KONTAMINASI MIKROPLASTIK DAN RESPONS BIOKIMIAWI IKAN NILA (*Oreochromis niloticus* (Linnaeus, 1758)) DI HILIR SUNGAI WINONGO, BANTUL, DAERAH ISTIMEWA YOGYAKARTA

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INTISARI

Pencemaran mikroplastik telah menjadi isu serius dalam ekosistem perairan karena berpotensi menyebabkan gangguan fisiologis pada organisme akuatik. Penelitian ini bertujuan mengevaluasi kontaminasi mikroplastik dan respons stres oksidatif pada ikan nila (*Oreochromis niloticus*) melalui pendekatan biomonitoring aktif di Sungai Winongo, Bantul, Daerah Istimewa Yogyakarta. Ikan dipelihara dalam keramba selama 28 hari, dengan pengambilan sampel pada hari ke-0, 3, 7, 14, 22, dan 28. Parameter yang diamati meliputi jenis dan jumlah mikroplastik dalam air (MPair) dan saluran pencernaan ikan (MPGIT), biomarker stres oksidatif di hati (SOD, CAT, H_2O_2, MDA), serta kondisi lingkungan (kecepatan arus, suhu, dan kadar oksigen terlarut/DO). Mikroplastik yang ditemukan didominasi oleh tipe fiber berwarna biru, baik di air maupun saluran pencernaan ikan. Konsentrasi MPair dan MPGIT meningkat signifikan selama masa paparan ($p < 0,05$). Aktivitas biomarker menunjukkan perubahan signifikan antar waktu, dengan pola yang mencerminkan respons fisiologis terhadap stres oksidatif. Namun, korelasi linier antara MPGIT dan biomarker teramati lemah dan tidak signifikan, baik terhadap SOD ($r = 0,268$), CAT ($r = 0,088$), H_2O_2 ($r = 0,146$), maupun MDA ($r = 0,193$). Model non-linier kuadratik menunjukkan hubungan signifikan antara MPGIT dengan SOD ($R^2 = 0,479$; $p = 0,008$) dan MDA ($R^2 = 0,382$; $p = 0,027$), dengan pola kuadratik yang mengindikasikan respons hormesis. Sebaliknya, kadar DO menunjukkan pengaruh yang lebih signifikan terhadap respons SOD dan MDA. Temuan ini menunjukkan bahwa meskipun mikroplastik terakumulasi dalam tubuh ikan, dampaknya terhadap stres oksidatif tidak selalu bersifat linier atau signifikan, serta dapat dipengaruhi oleh berbagai faktor lingkungan lainnya.

Kata kunci: mikroplastik, stres oksidatif, ikan nila, Sungai Winongo, *biomarker*.

MICROPLASTIC CONTAMINATION AND BIOCHEMICAL RESPONSES IN NILE TILAPIA (*Oreochromis niloticus* (Linnaeus, 1758)) IN THE DOWNSTREAM AREA OF THE WINONGO STREAM, BANTUL, SPECIAL REGION OF YOGYAKARTA

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ABSTRACT

Microplastic pollution has become a significant concern in aquatic ecosystems due to its potential to disrupt the physiological processes of aquatic organisms. This study aimed to evaluate microplastic contamination and oxidative stress responses in Nile tilapia (*Oreochromis niloticus*) through an active biomonitoring approach in the Winongo River, Bantul, Yogyakarta Special Region. Fish were caged for 28 days, with sampling conducted on days 0, 3, 7, 14, 22, and 28. Observed parameters included the type and abundance of microplastics in water (MPair) and the gastrointestinal tract of fish (MPGIT), as well as oxidative stress biomarkers in the liver (SOD, CAT, H_2O_2, MDA), and environmental variables (current velocity, temperature, and dissolved oxygen levels). The dominant microplastics found were blue-colored fibers, which were present in both water and the digestive tracts of fish. Both MPair and MPGIT levels increased significantly over time ($p < 0.05$). Biomarker activities also showed significant temporal variation, with patterns reflecting physiological responses to oxidative stress. However, linear correlations between MPGIT and biomarkers were weak and not statistically significant for SOD ($r = 0.268$), CAT ($r = 0.088$), H_2O_2 ($r = 0.146$), and MDA ($r = 0.193$). Only quadratic non-linear models revealed significant relationships between MPGIT and SOD ($R^2 = 0.479$; $p = 0.008$) and MDA ($R^2 = 0.382$; $p = 0.027$), suggesting a hormetic response. Conversely, dissolved oxygen levels had a more significant influence on SOD and MDA responses. These findings indicate that although microplastics accumulate in fish tissues, their impact on oxidative stress may not follow a linear or straightforward pattern and is likely influenced by multiple environmental factors.

Keywords: microplastic, oxidative stress, Nile tilapia, Winongo Stream, biomarker.