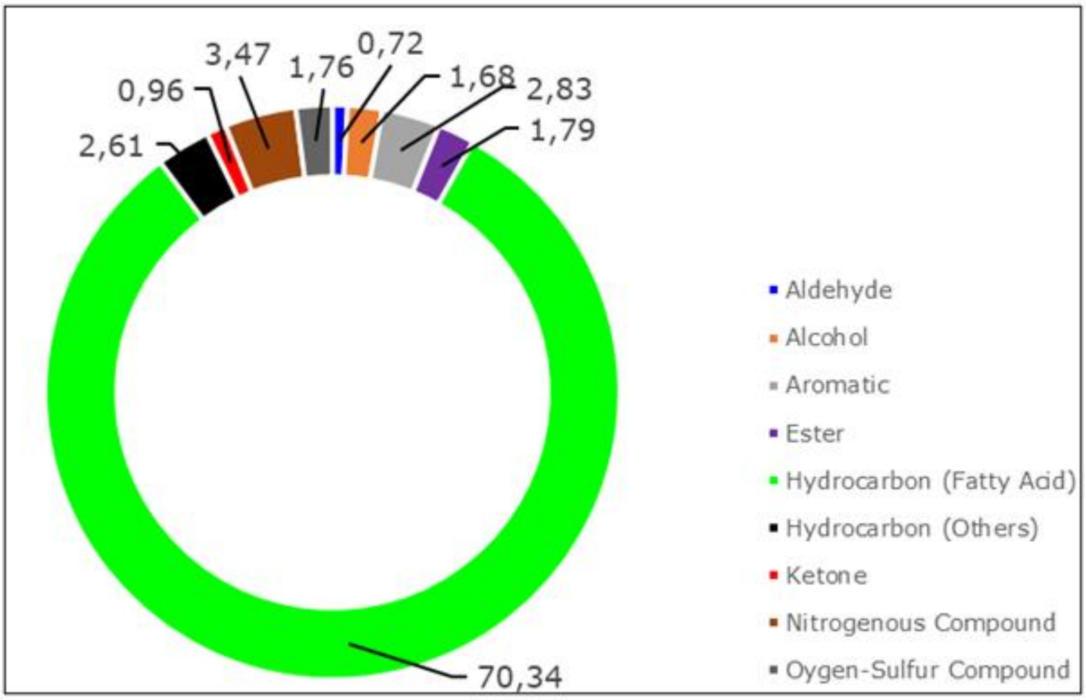

Figure 3. Total volatile compound groups of *Polymesoda erosa* meat.

P. erosa is a mollusc with a great nutritional potential, especially in fatty acids. Some of the saturated fatty acids (SFAs) from *P. erosa* are palmitic acid (C16:0), myristic acid (C14:0), lauric acid (C12:0), stearic acid (C18:0), behenic acid (C22:0), and pentadecanoic acid (C15:0). Monounsaturated fatty acids (MUFA) are margaric acid (17:1) and oleic acid (C18:1n9c), as found in this research, but also by Leiwakabessy et al (2019). Polyunsaturated fatty acids from *P. erosa* were not found in this study.

We also analyzed VOCs of water from Jada Bahrin River. There were 28 VOCs detected in the water, with the highest concentration found at peak 26 with a retention time of 20.762 min, for 1,6-anhydro-beta-D-glucopyranose (levoglucosan) (24.88%) (Table 2 and Figure 4). Latif et al (2012) explain levoglucosan (1,6-anhidro-β-D-glucopyranose) is an organic molecule that can be used as an indicator for cellulose burning. Thus, it is possible that levoglucosan from filter paper has contaminated the pyrolysis of VOCs.

Of the identified compounds, there were 6 aldehydes, 5 alcohols, 2 carbohydrates, 1 ester, 9 hydrocarbons, 4 ketones, and 1 protein (Figure 5). The hydrocarbons were the most abundant compound in the water. Cyclopropane, 1,1-dibromo-2-chloro-2-fluoro- (CAS) 1,1-dibromo-2-chlor, was the highest VOC found in the water of Jada Bahrin River, after levoglucan (which was presumed to have contaminated the sample). Cyclopropane belongs to the class of organic compounds known as cycloalkanes, a group of hydrocarbons, found at peak 1 with a retention time of 6.486 min and a concentration of 19.41%.

Cyclopropane, 1,1-dibromo-2-chloro-2-fluoro- (CAS) 1,1-dibromo-2-chlor is an organic compound found in jabon (*Anthocephalus cadamba*) (Hadi et al 2021) and has antioxidant properties in young agarwood (*Aquilaria malaccensis* Lamk) leaves (Batubara et al 2021). Thus, we did not consider this VOC as a dangerous compound for the environment or for human health.

Table 2

Volatile organic compounds of water from Jada Bahrin River of Bangka Regency, Bangka Island, Indonesia

Peak	*Retention time (min)*	*Concentration (%)*	*Name*
1	6.486	19.41	Cyclopropane, 1,1-dibromo-2-chloro-2-fluoro- (CAS) 1,1-Dibromo-2-Chlor
2	8.260	3.24	2-methyl-3-oxo-Butyronitrile
3	9.025	0.50	Pentane (CAS) n-Pentane
4	9.412	2.98	Acetic acid (CAS) Ethylic acid
5	9.796	6.17	2-propanone, 1-hydroxy- (CAS) Acetol
6	11.591	0.43	2,3-pentanedione (CAS) 2,3-pentadione
7	11.825	1.07	Propanoic acid, 2-oxo-, methyl ester (CAS) Methyl pyruvate
8	12.179	0.77	1-cyano-6-hydroxypentane
9	12.594	0.53	2-furancarboxaldehyde (CAS) Furfural
10	13.156	0.35	2-propanone, 1-(acetyloxy)- (CAS) Acetol acetate
11	13.325	1.63	2-furanmethanol (CAS) Furfuryl alcohol
12	14.351	1.99	Cyclohexanone (CAS) Anon
13	14.525	1.47	2-furancarboxaldehyde, 5-methyl- (CAS) 5-methyl-2-furfural
14	15.562	1.91	2-cyclopenten-1-one, 2-hydroxy-3-methyl- (CAS) Corylon
15	15.988	1.71	Hydroxy Dimethyl Furanone
16	16.379	5.90	Pentanal (CAS) n-Pentanal
17	16.967	1.82	7-methyl-1,4-dioxaspiro[2.4]heptan-5-one
18	17.196	1.69	1-octene (CAS) Caprylene
19	17.561	2.62	Oxirane, 2-butyl-3-methyl- (CAS) 2,3-epoxyheptane
20	18.046	4.42	2-furancarboxaldehyde, 5-(hydroxymethyl)- (CAS) HMF
21	18.442	1.15	4-heptanol, 2,6-dimethyl-4-(1-methylethyl)- (CAS) 2,6-dimethyl-4-Isopro
22	18.912	3.11	Ethenol, 2-ethoxy-, acetate (CAS)
23	19.392	1.66	L-Glutamic acid, N-[(phenylmethoxy)carbonyl]-
24	19.667	2.52	2-propenoic acid, 2-methyl-, hexyl ester (CAS) Hexyl methacrylate
25	20.075	1.27	1-cyclohexene-1-carboxylic acid (CAS) 1-cyclohexenecarboxylic acid
26	20.762	24.88	1,6-anhydro-Beta-D-Glucopyranose (Levoglucosan)

Table 2

Volatile organic compounds of water from Jada Bahrin River of Bangka Regency, Bangka Island, Indonesia (continuation)

Peak	*Retention time (min)*	*Concentration (%)*	*Name*
27	21.775	2.44	1,6-anhydro-Beta-D-Glucofuranose
28	22.308	2.36	4-decenoic acid, methyl ester (CAS) Methyl dec-4-enoate

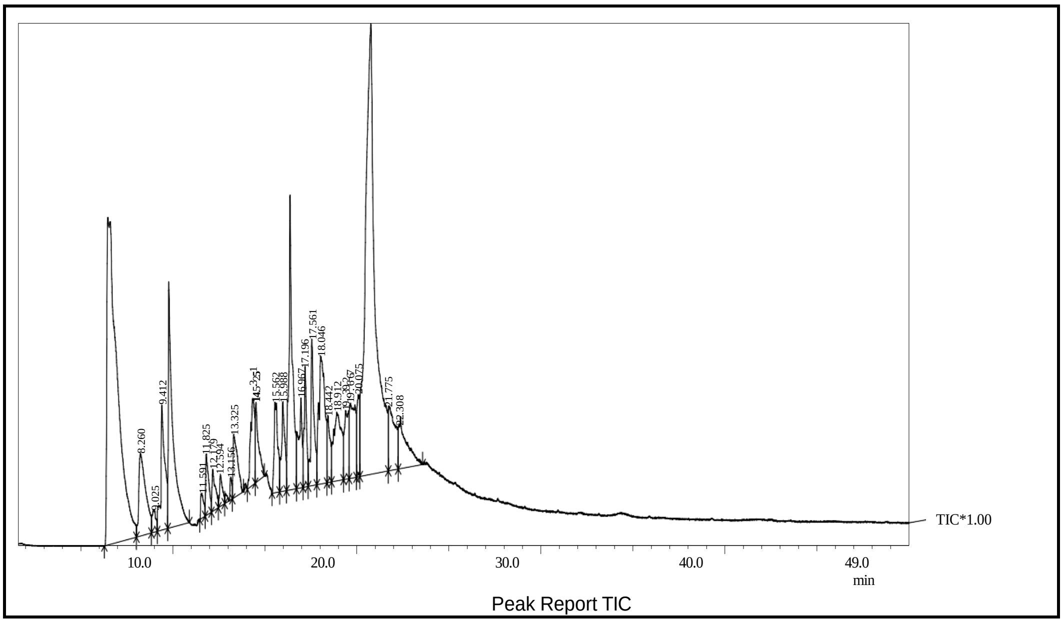

Figure 4. Total chromatogram of water from Jada Bahrin River of Bangka Regency.

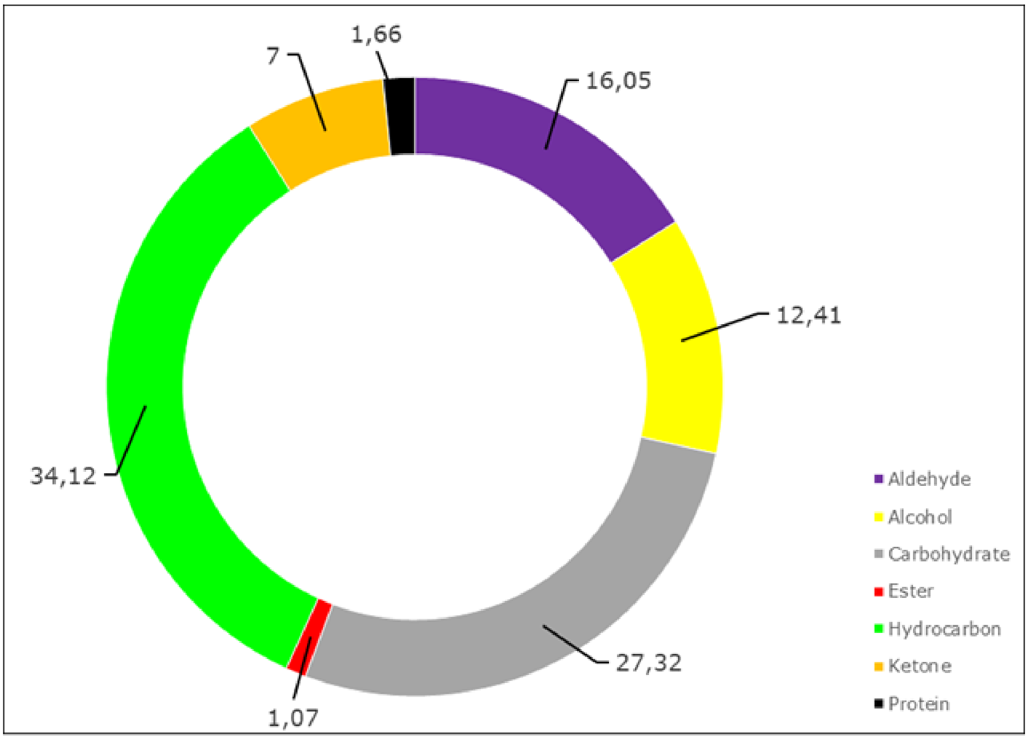

Figure 5. Total volatile compound groups in the water of Jada Bahrin River.

Sixty VOCs were detected in the sediment of Jada Bahrin River, with the highest concentration found at peak 50, with a retention time 41.694 min, for 1-bromo-3,7,11-trimethyl-dodeca-2,6,10-triene (6.36%) (Table 3 and Figure 6). Of the identified compounds, there were 1 aldehyde, 4 alcohols, 1 carbon dioxide, 6 esters, 45 hydrocarbons, and 3 ketones (Figure 7). The hydrocarbons were the most abundant compound type in the sediment. We found two VOC hydrocarbons that contain benzene, namely benzofuran, 2,3-dihydro- (CAS) 2,3-dihydrobenzofuran (R. time 18.481 min, 1.48%) and 1H-benzocyclohepten-7-ol, 2,3,4,4a,5,6,7,8-octahydro-1,1,4a,7-tetramethyl-, (R. time 36.717 min, 0.58%).

Benzene is an aromatic hydrocarbon and a colorless and odorous liquid (Meckenstock et al 2016; Yildizhan et al 2021). It is formed from both natural processes and human activities. It is classified as carcinogen for humans, with effects such as acute leukemia and probably other hematological cancers. Benzene is a major raw material used to make plastics, resins, synthetic fibers, nylons, dyes, detergents, pharmaceuticals and pesticides, and is also a component of crude oil (Smith 2010; Conte et al 2021). In the environment, this pollutant can be accumulated in organisms through direct or indirect routes. It is potentially accumulated in filter feeder organisms such as a clams.

Table 3

Volatile organic compounds of sediment from Jada Bahrin River of Bangka Regency, Bangka Island, Indonesia

Peak	*Retention time (min)*	*Concentration (%)*	*Name*
1	7.243	3.58	Carbon dioxide (CAS) Dry ice
2	17.642	0.53	10-undecenoic acid, Octyl ester (CAS) Octyl 10-Undecenoate
3	18.242	0.56	Nonanoic acid (CAS) Nonoic acid
4	18.481	1.48	Benzofuran, 2,3-dihydro- (CAS) 2,3-Dihydrobenzofuran
5	18.992	0.66	Decanoic acid (CAS) Capric acid
6	19.268	0.70	1-Octanol, 2-butyl- (CAS) 2-Butyl-1-octanol
7	19.492	0.32	2-Butanone, 4-cyclohexyl- (CAS) 4-Cyclohexyl-2-butanone
8	19.817	0.75	(1R*,6S*,10R*)-5,5-dimethyl-11,12-dioxatricyclo[8.2.1.0(1,6)]tridecan-10-ol
9	20.009	0.66	Hexadecane (CAS) n-Hexadecane
10	20.337	1.04	Docosanoic acid (CAS) Behenic acid
11	20.713	0.87	Tricosane (CAS) n-Tricosane
12	20.941	1.28	3-Hexadecene, (Z)- (CAS)
13	21.541	2.79	9-octadecenoic acid (Z)- (CAS) Oleic acid
14	21.867	0.47	2-undecanone, 6,10-dimethyl- (CAS) 6,10-dimethylundecan-2-one
15	22.067	2.35	Tetratetracontane (CAS) n-Tetratetracontane
16	23.015	4.98	Oxacycloheptadec-8-en-2-one (CAS) Ambrettolide
17	23.446	0.88	Pentatriacontane (CAS) n-Pentatriacontane
18	23.667	0.59	Megastigma-3,7(Z),9-triene
19	24.197	1.34	Pentatriacontane (CAS) n-Pentatriacontane
20	24.621	1.55	Oxacycloheptadec-8-en-2-one (CAS) Ambrettolide
21	25.026	1.16	Octadecane, 1-chloro- (CAS) 1-chlorooctadecane
22	25.974	0.40	Pentatriacontane (CAS) n-Pentatriacontane
23	26.891	0.69	Cyclododecanone (CAS) Cyclododecanon
24	27.067	0.37	Hexatriacontane (CAS) n-Hexatriacontane
25	27.973	0.60	1,2-Propanediol, 3-(Phenylmethoxy)-, Diacetate
26	28.388	0.52	Pentatriacontane (CAS) n-Pentatriacontane
27	29.667	1.22	Tetrapentacontane, 1,54-dibromo-
28	29.966	1.79	Tetratetracontane (CAS) n-Tetratetracontane
29	31.909	1.39	Pentatriacontane (CAS) n-Pentatriacontane
30	32.567	1.98	1-Hentetracontanol (CAS) N-Hentetracontanol-1
31	32.790	0.82	6-O-acetyl-7-desoxy-1,2:3,4:8,9:11,12-tetra-O-isopropyliden-7-nitro-.beta.-D-
32	33.117	1.05	Methyl Commate E

Table 3

Volatile organic compounds of sediment from Jada Bahrin River of Bangka Regency, Bangka Island, Indonesia (continuation)

Peak	*Retention time (min)*	*Concentration (%)*	*Name*
33	33.688	3.97	Nonacosanol (CAS)
34	34.060	1.81	Hexacosane, 9-octyl- (CAS) 9-n-Octylhexacosane
35	34.303	1.11	Pentatriacontane (CAS) n-Pentatriacontane
36	34.920	2.67	9,19-Cyclolanost-24-en-3-ol, Acetate
37	35.438	0.65	2-Pentadecanone, 6,10,14-trimethyl- (CAS) 6,10,14-Trimethyl-2-pentadecano
38	36.269	5.36	Silane, (9,19-cyclo-9.beta.-lanost-24-en-3.beta.-yloxy)trimethyl- (CAS) Cycl
39	36.717	0.58	1H-Benzocyclohepten-7-ol, 2,3,4,4a,5,6,7,8-octahydro-1,1,4a,7-tetramethyl-,
40	36.999	3.43	Silane, (9,19-cyclo-9.beta.-lanost-24-en-3.beta.-yloxy)trimethyl- (CAS) Cycl
41	37.474	1.18	Cycloeucalenol
42	37.817	1.48	Nonacosanol (CAS)
43	38.368	0.70	Silane, (9,19-cyclo-9.beta.-lanost-24-en-3.beta.-yloxy) trimethyl- (CAS) Cycl
44	38.590	0.79	Androst-5-en-3-ol, 4,4-dimethyl-, (3.beta.)- (CAS)
45	39.044	1.50	1-bromo-3,7,11-trimethyl-dodeca-2,6,10-triene
46	39.550	1.20	Cycloeucalenol
47	40.053	1.78	Androst-5-en-3-ol, Trifluoroacetate, (3.beta.)- (CAS)
48	40.639	2.68	13,27-Cycloursan-3-ol, Acetate, (3.Beta.,13.Beta.,14.Beta.)-
49	40.942	0.97	Tetracosane, 11-decyl- (CAS) 11-n-Decyltetracosane
50	41.694	6.36	1-bromo-3,7,11-trimethyl-dodeca-2,6,10-triene
51	42.132	3.08	1-bromo-3,7,11-trimethyl-dodeca-2,6,10-triene
52	42.629	3.31	4,4,6A,6B,8A,11,11,14B-octamethyl-1,4,4A,5,6,6A,6B,7,8,8A,9,10,11,12,
53	43.051	1.01	Norolean-12-ene
54	43.841	0.67	4,4,6A,6B,8A,11,11,14B-octamethyl-1,4,4A,5,6,6A,6B,7,8,8A,9,10,11,12,
55	44.417	0.57	9,19-cyclolanost-24-en-3-ol, Acetate
56	44.867	5.70	9,19-cyclolanost-24-en-3-ol, (3.beta.)- (CAS) Cycloartenol
57	45.517	0.68	Pentatriacontane (CAS) n-Pentatriacontane
58	45.828	2.30	6-isopropenyl-4,8A-dimethyl-3,5,6,7,8,8A-Hexahydro-1H-Naphth
59	46.399	1.22	9,19-cyclolanost-24-en-3-ol, (3.beta.)- (CAS) Cycloartenol
60	47.407	3.86	14-.Beta.-H-Pregna

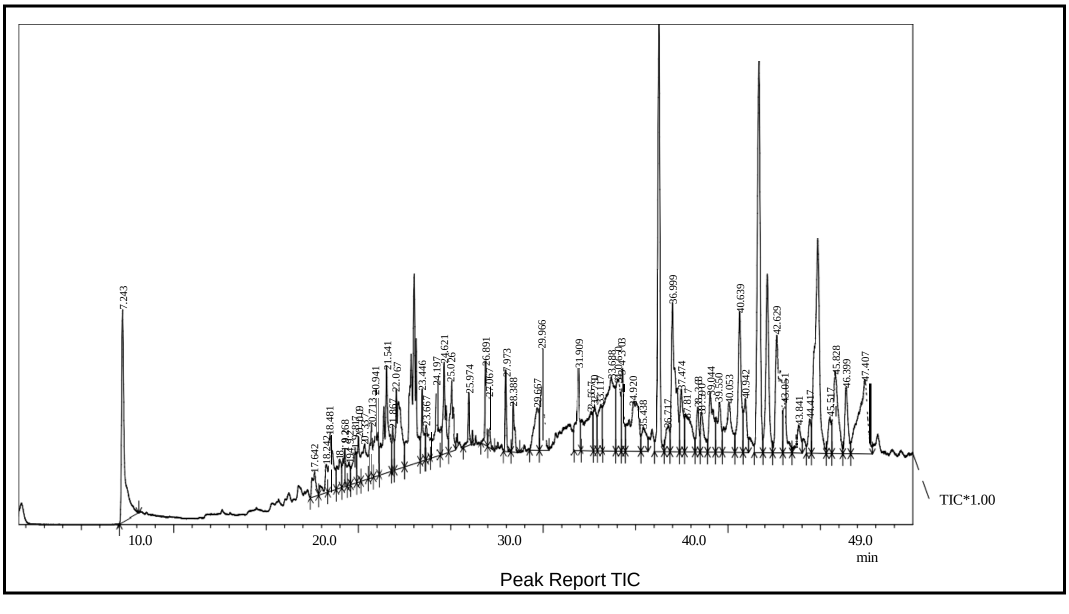

Figure 6. Total chromatogram of sediment from Jada Bahrin River of Bangka Regency.

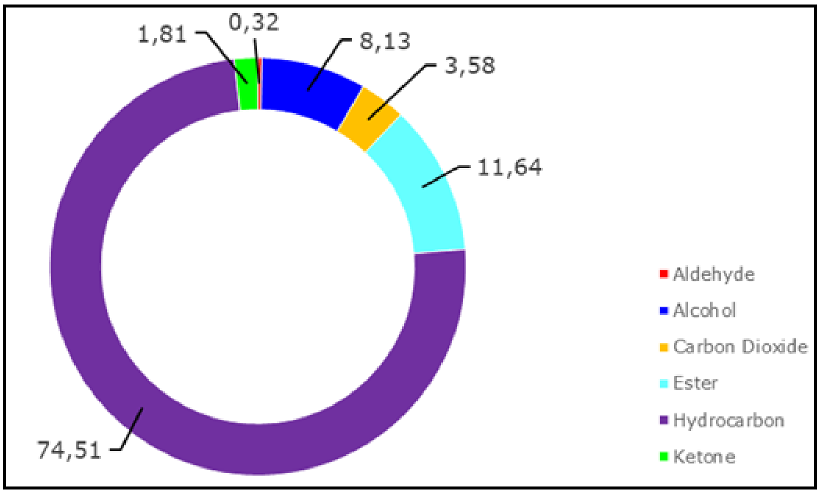

Figure 7. Total volatile compound groups of sediment from Jada Bahrin River.

Benzene accumulation has been observed in *Gafrarium divaricatum*, with concentration between 4.35 and 8.70 mg L^{-1}. Chronic exposure of clams to benzene resulted in loss of bubbling epithelium, separation and necrosis of epithelial cells, reduction in cytoplasm volume and density, fusion of cell membranes, disruption of the inner lining of tubules, and nuclei forming darkly stained areas at basal part of the cells (Agwuocha et al 2011). The presence of benzene in the environment at a concentration of 5.69 μL L^{-1} also affects the physiological processes of mussels, *Perna perna*, reducing oxygen consumption and ammonia excretion (Jorge et al 2007). Furthermore, aromatic hydrocarbon pollutants such as benzene, toluene, and xylene (BTX) contribute to damaging DNA in the bivalve *Corbicula fluminea* (Fedato et al 2010). In this research, we did not obtain benzene contaminated kepah meat in Jada Bahrin River. However, compounds that contain benzene were found in the sediment, so the potential contamination with benzene and its derivates should be considered in future studies.

Overall, this study showed that *P. erosa* can be used as a bioindicator of organic pollutants such as volatile organic compounds. VOCs found in the meat of kepah represented accumulated pollutants from the habitat (Nuryanto & Sastranegara 2013). In this study, we found VOCs containing benzene in the sediment, where benzene can be persistent (Jenneskens et al 2011). Furthermore, we must monitor the presence of benzene that accumulated in kepah. The potential of toxicity for human health is important, because it can produce carcinogenic effects, acute and chronic diseases, nervous system diseases, reproductive and developmental problems, immune system issues, respiratory problems, and hematological diseases (Falzone et al 2016; Dettenrieder et al 2020).

Conclusions. We have confirmed Pyr-GC/MS as an applicable instrument for determining volatile organic compounds (VOCs) in kepah meat, water and sediment. Hydrocarbons were the most abundant compound in kepah meat, water, and sediment, collected from Jada Bahrin River, Bangka Regency, Bangka Island, Indonesia.

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Conflict of Interest. The authors declare that there is no conflict of interest.

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