ATLANTIS PRESS
Advances in Social Science, Education and Humanities Research (ASSEHR), volume 149
2nd International Conference on Education, Science, and Technology (ICEST 2017)

Analysis of Heavy Metal Content of Lead (Pb) from Animal Product in Cattle Grazing in Landfill

Sartika Juwita
Sekolah Tinggi Penyuluhan Pertanian
Gowa, Indonesia
tika_drh@yahoo.co.id

Purwanta
Sekolah Tinggi Penyuluhan Pertanian
Gowa, Indonesia

***Abstract*—The contamination of farm products by heavy metals can cause a health hazard for humans. The purpose of this study is to identify and to determine the amount of heavy metals content of lead (Pb) from the animal product (meat, liver, and skin) in cattle that grazing in the landfill of Tamangapa of Makassar City based on the standard of Indonesian National Standard number 7387: 2009. The analysis used atomic absorption spectrophotometer (AAS). The result of the study showed that 24 samples contained heavy metals of lead (Pb) which two samples from meat, five samples from liver, and three samples from skin showed the level of heavy metals of lead (Pb) exceeded standard quality based on Indonesian National Standard number 7387: 2009 which about 1.0 ppm. The result of Analysis showed respectively 2.801 ppm and 1.880 ppm for meat samples, 1.970 ppm, 1.102 ppm, 1.768 ppm, 1.435 ppm, and 1.622 ppm for liver samples, 1.648 ppm, 1.318 ppm, and 1.209 ppm for skin samples.**

Keywords—cattle; animal product; lead (Pb); landfill

I. INTRODUCTION

Animal products in the provision of health must observe the principles of safe, healthy, whole and halal. Safe means that animal products do not contain the dangers of biological, chemical, and physical or material that could disturb human health. Healthy means that animal products must contain ingredients that are advantageous for people's health. Whole means that animal product is not reduced or mixed with other materials. While halal means that the supply of animal products must be by the Islam rule [1].

Meat is one of animal product which has a high nutritional value for humans. Moreover, meat is also a perishable food and potentially hazardous food. Consequently, the application of animal health and food safety from the farm until ready consumed is critical [2].

Contamination of agricultural products by heavy metals can cause a health hazard to humans. The effects of disruption of heavy metals on human health depend on which parts of the heavy metals are bound in the body and volume of exposure dose. Exposure of heavy metals does not give direct effect in the short term to human health, but health problems will occur in the long run due to the heavy metals accumulate in body tissues. Some of the health problems in humans as a result of the heavy metals are anemia, a disorder in various organs include tissue damage, nervous system, kidneys, liver, heart and brain, paralysis, stunted growth, kidney damage, bone loss, DNA damage, cause cancer as well as decreased intelligence. Children are the main groups that are vulnerable to heavy metal poisoning in food. Mercury, copper, arsenic, fluoride, cadmium, lead, cyanide, nitrite and antimony are some examples of heavy metals that are dangerous to the human body. Respectively toxicity of heavy metals from the highest to the lowest is Hg2+ > Cd2+ > Ag2+ > Ni2+ > Pb2+ > As2+ > Zn2+ [3], [4].

The case was quite famous as a result of heavy metal toxicity was mercury poisoning have occurred in the bay of Minamata Japan (1953-1960) that causing casualties to 2,265 victims recognized by the international community in 2001 (1,784 of whom have died). Poisoning in the area, particularly due to the consumption of mercury-contaminated fish or eating grain treated with mercury. The case in Indonesia, especially in Buyat Bay, causing casualties over a hundred people suffer disabilities such as in the case of Minamata, even some die [3], [5].

Food safety issues from the source of the animal product in Makassar city is the number of cattle grazing in Landfill that suspected meat contaminated with heavy metals from consumed materials. The landfill is often used by the community as the location of husbandry because the waste can be utilized as a source of animal feed. People thought arise to keep cattle in a landfill environment because considering that organic waste still has high enough nutritional value so that it can be used as animal feed. Cattle who consume garbage from the landfill have an increased risk of exposure of toxic. One of the potentially toxic materials into the risk factors is heavy metal. On the other hand, landfill as garbage is a potential source of food for cattle. Makassar city in the last two years based on the data increased the waste volume of 4,000 m3 / day or 500-550 ton/day in 2003 to 800 ton/day in 2014 [6].

II. RESEARCH METHOD

The type of this study is an observational study. 24 samples were taken from a slaughterhouse of Makassar city which the selected sample of cattle that grazing in the landfill of Tamangapa of Makassar city. 24 samples are consisting of eight samples of meat, eight samples of liver and eight samples of skin. The sample size for meat and skin were each with a sample weight of 0.5 kg/sample. Samples were taken from the liver by weight consists of 0.4 kg/sample. Testing of heavy metals content of lead (Pb) was conducted in the

Laboratory of Productivity and Quality Water, Faculty of Marine Sciences and Fisheries of Hasanuddin University.

Procedure; 0.5-gram sample < 0.5 mm was weighed into digestion tube. Next, add 5 ml HNO3 p.a and 0.5 HClO4 p.a and leave one night. The next day, be heated in a digestion block with a temperature of 100 ° C for 1 hour. Then, the temperature was increased to 150oC. After the yellow steam was exhausted, digestion block temperature was increased to 200oC. Destruction was completed after the white vapor come out and extract residual approximately 0.5 ml. Then, tube removed and allowed to cool. The extract was diluted with deionized water to a volume of exactly 50 ml and shook with tube shaker until homogeneous. This extract can be used for the measurement of macro elements: P, K, Ca, Mg, Na, S and microelements: Fe, Al, Mn, Cu, Zn, Pb, Cd, Ni, Co, and Cr. Finally, lead (Pb) was measured directly from the extracted sample using atomic absorption spectrophotometer (AAS) with each standard series as a comparison.

III. Results and Discussion

Heavy metal content of lead (Pb) in samples of meat, liver, and skin were taken from a slaughterhouse of Makassar city are shown in Table 1,2, and 3.

TABLE I. The Results of Analysis of Meat Samples

No	Sample code	Parameter
		Lead-Pb (ppm)
1	18.09.2015	0,728
2	6.10.2015	0.987
3	7.10.2015	2.801
4	7.10.2015	0.695
5	18.10.2015	0.903
6	08.10.2015	0.583
7	08.10.2015	0.605
8	19.10.2015	1.880

TABLE II. The results of Analysis of Liver Samples

No	Sample code	Parameter
		Lead-Pb (ppm)
1	18.09.2015	1.970
2	6.10.2015	1.102
3	7.10.2015	1.768
4	7.10.2015	0.188
5	18.10.2015	1.435
6	08.10.2015	0.748
7	08.10.2015	1.622
8	19.10.2015	0.597

Table 1 shows that eight samples contained level of heavy metals of lead (Pb), where two samples of meat exceeded standard quality based on Indonesian National Standard number 7387: 2009 which about 1.0 ppm [7]. Data shows from meat samples are sample number 3 and eight respectively 2.801 ppm and 1.880 ppm. Whereas, Table 2 shows that eight samples contained a level of heavy metals of lead (Pb), where five samples of liver exceeded standard quality based on Indonesian National Standard number 7387: 2009 which about 1.0 ppm [7]. Data shows from liver samples are sample number 1, 2, 3, 5 and seven respectively 1.970 ppm, 1.102 ppm, 1.768 ppm, 1.435 ppm, and 1.622 ppm. Moreover, Table 3 shows that eight samples contained a level of heavy metals of lead (Pb), where three samples of skin exceeded standard quality based on Indonesian National Standard number 7387:2009 which about 1.0 ppm [7]. Data shows from skin samples are sample number 2, 6 and eight respectively 1.648 ppm, 1.318 ppm, and 1.209 ppm.

TABLE III. The Results of Analysis of Skin Samples

No	Sample code	Parameter
		Lead-Pb (ppm)
1	18.09.2015	0.320
2	6.10.2015	1.648
3	7.10.2015	0.911
4	7.10.2015	0,112
5	18.10.2015	1.069
6	08.10.2015	1.318
7	08.10.2015	0.695
8	19.10.2015	1.209

Results of research conducted by Khalafalla et al. showed that meat contains heavy metals (Zinc and Cadmium) from cattle that grazing in Jatiberang and Campo landfill as well as outside landfill that exceeded the limit according to the Directorate General of Food and Drug Administration [4]. While, the levels of heavy metals Pb, Cu, Hg, Co, and As in meat from cattle that grazing in the landfill and outside the landfill either in the city of Semarang, Surakarta and Sragen still below the standard of Food and Drug Administration of Indonesia.

Heavy metal residues of lead (Pb) are more common in liver samples for liver-related function as an organ of detoxification. The liver is an organ most widely accumulates toxic substances and plays an important role in the metabolism and transformation of pollutants from the environment [8]. Moreover, it is an organ that contains a great amount of metallothionein protein which can bind heavy metals, so it is very susceptible to toxic effects [9], [10]. The process of detoxification of heavy metals of lead (Pb) in the liver is through a metal bonding process (metallothionein) in tissue. The ability of detoxification by the liver is relatively limited, so that the excessive heavy metals in the body will be distributed to all body tissues of cattle through the blood vessels. If liver has a lower ability to detoxify heavy metals, as a consequence more heavy metals of lead (Pb) will be distributed in other tissues such as meat and skin.

Cattle that eat garbage and contaminated with toxic materials of lead (Pb) will accumulate lead (Pb) in their body. If cattle are used as a source of human food, then humans who consume cattle would also likely accumulate lead (Pb). Eventually, humans will experience health problems [11].

IV. Conclusion

Animal product (meat, liver and skin) from cattle that grazing in landfill of Makassar City containing contamination of heavy metal of Lead (Pb), which two samples from meat, five samples from liver, and three samples from skin showed

level of heavy metals of lead (Pb) exceeded standard quality based on Indonesian National Standard number 7387:2009.

REFERENCES

[1] A. M. Thomson and M. Metz, *Implications of economic policy for food security: A training manual*. Food & Agriculture Org., 1999.

[2] F. Toldrá, *Handbook of meat processing*. John Wiley & Sons, 2010.

[3] L. Järup, "Hazards of heavy metal contamination," *Br. Med. Bull.*, vol. 68, no. 1, pp. 167–182, 2003.

[4] F. A. Khalafalla, F. H. Ali, F. Schwagele, and M. A. Abd-El-Wahab, "Heavy metal residues in beef carcasses in Beni-Suef abattoir, Egypt," *Vet. Ital.*, vol. 47, no. 3, pp. 351–361, 2011.

[5] L. M. L. Nollet and F. Toldrá, *Handbook of analysis of edible animal by-products*. CRC Press, 2011.

[6] W. Hyde, "Garbage classification system." Google Patents, Jul-1973.

[7] S. N. Indonesia, "Batas maksimum cemaran logam berat dalam pangan," *Badan Standar Nasional, Jakarta*, 2009.

[8] P. B. Tchounwou, C. G. Yedjou, A. K. Patlolla, and D. J. Sutton, "Heavy metal toxicity and the environment," in *Molecular, clinical and environmental toxicology*, Springer, 2012, pp. 133–164.

[9] S. Sadjirun, H. Rasyid, J. Mellawati, S. Yumiarti, and S. Suwirma, "Study on the heavy metal content of low land rice soil," 1996.

[10] F. X. Han, J. A. Hargreaves, W. L. Kingery, D. B. Huggett, and D. K. Schlenk, "Accumulation, distribution, and toxicity of copper in sediments of catfish ponds receiving periodic copper sulfate applications," *J. Environ. Qual.*, vol. 30, no. 3, pp. 912–919, 2001.

[11] L. R. McDowell, *Minerals in animal and human nutrition*. Academic Press Inc., 1992.