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Research Article

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Bioaccumulated pesticides on shellfishes meat *Corbicula sumatrana* and *Contradens contradens*

Armein Lusi Zeswita, Vivi Fitriani and Nursyahra

Department of Biology, STKIP PGRI SUMBAR, West Sumatera, Indonesia

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ABSTRACT

Shellfish Corbicubicula sumatrana and Contradens contradens are benthic animals inhabiting in muddy and sandy water bottom. The nature of these benthic animals tend to settle down and have a very low level of mobility. Besides, the shells also are filter feeder . Two types of these shellfishes is commonly found in Lake Singkarak. Around the lake there are areas of agriculture and some of the rivers that flow into the lake. Seeing by high agricultural activities around the lake worried that the effects of excessive pesticide used will be accumulated on water. Research aimed to determine pesticide compounds that accumulated in aquatic biota of Lake Singkarak especially Corbicula sumatrana and Contradens contradens. This research had been done from February to July 2015. Samples were taken at the mouth of Sungai Batang Lembang a river that flow into Lake Singkarak. Accumulation analysis using Gas Chromatography onto meat extract of these two shellfishes. The result shows that the Corbicula sumatrana's meat contains 50 chemical compounds and the Contradens contradens's meat discovered 55 types of chemical compounds as well as on the gills Contradens contradens found 137 chemical compounds. Ten derivative DDT of all 137 chemical compounds which found.

Key words: *Corbicula sumatrana*, *Contradens contradens*, bioaccumulated

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INTRODUCTION

Pelecypoda species were found in the fresh water are *Corbicula sumatrana* and *Contradens contradens*. *C. sumatrana* known by local people as "pensi" and *Cont. Contradens* known by lokal people as "alo-alo". Pensi and alo-alo had been found in West Sumatra in Lake Singkarak, Lake Diateh and Lake Dibawah also other Corbicula species such as *C. moltokiana* in Lake Maninjau (1). *C. javanica* And *C. rivalis* in Lake Lido, West Java (2).

Jutting (1953)(3) explained that Corbicula generally have a very small, almost symmetrical, rounded to oval triangular irregular shells. Generally hard with little or no transparency, umbo rising in some species. Hard outer skin, rather fibered, ribbed, concentric, the hard outer ligament shells consists of three layers namely Periostracum (outer layer), prismatic (middle layer) and nakreus (inner layer). The outer surface shells mostly smooth but some also shown growth lines and radial lines or a combination of both (4; 5)

Shellfish have a soft body, bilaterally symmetrical and wrapped by a shell derived from the mantle layer. Shells consisting of two pieces of shells, left shells and right shells which connected by ligaments. The ligament is located on the dorsal position behind the apex, from where we can distinguish the front and rear also left shell and right shell (6).

Corbicula sumatrana and *Contradens contradens* are benthic animals that inhabit in muddy and sandy water bottom. These shellfishes harvested in big number. It happened because these shellfishes meat are good tasted food. Residents around Lake Singkarak familiar with pensi. It has been sold both with or without shells. Pensi is a source

of practical and delicious food as a animal protein substitute. Pensi is harvested on various sizes. In every harvesting time always obtained Pensi in small size and large is rarely obtained.

Lake Singkarak is surrounded by various forms of ecosystems and conditions . Some places around the lake are areas of agriculture and also some estuaries. The use of pesticides in agricultural areas and estuaries of several rivers is suspected inputs of toxic chemicals on lakes, and pesticide residues are expected to be accumulated in the water bottom that will affect the water conditions. Disruption of aquatic ecosystems necessarily affected biota existance on lake.

Pesticides are chemicals that are commonly used in agricultural activities to control insect pests and plant pests. The use of pesticides in Indonesia is increasing very rapidly due to the expansion of agricultural areas for food crops and vegetables. One type of insecticide used in Indonesia is a class of organochlorine.

Broadly speaking, pesticides are divided into three major groups such as organochlorine pesticides (chlorine-based hydrocarbons), organophosphates (organic phosphates) and carbamates. Organophosphate and carbamate class are more toxic than organochlorine class. Organophosphate and carbamate class have acute effect and often arise poisoning in animals. Organochlorine group are persistent or not readily biodegradable and the effect of chronic and cause bioaccumulation in the food chain . In Indonesia at this time exist more than 5000 pesticides, both from organochlorines, organic phosphates or carbamates which contain one or more active ingredients that are allowed on the market.

On this lake found among various biota which can be economic source for local people such as fish bilih (*Mystacolensis padangensis*), fish Barau (*Hampala* sp), some types of molluscs such as Pelecypoda group pensi such as (*C. sumatrana*) and alo-alo (*Contradens contradens*). According to Uno (2001)(7) fresh water metal contained is coming from the metal-containing waste water disposal, erosion, and directly from air. Fresh water containing inorganic and organic materials which more than seawater. These materials have the ability to absorb the metal, so metal pollution in fresh water more easily occur.

Based on above it is necessary to preserve the animal populations and monitor the water quality on Lake Singkarak by using these animals as bio-indicators of it's water and seeing bio-accumulation of chemical harmful compounds in the water so it can be sustainable and can improve people economy around lake.

EXPERIMENTAL SECTION

Research had been done in June 2015 around Sumani estuary river and Tikalak in Singkarak lake in Solok district. Analysis of samples had been done at the Laboratory of Biology, University of Bung Hatta and Health Laboratory in Gunung Pangilun.

Equipments for this research are sauah (net), buckets, 1 kg plastic bags, rubber bands, paper labels, knives (cutter), gloves, weights, 110 mm Whatman filter paper, thread, soklet, waterbath, beaker, enlenmayer, pipette, glass foil and the materials are pensi meat samples (*Corbicula sumatrana*) and alo – alo meat (*Contradens contradens*), technical hexane, and water.

Research area description

Lake Singkarak is located at ± 362 m above sea level, 107.8 km^2 with a 21 km maximum length and 7 km width. Sampling was carried out in two stations is the first station in estuary of Sungai Batang Sumani, nagari Guci Sumani, second station is in Tikalak close to the fishing settlements and away from the river estuary.

The method used in this research is descriptive survey method of sample collection directly to the field . Samples have been collected for meat , then wind dried , extracted using soxlet for 8 hours, purification (purification) hexane from the sample. The extract was tested using chromatography gas.

Work description

1. Fieldwork

Before doing the research necessary to prepare tools and materials such as 10 pieces of Plastic 1 kg, rubber bracelets, Sauah (net), the scales. Samples were taken at each station were set off, then weighed sample of ± 100 grams. Samples photos for documentation, Thereafter the sample is inserted in a plastic 1 kg. Samples were obtained in the field opened the shell, then taken pensi meat. Cut into pieces and dried in the sun until the water content in mussel gills dry up (3-4 hours). Weight the samples were dried ± 75 grams.

2. Laboratory work

Dried samples were taken to the Chemistry laboratory and wrapped with 110 mm Whatman filter paper, tied with yarn. Then prepared Soklet, samples had been inserted into the tube wrapped soklet then put off the wool. Attach the hose on soklet, technical hexane prepared soklet tube was inserted in the tube to the limit. Then refill the tube soklet with hexane to hexane stagnant sample. After all the preparations ready to turn sochlet. Wait up to 12 cycles (± 8 hours) until the remaining mussel extracts up to ± 5 ml, did purificated (purification) by hexane. Insert extract viil shells into the bottle and labeled.

The results of sample extract purification process injected into the GC. The solution was added with acetone and then injected into the GC to identify organochlorine species contained in the sample. The results of the GC is a graph showing the existence and identified certain compounds in shellfish meat. Samples of water and Lake Singkarak substrate also help the identification of pesticide compounds (Medium road).

RESULTS

The research has been conducted of the obtained results as shown in Table 1. Discovered many type of chemical compounds. On *C. sumatrana*'s and *Ct. Contradens* meat was not detect Organochlorine Pesticides but found 2 group of toxit chemical compounds, that is Benzene and Chlorine. *C. sumatrana*'s meat was found 13 toxic chemical compounds, and on *C. Contradens's* meat was found 31 toxic chemical compounds.

Table 1. Toxic chemical compound to accumulated of *Corbicula sumatrana's* meat on Muara Sungai Sumani District (location I)

No	Retention time (minute)	Chemical Compound
1.	4.977	*Benzene acid* (CAS) *phenylacetic acid*
2.	5.783	*Benzene acetamimide* (CAS) 2- *phenylacetamide*
3.	11.161	*Benzeneethanol, alpha-ethyl-* (CAS) 2- *Butanol, 1-phenyl*
4.	15.060	*Hetacosane, 1-chloro-*
5.	16.728	*1,2- Benzenedicarboboxylic acid, dioctil ester* (CA S) *dioctyl phthalate*

Table 3. Toxic chemical compound to accumulated of *Corbicula sumatrana's* meat on area Tikalak district (location II)

No	Retention time (Minute)	Chemical compound
1.	3.127	*Benzene 1,3,5 trymethyl-CAS 1,3,5 trimethyl benzene*
2.	3.364	*1'-Cyano-1'- Peracetoxyethylbenzene*
3.	4.972	*Benzeneacetic* acid (CAS) *phenylacetic acid*
4.	5.725	*5-bromo-5 Chloro-4-0xopent-2-enoat*
5.	5.725	*2-Chloro-1,1-difluoro-1 tridecen-3-ol $$*
6.	5.775	*Benzene (8-bromooctyl)-CAS (8-bromooctyl) benzene $$*
7.	11.181	*Benzene etanol, alpha-ethyl* (CAS) *butanol, 1 phenyl*
8.	16.744	*1,2 – Benzenedicarboxylic acid, dioctyl ester (CAS) dioctyl phthalate*

From the research that has been done in Table 1 and Table 2, the results of the analysis by gas chromatography that is, not detected pesticide compounds in the form of organochlorine compounds in the samples. But in the two samples found some toxic compounds that are thought to be a derivative of the pesticide compounds. Although theoretically difficult to prove. However, it can be seen with the presence of Benzene and Chlorine groups that still binds to several types of compounds that have been adapted to the standard of organochlorine pesticides. This compound is thought to be derived from pesticides. Compounds found to bind to different compounds.

Table 3. Toxic chemical compound to accumulated of *Ct.contradens's* meat on area Muara Sungai Sumani district (location I)

No	Retention Time	Chemical compound
1.	2.869	*Benzene,1-ethyl-2-methyl-(CAS)-ethyltoluene*
2.	2.924	*Benzene,1,2,4-trimethyl-(CAS) 1,2,4- trimethylbenzene*
3.	3.017	*Benzene,1-ethyl-4-methyl-(CAS) p-ethyltoluene*
4.	3.135	*Benzene,1,2,3-trimethyl-(CAS) 1,2,3- trimethylbenzene*
5.	3.370	*Benzene,1,3,5-trimethyl-(CAS) 1,3,5- trimethylbenzene*
6.	3.983	*Benzeethanol (cas) phenethyl alcohol*
7.	4.995	*Benzeneacetic acid (*CAS)*phenylacetic acid*
8.	5.728	*Ethyl (e)-5-bromo-5-chloro-4-oxopent-2-enoate*
9.	9.983	*Chloromethyl 6-chloroundecanoate*
10.	16.773	*1,2 benzenedicarboxylic acid, bia(2-ethylhexyl) ester (CAS)Bis (2-ethylhexy)*
11	12.183	*Rhodium, bis [5,6-bis(.eta 2-ethenyl) cycloctene] di-mu-chlorodi-, stereoisomer (CAS)*
12.	12.183	*Rhodium, mue-dichloro-di-(*CIS-*5,6-divinylcycloocten)-bis-$$*
13.	14.158	*Rhodium,[1,2-bis(.eta.2-ethenyl)-4ethenylcyclo hexane]di-.mu.-chloro-(*CAS*) rhodium,mue-dichloro-di-(-1,2,4trivincyc.*
14.	12.183	*Rhodium,[1,2-bis(.eta.2-ethenyl)-4 ethenylcyclohexane]-.mu.-chlorodi-(*CAS*)rhodium,*MUE*-dichloro-di-(1,2,4 trivinylcyc*
15	13.033	*Iron, tricarbonyl [N-9phenyl-2-pyridinylmethylne) benzene-N-N']-$$ IRON, tricarbonyl [N-9phenyl-2-pyridinylmethyle*

Table 4. Toxic chemical compound to accumulated of *Ct. contradens's* meat on area Tikalak district (location II)

No	Retention time	Chemical compound
1.	2.921	*Benzene, 1,2,4-trimethyl-(CAS) 1,2,4- rimethylbenzene*
2.	3.008	*Benzene, 1-ethyl-4-methyl- (CAS) p-ethyltoluene*
3.	3.132	*Benzene, 1,3,5-trimethyl- (CAS) 1,3,5-trimethylbenzene*
4.	5.729	*Ethyl (E)-5-dichloro-4-oxopent-2-enoate*
5.	9.267	*2-carcobenzyloxy-1-tert-butylhydrazinecarbonyl chloride*
6	9.986	*1,2-benzenedicarboxylic acid, diundecyl ester (CAS) DUP*
7.	9.267	*Benxyl prop-1-enyl ether benzene, [(1-propenyloxy)methyl1-(CAS)ether, benzyl propenyl (CAS) benzyl propenyl ether*
8.	12.192	*rhodium, bis [5,6-bis(.eta.2-ethenyl)cyclooctene]di- mu.-chlorodi-,stereoisomer*
9.	16.579	*1,2-benzenedicarboxylic acid, bis (2-ethylhexyl) ester (CAS) bis(2-ethylhexyl)*
10.	12.183	*rhodium,bis[5,6-bis(.eta.2 ethenyl)cyclooctene]di-mu.-chlorodi-,stereoisomer* (CAS),
11.	12.183	*Rhodium,Mue-Dichloro-Di-(Cis-5,6-Divinylcycoocten)-Bis-$$*
12.	12.183	*rhodium,1,2-bis(.eta.2-ethenyl)-4-ethenylcyclo hexane] di-.mu.-chlorodi-*(CAS) rhodium, mue-dichloro-di- (1,2,4-Trivinylcyc
13.	5.733	*Ethyl (E)-5,5-Dichloro-4-oxopent-2-enoate $$,*
14.	5.733	*Ehtyl (E)-bromo-5-chloro-4-oxopent-2-enoate $$.*
15.	16.692	*rhodium,[1,2-bis(.eta.2-ethenyl)-4-ethenylcyclohexane]di-.mu.-chlorodi-(cas)rhodium, mue-dichloro-di-(1,2,4-trivinylcyc*
16.	3.950	*Cyclohexanemethyl dichloroacetate $$*

Based on Table 3 and 4, as shown as toxic compounds in mussel meat meal Contradens contradens. In contrast to that found in shellfish meat C. sumatrana, the mussel meat Ct, contadens found 31 species toksit compound where at Muara Sungai Batang Lembang found 15 compounds and in the area tikalak 16 types of toxic compounds from the group of benzene and chlorine.

Based on his research results Butler (1973)(8) found 15 organochlorine compounds in *Corbicula fluminea* shells were located in the estuary area. The highest and the dominant organochlorine compounds is DDT and Dieldrin group.Based on analysis of accumulated pesticides on aquatic biota can be seen prohibited pesticides especially DDT compounds still used. Organochlorine insecticides are generally used in Indonesia since the early 1950s to control pests/insects in agriculture. Since late 1990, all organochlorine insecticides have been banned in Indonesia because it's toxic, bioaccumulative, and persistens in the environment. However, because cheap price, easy to use, and eradicate the pest effectively, some organochlorine insecticides are still used in Indonesia. Pesticide used continuesly has cause many disasters and tragedies of human living such as death of hundred fishes in the Mississippi river which flowing through Belgium and the Netherlands or death of thousand people per year in Sri Lanka as well as the incidence of various diseases in the Philippines. Vicious chain of pesticide used will certainly take victims. Evil chain was likely to start from the water because water is a vital ingredient for humans. Evil chain was seen in the table below.

Table 2. Pesticide Compound on several water organism

No.	Organisms	Pesticide Contain
1.	Plankton	0.04 ppm
2.	Water plants	0.08 ppm
3.	Shellfishes	0.42 ppm
4.	Fishes	1.28 ppm
5.	Aquatic birds	3.51 ppm
6.	Human	12 ppm

This vicious chain is just one example of the damage that caused by pesticide pollution, flow velocity and displacement landfill pesticides, both in the water, plants, fish and breast milk. Butler (1966)(8) reported that DDT in 10 days could reach levels 25.000 times higher in biota body than in sea water levels. Meanwhile, according to Berg *et al* (1992)(9) accumulation of DDT occurred in the food chain. In fish (*Tilapia rendalli*) accumulated DDT 1900 ng/g, further predatory fish (*Hydrocynus forskahli*) accumulated DDT 5000 ng/g. shellfish that live on the water bottom and tend to settle (*Corbicula africana*) DDT accumulate as much as 10 100 ng/g and fish *Labeo altivelis* accumulated DDT. DDT as much as 5700 ng/g .

CONCLUSION

The research has been conducted of the obtained results that is discovered many type of chemical compounds . On *C. sumatrana*'s meat was found 13 toxic chemical compounds, and on *C. contradens*'s meat was found 31 toxit chemical compounds.

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