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PRELIMINARY STUDIES ON THE EFFECT OF ENVIRONMENTAL ASPECTS ON COCKLES QUALITY IN CILAMAYA WATERS, SUBANG, WEST–JAWA

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ABSTRACT : **To investigate environmental quality of Cilamaya waters and its effect on the cockles, a preliminary study was carried out.**

Results showed that mercury content of sea water was not detected, although the mercury content of sediment was in the range of 0.120–0.127 ppm. The highest mercury contents of cockles ("kerang tahu") was 0.264 ppm, much less than the MTC of WHO of 0.5 ppm, indicating that waters area has not been polluted by the heavy metal yet.

Blood cockles had the highest total bacterial count and *Staphylococcus* count, i.e. (100–800) x 10^5 and (160–180) x 10^3 respectively. All cockles, sea water and sediment had a high content of coliform, however *E. coli* test was negative.

INTRODUCTION

Cockles has a good prospect to be an Indonesia devisa source in the future. Fishery Statistic of Indonesia showed that the blood cockle productions were 40,980 tons in 1978, 32,183 tons in 1979, 32,399 tons in 1980 and 37,400 tons in 1981 in spite of the fact that cockle and mollusc imports were 52 tons in 1980, 188 tons in 1981 and 50 tons in 1982 (Anonimous, 1984).

The environment condition, where the cockles life, determines greatly the cockles quality. The good quality of environment may result a good quality of product, on the other hand the environment which has been contaminated by pollutants, may produce poor quality of cockles. The integrated research of both environmental aspects and cockles is neceesary to do.

In consumption of cockles one must aware of its safety, cockles with high content of mercury must be rejected for daily intake, because it can cause mercury poisoning ("Minamata disease" in Japan). The FDA of United State and Indonesian Department of Health confirmed that the mercury allowable limit was 0.5 ppm for foods, while some other countries have difference in mercury standard limit. According to Connell (1975) in between 1953 and 1961 a minamata disease had been being a mysterious disease affecting the central nervous system occured in persons living in the region of Minamata Bay, Japan. This was ultimately shown to be caused by eating marine fish contaminated with high concentration of mercury.

Some institutes have established standards of heavy metal concentration of environment, as shown in table 1.

The standard of heavy metal maximum concentration or other parameters is as a guide on determination of the environment quality and pollution level.

This research tried to investigate the relationship between the environment quality and cockles quality. The research was carried out in March, 1985.

Table 1. Standard of Heavy Metal Concentration in Water

Kind of heavy metal	name of institute		
	EPA*)	FWPCA**)	NASE***)
Hg (ppm)	0.1	0.03	0.1
Cd (ppm)	10.0	–	0.2
Pb (ppm)	20.0	0.03	10.0
Ni (ppm)	7.0	–	2.0
Zn (ppm)	10.0	–	20.0
Cu (ppm)	–	30.0	–

Source: Anonymous (1981)

Note: *) EPA : Environmental Protection Agency, 1973
**) FWPCA : Federal Water Pollution Control Administration, 1968
***) NASE : National Academic of Science and Engineering, 1973

MATERIAL AND METHODS

Materials

Cockles sampled in this study were blood cockles *(Anadara granosa),* "kerang gundul" *(Anadara nodifera),* and "kerang tahu", they were obtained from Cilamaya waters, Subang, West Jawa. Sediment and water in which the cockles live were analized, where cockles live there.

Methods

Life cockles were brought to RIFT laboratory (Jakarta) in plastic baskets. Sediment and water samples were taken by placing closed botles.

Analysis Parameters

A. Chemical analysis:

- Determination of Mercury (Hg)
  Mercury (Hg) content of the samples was determined by cold vapor system using atomic absorption spectrophotometer as suggested by Whiteside (1979)
- Moisture Content
  Moisture content was determined according to the method of AOAC (1980)

B. Microbiological Analysis:

- Total Plate Count
  Total Plate Count was determined by pour plate method.
- *Staphylococcus sp.*
  Staphylococcus sp. count was determined using Baird Parker agar
- Coliform and **E. coli**
  Method of Quadri *et al* (1974) as cited in Sumner (1981) was applied to determine coliform and *E. coli.*

RESULTS AND DISCUSSION

A. Quality of Sea Water and Sediment

Table 1. Showed the results of mercury analysis of sea water and sediment.

Table 1. Chemical Analysis of Water and Sediment

Kind of Sample	Moisture (%)	Mercury (ppm)
Water :		
W I	–	n.d.*)
W II	–	n.d.*)
Sediment :		
S I	82.50	0.120
S II	85.76	0.127

Note: W I : water taken from the living area of Blood cockles
W II : water taken from the living area of "kerang tahu" and "kerang gundul"
S I : sediment taken from the living area of blood cockles
S II : sediment taken from the living area of "kerang tahu" and "kerang gundul"
n.d.*) = not detected

Mercury content of sea water was not detected, however the mercury content of sediment was in the range of 0.120–0.127 ppm. Keckes and Miettinent (1972) stated that due to great affinity of mercury and organomercurial to SH group and the common occurence of traces of proteinous materials in natural waters, it can be assumed that mercury in natural water is usually bound to a matrix like suspended matter, planklon, higher organisms or bottom material. It can be concluded that sea water of Cilamaya waters had a low content of material containing SH group. Whereas the volatile characteristic of mercury from the survace of sea water must be considered (Keckes and Miettinen, 1972). The Standard of mercury content of sea water for living of marine organism and marine culture were 0.006 ppm and 0.003 ppm respectively (Anonimous, 1984). With regard of mercury content, the Cilamaya waters was good quality or not polluted by mercury. The mercury compund, however, was found in sediment, and that indication informed that sediment only contained a high enough of materials cointaining SH group.

Table 2. Microbiological Analysis of Water and Sediment

Kind of sample	TPC ($\times 10^4$)	*Staph* ($\times 10^3$)	Coliform (MPN)	*E. coli* (MPN)
Water:				
W I	57 – 800	1.6 – 110	>2400	neg*)
W II	4 – 930	0.7 – 140	>2400	neg*) – 14
Sediment:				
S I	600 – 1400	98 – 320	>2400	neg*)
S II	120 – 1200	130 – 150	>2400	0 – 11

Note : neg*) = negative

Total bacterial count of sea water and sediment were in the range of $(4–930)x10^4$ and $(6–14)x10^6$ respectively. While *Staphilococcus* found at sea water was about $(0.7–140)x10^3$, and *Staphilococcus* is known as pathogenic bacteria for human.

Coliform of sea water and sediment were more than 2400 MPN, however *E. coli* of sea water and sediment were in the range of negative to 14 MPN and negative to 11 MPN respectively. Standard of *E. coli* which has been established by the Ministry of State of Population and Environment was less than 1000/100gr. If compared to that standart, it can be concluded that Cilamaya waters has not been polluted by faecal contamination yet.

B. Quality of Cockles

Cockles living at the bottom of the waters area, have possibility to contact with the sediment having more potential as pollutant agents than sea water, and this fact determined cockles quality harvested from that waters.

The result showed that the mercury content of blood cockles, "kerang tahu" and "kerang gundul" were 0,222 ppm, 0,264 ppm and 0,235 ppm repectively. If those data were related to the sediment condition, it could be predicted that the mercury compound which was found in cockles was from sediment. The highest mercury content of cockles was 0,264 ppm ("kerang tahu") which is still below MTC (Maximum Tolarable Concentration) of WHO for fish and fishery product (0,5 ppm).

Table 3. Chemical Analysis of Cockles

Sample	Moisture (%)	Mercury (ppm)
Blood cockles	81.02	0.222
"Kerang tahu"	80.00	0.264
"Kerang gundul"	80.23	0.235

Table 4. Microbiological Analysis of Cockles

Sample	TPC ($x 10^5$)	*Staph* ($x 10^3$)	Coliform (MPN)	*E. coli* (MPN)
Blood cockles	100–800	160–180	>2400	neg.*)
"Kerang tahu"	4.1–4.2	9.1–190	>2400	neg.*)
"Kerang gundul"	3.9–760	79–160	>2400	neg.*)

Note : neg.*) = negative

The mercury compound presents in the marine organisms through 3 ways, i.e. feeding circle, gills and diffusion through the surface of skin (Mandelli, 1974 *in* Hutagalung, 1985). However feeding circle is as the main role on the mercury content of organism (Waldichuk, 1974 *in* Hutagalung, 1985).

The total bacterial count of Blood cockles and "kerang gundul" were $(100–800)x10^5$ and $(3.9–760)x10^5$ respectively, and those values were higher than the ICMSF standard of the total bacterial count for fresh fish and fisheries products, i.e. 10^6/gram (Sumner, 1981). "Kerang tahu", however, had a low value of bacterial count, i.e. $(4.1–4.2)x10^5$. According to Colwell and Liston

(1961) and Eliot (1926) in Thayib *et al* (1977) that the cleanliness of cockless is determined not only by environmental aspects but also the freshness of samples. The cockles which has been contaminated by pathogenic bacteria, can release contaminant during several days, if those cockles put in clean water.

All cockles had higher *Staphylococcus* count than its standard of in the range of $10^2 - 10^3$/ gram, however those cockles were still safe to consume, because *Staphylococcus* poisoning can happen in food having a *Staphylococcus* count in excess of 10^6/gram (Sumner, 1981).

All cockles freed from *Escherichia coli,* although blood cockles, "kerang tahu" and "kerang gundul" had high value of coliform (>2400 MPN). This fact confirmed with the condition of environment. In general, coliform bacteria indicates sewage contamination on environment or organism.

CONCLUSION

It is concluded that the cockles caught from Cilamaya waters, Subang, West–Jawa, meet the WHO standard for mercury content of fishery products. The products also meet the microbiological specifications, including total bacterial count, *Staphylococcus* and *E. coli,* except the bacterial count of blood cockles and "kerang gundul".

It also appears that in general the sea water of Cilamaya waters has not been chemically and microbiologically polluted yet.

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