

**Biomonitoring Aktif Ekosistem Sungai Code, Daerah Istimewah Yogyakarta:
Akumulasi Mikroplastik dan Logam Pada Kerang Kijing Taiwan *Sinanodonta
woodiana* (I. Lea, 1834), dan *Integrated Biomarker Response***

Tondy Ukasha

(22/495128/PBI/01833)

Fakultas Biologi, Universitas Gadjah Mada, Sleman, Daerah Istimewah Yogyakarta,
Indonesia

ABSTRAK

Aliran sungai yang melewati area padat pemukiman penduduk, pusat bisnis dan industri, terus menerus terancam oleh berbagai jenis pencemar, antara lain logam dan mikroplastik (MP), yang berasal dari sumber yang tersebar. Biomonitoring perlu dilakukan untuk mengevaluasi kesehatan ekosistem sungai, mengingat sungai penting secara ekologis dan bagi kehidupan manusia. Pendekatan biomonitoring melalui multimarker dapat memberikan gambaran kondisi ekosistem sungai secara komprehensif dan dapat diketahui biomarker yang sensitif dan spesifik terhadap hadirnya jenis pencemar tertentu. Penelitian ini mengevaluasi kesehatan ekosistem Sungai Code, Yogyakarta, Indonesia, melalui biomonitoring aktif dengan mentransplantasikan kerang *Sinanodonta woodiana* ke dalam karamba, pada 3 stasiun yang merepresentasikan kondisi ekosistem tercemar ringan, sedang, dan berat berdasarkan aktivitas manusia di sekitar sungai. Kerang ditransplantasikan di Sungai Code, kemudian pada hari 0, 3, 7, 14, 21, dan 28, diambil dan dibedah di laboratorium, untuk diambil insang dan mantel. Selanjutnya, pada organ tersebut dianalisis akumulasi MP dan karakteristiknya, konsentrasi Cu, aktivitas enzim superoxide dismutase (SOD), catalase (CAT), asetilkolin esterase (AChE), kandungan metallothionein (MT), dan kerusakan DNA. Evaluasi biomarker yang sensitif terhadap pencemar dilakukan dengan integrated biomarker response (IBR). Perairan Sungai Code di semua stasiun telah tercemar MP dan Cu. Peningkatan kandungan MP dan Cu dalam organ kerang tersebut merupakan fungsi waktu. Kemelimpahan MP dan konsentrasi Cu pada perairan berkorelasi positif dengan akumulasinya pada kedua organ. Paparan berbagai jenis pencemar di sungai tersebut mengarah pada peningkatan aktivitas SOD, CAT, AChE, konsentrasi MT dan terjadinya kerusakan pada DNA kerang tersebut. Hasil analisis IBR menunjukkan bahwa kerusakan DNA, aktivitas CAT, dan konsentrasi MT merupakan biomarker yang responsif terhadap pencemaran sungai.

Kata Kunci: *Sinanodonta woodiana*, Biomarker, Mikroplastik, Tembaga

**ACTIVE BIOMONITORING OF CODE RIVER ECOSYSTEM, SPECIAL
REGION OF YOGYAKARTA: ACCUMULATION OF MICROPLASTIC
AND HEAVY METALS IN THE TAIWAN MUSSEL *Sinanodonta woodiana*
(I. Lea, 1834), AND INTEGRATED BIOMARKER RESPONSE**

Tondy Ukasha

(22/495128/PBI/01833)

Faculty of Biology, Gadjah Mada University, Sleman, Special Region of Yogyakarta,
Indonesia

ABSTRACT

Streams that pass through densely populated areas, business and industrial centers, are continuously threatened by various types of pollutants, including metals and microplastics (MP), originating from dispersed sources. Biomonitoring is necessary to evaluate the health of river ecosystems, considering that rivers are important ecologically and for human life. A biomonitoring approach through multimarkers can provide a comprehensive picture of the condition of river ecosystems and can identify biomarkers that are sensitive and specific to the presence of certain types of pollutants. This study evaluates the ecosystem health of the Code Stream, Yogyakarta, Indonesia, through active biomonitoring by transplanting *Sinanodonta woodiana* mussels into cages, at 3 stations representing lightly, moderately and heavily polluted ecosystem conditions based on human activities around the river. The mussels were transplanted in the Code Stream, then on days 0, 3, 7, 14, 21, and 28, taken and dissected in the laboratory, for gills and mantle. The organs were analyzed for MP accumulation and characteristics, Cu concentration, superoxide dismutase (SOD), catalase (CAT), and acetylcholine esterase (AChE) enzyme activities, metallothionein (MT) content, and DNA damage. The evaluation of biomarkers that are sensitive to pollutants is done by integrated biomarker response (IBR). The Code Stream waters at all stations were polluted with MP and Cu. The increase of MP and Cu content in the mussel organs was a function of time. The abundance of MP and Cu concentration in the water were positively correlated with their accumulation in both organs. Exposure to various types of contaminants in the river leads to an increase in SOD, CAT, AChE activity, MT concentration and damage to the mussel DNA. The results of IBR analysis showed that DNA damage, CAT activity and MT concentration were biomarkers responsive to river pollution.

Keyword: *Sinanodonta woodiana*, Biomarker, Microplastics, Copper