

ABSTRAK

APLIKASI BIOFILTER ANAEROB DENGAN KOMBINASI MEDIA *BIOBALL* DAN PASIR SILIKA DALAM PENGOLAHAN LIMBAH CAIR *LAUNDRY* DI KEMANTREN PAKUALAM, KOTA YOGYAKARTA

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Usaha *laundry* di Kelurahan Purwokinanti, Kemantren Pakualam, Kota Yogyakarta terdiri atas empat usaha yang menghasilkan limbah 3150 liter/hari dari proses pencucian, namun belum dikelola dan masih dibuang melalui selang mesin cuci ke drainase dan Sungai Code. Limbah *laundry* berpotensi mencemari lingkungan sehingga perlu diolah, salah satunya menggunakan biofilter dengan kombinasi media *bioball* dan pasir silika. Tujuan penelitian ini yaitu menganalisis kadar parameter BOD, COD, TSS, pH, dan deterjen pada limbah cair *laundry* di daerah penelitian; menganalisis efektivitas penggunaan biofilter anaerob dengan kombinasi media *bioball* dan pasir silika dalam pengolahan limbah cair *laundry* berdasarkan variasi waktu tinggal; dan membuat desain unit biofilter anaerob dengan kombinasi *bioball* dan pasir silika dalam pengolahan limbah cair *laundry* yang tepat di daerah penelitian.

Penelitian ini menggunakan pendekatan kualitatif dan kuantitatif. Pengumpulan data dilakukan melalui survei pemetaan dan pengambilan sampel limbah cair *laundry* dengan metode *composite sampling* dari empat usaha *laundry*. Selanjutnya, dilakukan uji laboratorium terhadap parameter BOD, COD, TSS, pH, dan deterjen, serta eksperimen biofilter anaerob bermedia *bioball* dan pasir silika dengan variasi waktu detensi 24, 48, dan 72 jam. Data yang diperoleh kemudian dianalisis menggunakan metode deskriptif dan regresi linear sederhana.

Hasil penelitian menunjukkan bahwa parameter BOD (756 mg/l), COD (1350 mg/l), TSS (386 mg/l), dan deterjen (84,92 mg/l) melebihi baku mutu sebelum dilakukan pengolahan. Berdasarkan hasil percobaan, efektivitas optimum biofilter anaerob terjadi pada waktu detensi 72 jam dengan penurunan BOD 79,894%, COD 71,481%, TSS 93,532%, dan deterjen 49,211%. Hasil uji parameter tersebut berturut-turut sebesar 152 mg/l, 385 mg/l, 25 mg/l, dan 43,13 mg/l, dengan hubungan terbalik antara waktu detensi dan konsentrasi berdasarkan analisis regresi. Walaupun demikian, parameter BOD, COD, dan deterjen belum memenuhi baku mutu, sehingga perlu penambahan bak equalisasi dan biofilter aerob.

Kata kunci: biofilter anaerob, *bioball*, *laundry*, pasir silika, waktu detensi.

ABSTRACT

APPLICATION OF ANAEROBIC BIOFILTER WITH A COMBINATION OF BIOBALL AND SILICA SAND MEDIA IN THE TREATMENT OF LAUNDRY WASTEWATER IN PAKUALAMAN DISTRICT, YOGYAKARTA CITY

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The laundry industri in Purwokinanti Village, Pakualaman Subdistrict, Yogyakarta City, consists of four businesses generating 3,150 liters of wastewater per day from washing processes. Currently, this waste remains untreated and is discharged directly through washing machine hoses into the drainage system and the Code River. Consequently, treatment is necessary, specifically through the use of a biofilter with bioball and silica sand media. The objectives of this study are: to analyze the levels of liquid laundry waste pollutants in the study area based on BOD, COD, TSS, pH, and detergent parameters; to analyze the effectiveness of an anaerobic biofilter using a combination of bioball and silica sand media in treating laundry wastewater based on hydraulic retention time variations; and to design an appropriate anaerobic biofilter unit utilizing bioball and silica sand for laundry wastewater treatment in the research area.

This research employs both qualitative and quantitative approaches. Data collection was conducted through mapping surveys and wastewater sampling using the composite sampling method across the four laundry businesses. Subsequently, laboratory tests were performed for BOD, COD, TSS, pH, and detergent parameters, alongside anaerobic biofilter experiments using bioball and silica sand media with detention times of 24, 48, and 72 hours. The data obtained were analyzed using descriptive methods and simple linear regression.

The results show that BOD (756 mg/l), COD (1350 mg/l), TSS (386 mg/l), dan deterjen (84,92 mg/l) parameters exceeded the quality standards prior to treatment. The optimum effectiveness was achieved at a detention time of 72 hours, with removal efficiencies of 79.894% for BOD, 71.481% for COD, 93.532% for TSS, and 49.211% for detergent. The final concentrations of these parameters were 152 mg/L, 385 mg/L, 25 mg/L, and 43.13 mg/L, showing an inverse relationship between detention time and concentration based on regression analysis. However, the BOD, COD, and detergent parameters still do not meet the quality standards, thus the addition of an equalization tank and an aerobic biofilter is required.

Keywords: anaerobic biofilter, bioball, laundry, silica sand, detention time.