Development of Bioindicator and Biomonitoring System for Aquatic Environmental Quality— A subtopic of Pollution on aquatic Environment (bioindicator)*

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Key words: bioindicator, biomonitoring, *Brotia costula*, aquatic pollution, river water quality.

Introduction

On the basis of long term experiments, aquatic organisms such as fish, mussels and aquatic snails are the most convenient aquatic animals used both in bioindicator and biomonitoring of pollutants such as heavy metals and pesticides in the aquatic environment. Mollusks are frequently used as environmental indicators of biological integrity because of their advantages. They are abundant in most aquatic habitats, have limited mobility and relatively long life cycle. Further more their sampling and subsequent identification are easy and inexpensive. The objectives of this project are to investigate the suitability of fresh water snail, *Brotia costula* as an indicator and biomonitoring of water quality in rivers. The pollutants in the water could cause some cardiophysiological changes and histological changes in its soft tissues such as gills, foot muscle and intestine that may lead to its mortality. It also can cause some changes in the population structure of the snail.

Fish responses to polluted river water are also indicated by histological changes of its gills, the first organ that received the assault of the pollutants. The behavioral responses by fish and snail, such as avoidance responses from the polluted water will also be used as indicator of water quality degradation. Based on this information, a pollution monitoring system is to be devised using fresh water snail, *Brotia costula* as a single species biological indicator.

Materials and Methods

Toxicity studies: *Brotia costula*, a freshwater snails, and *Oreochromis niloticus*, nile tilapia were used in the sensitivity tests. Snails collected from clean water and fish obtained from commercial hatchery were exposed to several points of Langat River that received effluents from housing, industrial and agricultural activities. Caged snails and fishes were sampled at certain interval to examine their histological changes. The mortalities were also observed and the responses were expressed as LT_{50}. Snails from clean water were also being released into pristine river to study its population establishment and development. Cardiophysiological activities of *B. costula* in polluted water were studied by using specially modified ECG and the custome made probes.

For behavioral studies, fish and snail were released into a specially designed exposure tank where clean and polluted water is allowed to flow side by side without interfering its interface. The avoidance responses by fish and snail toward the polluted water will also be analyzed.

Results and Discussion

Brotia costula was found to be sensitive to effluent from industries and agricultural activities. The LT_{50} values for this snail in Langat River ranged from 2.9 to 8.4 days depending on the type of pollutant and the volume of water in the river. Volume of water is closely associated with rainfall and the amount of water discharged from the Pang Soon dam and this determine the concentration of pollutant in the river. More experiments to evaluate its sensitivity are currently in progress. The more detailed studies of histological changes of respiratory, digestive and locomotory organs are still being analyzed. Initial results revealed that necrosis, erosion, hypertrophy and spaces in between the epithelial tissues are apparent in the snail. In clean water, *Brotia costula* produces recruits that are exceeding the number of adult breeders. This is a characteristic of a normal stable population. The progress of population establishment of *Brotia* that was transferred from Langat river to pristine water in Rasah River and the streams around UPM campus are being closely studied. All the basic information on the biology of this snail is vital if this snail would finally be chosen as an indicator species for the water quality monitoring

Conclusions

Fresh water snail, *Brotia costula* was found to be sensitive to effluent from industrial and agricultural activities. It showed great potential as biological indicator and biological monitoring of river water quality. Further studies are needed to evaluate fish as bioindicator and the biomonitoring devices for the water quality.

Benefits from the study

A simple and effective system can be developed with the use of a fresh water snail to monitor the quality of effluent discharged by industries. The same devise can also be used in monitoring the water intake in the drinking water industry.

A technically elaborate and sophisticated device (ie ECG) is helping in the development of a more of simple method in monitoring water quality; such as the biocensor, using heart activities of snail and fish of fish in detecting environmental pollutants.

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None.

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* *An update of the abstract published in UPM Research Report 1998.*

I·R·P·A INTENSIFICATION OF RESEARCH IN PRIORITY AREAS

Research funded by the Intensification of Research in Priority areas (IRPA) - Supported by IRPA RM-7 (1996-2000), Cycle 1996, Grant 08-02-04-0042.