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論文題目	Ecological Risk Assessment of a River on Agricultural Area in West Java Province, Indonesia and Comparison with Whole Effluent Toxicity Test (インドネシア西ジャワ地方農業地区における河川の生態リスク評価と WET 試験との比較)		

（論文内容の要旨）

This thesis comprises the ecological risk assessment in Cipeles River, West Java Province, Indonesia and its comparison to the Whole Effluent Toxicity (WET) test. The thesis was divided into 8 chapters as followed:

Chapter 1 Introduction

This chapter described the background, the objective, the study area, and the systematics of this thesis. The study area was Cipeles River, a tributary of Cimanuk River located in the agricultural area of Sumedang District, West Java Province, Indonesia.

Chapter 2 Literature review

This chapter reviewed the ecological risk assessment, Fish Embryo Toxicity (FET) test, the test that conducted in determining the toxicity level in this study, and also physicochemical toxicity such as ammonia-nitrogen and zinc to the aquatic environment. It also reviews the organophosphorus (ORP) pesticide, its occurrence in the aquatic environment, and the toxicity level in previous studies.

Chapter 3 Determination ORP Pesticides in River Water Sample using Solid Phase Extraction and Gas Chromatographic-Mass Spectrometer

This chapter discussed the problem formulation of organic compounds that might emerged in the study area. The objective was to determine the ORP concentration in water samples from several sampling locations simultaneously using the SPE coupled with GC-MS. The recovery using multiple ORP standards was within the acceptable range and the coefficient of determination R^2 of each 13 compounds >0.98-0.99. The chlorpyrifos was detected in the water sample from upstream (St.1), city area (St.4), and downstream (St.10), at 1.19, 0.49, and 0.28$\mu g.L^{-1}$, respectively. While terbufos and thiometon were detected on the St.1 sample at 0.93$\mu g.L^{-1}$ and 0.07$\mu g.L^{-1}$, respectively.

Chapter 4 Distribution, Source Identification, and Assessment of Heavy Metal Pollution in the Surface and Pore Waters of Cipeles River, West Java Province, Indonesia

This chapter focused to determine the heavy metals in surface and pore water by ICP-MS for a basic database on pollution assessment using heavy metal pollution indices (HMPI). A spatial analysis using GIS also conducted here. The dominant heavy metals, Fe and Mn, had detected as the results of runoff from the laterite and alluvial soils in the study area. The presence of other micro concentrations of heavy metals in the city center showed the anthropogenic source of non-mining activities, such as fertilizer and pesticide usage in agriculture. As a result, the heavy metal occurrence in the pore water was Mn>Fe>Ba>Co>Zn>Cu>Pb>Cr in the order of abundance, while in the surface water, *i.e.*, Fe>Mn>Zn>Ba>Cu>Pb>Co>Cr. The high concentration of zinc in St.4 and St.8 samples contributed to their high HMPI.

Chapter 5 Lethal and Sublethal Effect on Early-life Stage of Zebrafish by

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Organophosphorus Phorate Exposure

This chapter highlighted the determination of acute lethal and sublethal toxicity of ORP phorate exposure using zebrafish early-life stage toxicity test on a prolonged period. This bioassay would reduce the requirement of the sample volume, while the prolonged period 120hpf accommodates the zebrafish larvae ability to swim-up as an important stage to survive. This study revealed that increasing of phorate concentration and the exposure time (t_{exp}) significantly different from the control of lethal rate and hatching rate. The probit analysis on lethal LC_{50} resulted 4.54 $mg.L^{-1}$, while the estimation of no-effect concentration was found 7.67 $\mu g.L^{-1}$ at 30 days. The EC_{50} on hatching rate and swim-up failure was 9.75 $mg.L^{-1}$ and 2.14 $\mu g.L^{-1}$, respectively. Only t_{exp} gave a significant difference to the swim-up failure rate. So, the prolonged period 120hpf was significant to be monitored as proposed. Rely on the result of a lethal effect, even LC_{50} endpoint was higher than the fish acute toxicity, this bioassay could be used as the previous screening to fish acute toxicity to support the 3Rs principle.

Chapter 6 Whole Effluent Toxicity (WET) Test of River Water Sample using Early-life stage Zebrafish

The WET test to determine the lethal and sublethal effects on salinity variation and field water sample, which implemented the previous zebrafish early-life stage bioassay, was discussed in this chapter. Salinity treatment only had a significant effect on the lethal rate when above 0.17psu. Meanwhile, salinity treatment had no significant difference to the hatching rate and swim-up failure rate. This study also revealed that zebrafish embryo could survived on salinity as low as 0.04 psu. From the WET test, significant difference analysis showed on lethal effect from sample St.1, St.4, and St.7, while the hatching rate from sample St.4, St.5, and St.8. The swim-up failure rate was significantly different in the sample St.1, St.5, St.7.

Chapter 7 Ecological Risk Assessment (ERA) Estimation

The ERA calculation especially on detected ORP in the surface water sample was discussed in this chapter. Regarding the risk quotient (RQ) on three trophic levels of aquatic organisms, the ORPs detected in water samples put concern not only the acute lethal-sublethal effect to the local aquatic organisms that have sensitivity as early-life stage *Lepomis m.* but also the chronic effect on the lower trophic level, such as daphnids. At St.1, the RQs resulted by chlorpyrifos, *i.e.*, on daphnid (1.45) and on adult *Lepomis m.*(0.699); by terbufos, *i.e.*, on daphnid (2.33), on adult *Lepomis m.*(0.518), and on juvenile *Lepomis m.* (1.211). At St.4, the RQ by chlorpyrifos on daphnid is 0.595. The concern also addressed to St.7 because of ammonia (RQ =1.69), meanwhile to St. 4 (RQ = 2.04) and St.8 (RQ = 0.76) because of zinc.

Chapter 8 General Conclusion and Future Recommendation

This chapter summarized the conclusions of the various findings and their implications. The ERA estimation on concerning the physicochemical parameter and ORP pesticide had significant correlation with the WET test result. The recommendations for further research also discussed in this chapter.