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Heavy Metal Concentration in Orchard Area, Amphawa District, Samut Songkram Province, Thailand

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Abstract**—**A study was conducted in May to July 2013 with the aim of determination of heavy metal concentration in orchard area. 60 samples were collected and analyzed for Cadmium (Cd), Copper (Cu), Lead (Pb), and Zinc (Zn) by Atomic Absorption Spectrophotometer (AAS).

The heavy metal concentrations in sediment of orchards, that use chemical for Cd (1.13 ± 0.26 mg/l), Cu (8.00 ± 1.05 mg/l), Pb (13.16 ± 2.01) and Zn (37.41 ± 3.20 mg/l). The heavy metal concentrations in sediment of the orchards, that do not use chemical for Cd (1.28 ± 0.50 mg/l), Cu (7.60 ± 1.20 mg/l), Pb (29.87 ± 4.88) and Zn (21.79 ± 2.98 mg/l). Statistical analysis between heavy metal in sediment from the orchard, that use chemical and the orchard, that not use chemical were difference statistic significant of 0.5 level of significant for Cd and Pb while no statistically difference for Cu and Zn.

Keywords**—**Heavy metal, Orchard, Pollution and monitoring, Sediment.

I. Introduction

SAMUT Songkram province was a small province located at central of Thailand near the mouth of the Mae Klong river, 80 kilometers west of Bangok [1]. The strategic development of this province has been dedicated to ecotourism and hospital [2].

As a result of SWOT analysis, the strengths of the province include magnificent natural resources and environment, stock of marine and agricultural products, high quality of human resources and local lifestyle conservation. The weakness of province includes degradation of natural resources and environment, the water pollution from neighborhood and improper water resources management [3].

The Mae Klong River, in Samut Songkhram Province, is a river that runs through three provinces in west Thailand and flows into the Gulf of Thailand and its total length is 140 km. The upper stream is mainly an agricultural area. The Mae Klong River supplies water for irrigation and supports water for aquaculture, i.e., shrimp farms and fish ponds and agriculture, i.e., paddy fields and fruit orchards.

These activities required the use of water and released waste water into the environment making the water source contaminated with all toxic substances including heavy metals.

Sediment is well known as a sink for contaminants such as heavy metal. During the sedimentation process, suspended particulate matter acts as a scavenger of dissolved elements, resulting in the removal of discharged contaminants. Although, these adsorbed particulate matter will be trapped in the bottom sediment [4]. Heavy metals such as cadmium, mercury, lead, copper and zinc are regarded serious pollutants of aquatic ecosystems because of their environmental persistence, toxicity and ability to be incorporated into food chains.

Heavy metal can accumulate in the food chain and persist in nature. The accumulation of heavy metal contaminants in the environment has become a concern due to growing health risks to the public. Because of exposure to heavy metal contamination has been found to cause kidney damage, liver damage, carcinogenic and etc. For example, at Mae Sot District, Tak Province, the paddy fields (in the Mae Tao and Mae Ku areas) were found to contain markedly elevated cadmium levels during the surveys in 2001-2004 [5].

Each area of the Samut Songkram province is connected by canals. The residents are mainly living by agriculture such as coconut plantation. Use of chemical substances in the agricultural activities can be commonly seen throughout the province. This relatively causes contamination of chemical substances in soil and water sources [6].

Surface water quality in the Amphawa district was found high levels of Pb, Cu, Cd and Zn concentration [7].

The aim of this study to determination of heavy metal (Pb, Cu, Cd, and Zn) concentration in orchard area (that use and not use chemical in process) in the Bang-nanglee Sub-District, Amphawa district, Samut Songkhram Province.

II. Materials and Methods

A. Study Area

The Bang - nanglee Sub-District Administrative Office is situated in central Thailand (Fig. 1). There were 5.58 km^2 of low-plain land with rivers and canals located about. Its population was 3,712 peoples of 850 households. Most people committed to agricultural profession, such as cultivating lychee (Fig. 2), pomelo (Fig. 3) and coconut (Fig. 4). [8]

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Fig. 1 Map of Thailand [1]

Fig. 2 The lychee orchard

Fig. 3 The pomelo orchard

Fig. 4 The coconut orchard

B. Methodology

60 Sediments sample were collected from 60 orchards. These samples were carried by polythene bag. After collection, some portion of sediment samples was dried in air at 30ºC. For heavy metal test, 5 gm of dried sample was digested with nitric acid and prepared 100 ml solution. Finally, four heavy metals (Pb, Cd, Cu, and Zn) concentration were determined by atomic absorption spectrophotometer (AAS), (Fig. 5).

Fig. 5 Atomic Absorption Spectrophotometer Instrument (THERMO series) [9]

C. Standard and Reagent

The primary standards for AAS were obtained from high purity metals or salts dissolved in high purity acids.

III. Result and Discussion

A. Heavy Metal Concentrations

The heavy metal concentrations (Cd, Cu, Pb and Zn) in sediment from the orchard are shown in Table I and Fig. 6.

TABLE I
THE HEAVY CONCENTRATION IN SEDIMENT

Heavy metal	Concentration in sediment orchard (mg/kg)	
	Use chemical	Do not use chemical
Cd	0.68 – 2.53 (1.28 ±0.50)	0.78 – 1.93 (1.13 ±0.26)
Cu	5.71 – 10.61 (7.60 ±1.20)	6.0 – 10.13 (8.00 ± 1.05)
Pb	19.85 – 41.26 (29.87 ±64.44)	10.25 – 18.30 (13.16 ± 2.01)
Zn	17.30 – 30.08 (21.97 ± 2.98)	31.87 – 44.58 (37.41 ± 3.20)

Range of Cd concentration in sediment from the orchard, that use chemical, and the orchard, that not use chemical, was 0.78 – 1.93 mg/kg (average 1.13 ± 0.26 mg/kg) and 0.68 – 2.53 mg/kg (average 1.28 ± 0.50 mg/kg) respectively.

Range of Cu concentration was 6.0 – 10.13 mg/kg (average 8.00 ± 1.05mg/kg) and 5.71 – 10.61 mg/kg (average 7.60 ±1.20 mg/kg) respectively.

Range of Pb concentration was 10.25 – 18.30 mg/kg (average 13.16 ± 2.01 mg/kg) and 19.85 – 41.26 mg/kg (average 29.87 ± 64.44 mg/kg) respectively. The lead (Pb) come from the chemical fertilizer in agricultural process.

Range of Zn concentration was 17.30 – 30.08 mg/kg (average 21.97 ± 2.98mg/kg) and 31.87 – 44.58 mg/kg (average 37.41 ± 3.20mg/kg) respectively. Zinc concentration

was high concentrate because the agricultural processes use of zinc for acceleration produce of lychee and pomelo.

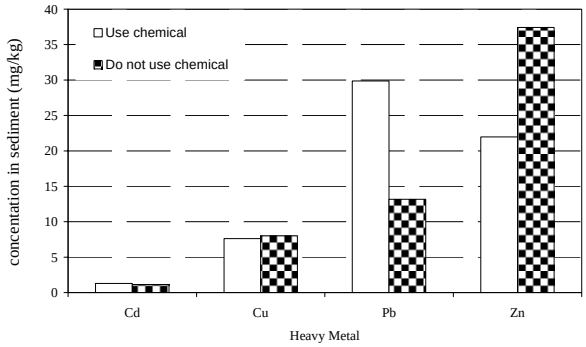

Fig. 6 The heavy metal concentration in the orchard sediment

IV. Conclusion

The heavy metal concentrations in sediment of orchards, that use chemical for Cd (1.13 ± 0.26 mg/l), Cu (8.00 ± 1.05 mg/l), Pb (13.16 ± 2.01) and Zn (37.41 ± 3.20 mg/l). The heavy metal concentrations in sediment of the orchards, that do not use chemical for Cd (1.28 ± 0.50 mg/l), Cu (7.60 ± 1.20 mg/l), Pb (29.87 ± 4.88) and Zn (21.79 ± 2.98 mg/l). Statistical analysis between heavy metal in sediment from the orchard, that use chemical and the orchard, that not use chemical were difference statistic significant of 0.5 level of significant for Cd, and Pb; while, Cu and Zn were not statistically different.

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References

[1] Choo-In. S., Jantama. P., Taeouang. P., and Utarasakul. T. (2013) Impact of floating market activities on water quality in Amphawa floating market, Samut Songkhram Province, Thailand. In : Proceeding of ICCEE2013. International Conference on Civil and Environmental Engineering. Zurich. 14– 15 January 2013. p 611-614

[2] Utarasakul. T., Chomsopa., & W. Panrod. Sustrainable Water Mangement for Torism Accommodations in Amphawa. In : Proceeding of ICCEE2013. International Conference on Civil and Environmental Engineering.; Zurich. 14– 15 January 2013. p. 67-70

[3] Choo-In. S., Tharasawatpipat. C., Kaseamsawat. S., and Utarasakul. T (2013). Seasonal Variations in Surface Water Quality, Samut Songkram Province, Thailand. ICSWRM 2013 : International Conference on Sustainable Water Resources Management. Stockhlom. 15 – 16 July 2013. p. 1463 - 1466.

[4] Sirinawin. W., and Sompongchaiyakul. (2005). Nondetrital and total metal distributionin core sediments from the U- TapaoCanal, Songkhla, Thailand.

[5] Kingsawat. R., and Roachanakanan. (2011). Accumulationand distribution of some heavy metals in water, soil and rice fields along the Pradu and Philok canals, Samut Songkram province, Thailand. Environmental and Natural Resources J. vol 9 No 1. April 2011:38-48

[6] Paiboon Jeamponk, Tasanee Ponglaa, Patchapon Srisanguan. (2014). Sources of Water Supply and Water Quality for Local Consumption: The Case Study of Eco-Tourism Village, Suan Luang Sub- District Municipality, Ampawa District, Samut Songkram Province, Thailand. Proceeding of ICEEB 2014 : International Conference on Ecology and Environment Biology. London. 20– 21 January 2014. p 376-379.

[7] Choo-In. S., Tharasawatpipat. C., Kaseamsawat. S., and Utarasakul. T (2013). Seasonal Variations in Surface Water Quality, Samut Songkram Province, Thailand. ICSWRM 2013 : International Conference on Sustainable Water Resources Management. Stockhlom. 15 – 16 July 2013. p. 1463 - 1466.

[8] Kasemsawat.S., and Choo – In. S. (2014). Surface Water Quality in Orchard Area, Amphawa District, Samut Songkram Province, Thailand. Proceeding of ICEEB 2014 : International Conference on Ecology and Environment Biology. London. 20– 21 January 2014. p 442-445

[9] Sivapan Choo – In. (2014). Comparative Stadies on the Concentration of Some Heavy Metal in Urban Particulate Matter, Bangkok, Thailand. Proceeding of ICEEB 2014 : International Conference on Ecology and Environment Biology. London. 20– 21 January 2014. p 455-458.