Komposisi dan kelimpahan mikroplastik pada air, sedimen, dan ikan belanak mugil cephalus (Linnaeus, 1758) di Muara Sungai Blanakan, Subang, Jawa Barat = Composition and abundance of microplastics in water, sediment, and flathead grey mullet mugil cephalus (Linnaeus, 1758) in the Blanakan Estuary, Subang, West Java

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Abstrak

Plastik merupakan bahan stabilitas tinggi hasil polimerisasi monomer dengan tingkat penggunaan yang tinggi. Sampah plastik berbahaya bagi lingkungan karena partikel penyusunnya memiliki ketahanan dan kestabilan tinggi sehingga proses degradasinya berlangsung lama. Di lingkungan perairan, plastik akan mengalami degradasi atau penguraian menjadi partikel kecil yang disebut mikroplastik (<5 mm). Partikel mikroplastik berpotensi termakan oleh berbagai biota perairan sehingga membahayakan siklus rantai makanan melalui proses biomagnifikasi. Penelitian ini bertujuan untuk menganalisis karakteristik mikroplastik (bentuk, ukuran, dan jenis polimer) pada air, sedimen dan ikan belanak Mugil cephalus (Linnaeus, 1758) pada organ dan jaringan (daging, insang, saluran pencernaan) di Muara Sungai Blanakan, Subang, Jawa Barat. Metode penelitian ini diawali dengan pengambilan sampel dengan air diambil sebanyak 50 L lalu disaring menggunakan plankton net hingga tertampung volume air 1000 mL, sampel sedimen diambil menggunakan Vanveen grab hingga tertampung pada jar 500 mL dan sampel ikan belanak diambil 10 ekor menggunakan bubu. Ekstraksi sampel sedimen dilakukan dengan pemberian larutan NaCl jenuh dengan perbandingan 1 (sedimen): 2 (NaCl jenuh), kemudian diberi larutan H2O2 30% + FeSO4 0,05 M dengan perbandingan 1:1 untuk sampel air dan sedimen. Ekstraksi sampel ikan dilakukan dengan mengambil jaringan dan organ yang digunakan, ditimbang dan dan diberi larutan KOH 10% sebanyak 50 mL. Sampel air, sedimen dan ikan disaring menggunakan kertas saring Whatman dan diidentifikasi mikroplastik menggunakan mikroskop olympus CX22LED. Analisis polimer mikroplastik dilakukan dengan metode Raman Spectroscopy. Uji statistik seperti uji kruskal-walis, one way anova, dan uji regresi spearman dan pearson digunakan untuk menganalisis data yang diperoleh. Hasil penelitian menunjukkan rata-rata total kelimpahan mikroplastik pada air 710 ± 183,34 partikel meter-3, sedimen 879,63 ± 205,13 partikel Kg-1 dan ikan belanak 210,8 ± 108,80 partikel individu-1. Nilai kelimpahan mikroplastik ikan belanak jika diurutkan dari yang tertinggi hingga terkecil adalah daging, saluran pencernaan, dan insang. Secara keseluruhan, bentuk dan ukuran mikroplastik yang paling banyak ditemukan adalah fiber dan <300 µm. Polimer mikroplastik yang dominan adalah PET, PP, dan PVC. Berdasarkan hasil uji beda nyata kelimpahan mikroplastik antar organ dan jaringan ikan belanak menunjukan tidak memiliki perbedaannya yang signifikan. Hasil uji korelasi Spearman menunjukan adanya korelasi antara kelimpahan mikroplastik di air dan sedimen Muara Sungai Blanakan terhadap kelimpahan mikroplastik di ikan belanak.

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Plastik is a high-stability material resulting from the polymerization of monomers, with a high level of usage. In aquatic environments, plastic undergoes photo-oxidative degradation by UV radiation from the sun and chemical processes, leading to the breakdown of plastic waste into small particles known as microplastics (<5 mm). Microplastic particles have the potential to be ingested by various aquatic

organisms, posing a risk to the food chain through biomagnification. This study aims to analyze the characteristics of microplastics in water, sediment, and the flathead grey mullet (Mugil cephalus) in different organs and tissues (muscle, gills, digestive tract) in the Blanakan River Estuary, Subang, West Java, based on their shape, size, and polymer types. Water samples were collected in a volume of 50 L, filtered using a plankton net to obtain a final volume of 1000 mL. Sediment samples were collected using a Vanveen grab and stored in 500 mL jars, while flathead grey mullet samples were collected using bubu (10 individuals). Sediment sample extraction was performed using a saturated NaCl solution with a ratio of 1 (sediment) to 2 (saturated NaCl solution), followed by the addition of a 30% H_2O_2 + 0.05 M $FeSO_4$ solution in a 1:1 ratio for water and sediment samples. Fish sample extraction involved weighing and placing the tissues and organs in a glass beaker, followed by the addition of a 10% KOH solution in a volume of 50 mL. The water, sediment, and fish samples were then filtered using Whatman filter paper with the assistance of a vacuum pump, and placed in Petri dishes for microplastic identification using an Olympus CX22LED microscope. Polymer analysis of microplastics was performed using Raman Spectroscopy. Kruskal-Wallis and one-way ANOVA tests were used to determine significant differences in the abundance and composition of microplastics (size and shape) in water, sediment, flathead grey mullet, and their respective organs. Spearman and Pearson correlation tests were used to investigate the influence of water and sediment, as well as morphometric values, on microplastic accumulation in flathead grey mullet. The research findings showed an average total abundance of microplastics in water to be 710 ± 183,34 particles meter-3, in sediment to be 879,63 ± 205,13 particles kilogram-1, and in flathead grey mullet to be 210,8 ± 108,80 particles individual-1. When ranked in descending order, the abundance of microplastics in the three parts of the flathead grey mullet were as follows: flesh, digestive tract, and gills. Overall, the most commonly found forms and sizes of microplastics were microplastic fibers and those below 300 µm. The polymer analysis revealed that the microplastics found in the Blanakan River Estuary were dominated by PET (40%), PP (40%), and PVC (20%). Based on the significant difference test for microplastic abundance among different parts of the flathead grey mullet, no significant differences were found. The Spearman correlation test indicated a correlation between the abundance of microplastics in water and sediment in the Blanakan River Estuary and the abundance of microplastics in flathead grey mullet.