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ANALISIS PERFORMA DAN SEBARAN LENGAS TANAH VERTICAL SUB-SURFACE FLOW CONSTRUCTED WETLAND (VSSF-CW) DENGAN PERBEDAAN HYDRAULIC LOADING RATE (HLR)

Kehadiran limbah hasil dari aktivitas manusia dapat berdampak negatif bagi lingkungan terutama bagi kesehatan manusia. Salah satu upaya yang dikembangkan untuk mengatasi permasalahan limbah cair adalah *constructed wetland (CW).* CW menggunakan pertimbangan *Hydraulic Loading Rate* (HLR) yang menjadi parameter penting dalam efektivitas kinerjanya. HLR CW berbeda-beda tiap rumah tangga tergantung jumlah anggota keluarga. Penelitian ini bertujuan mengetahui performa dan sebaran lengas *Vertical Subsurface Flow Constructed Wetland (VSSF-CW)* dengan variasi *Hydraulic Loading Rate (HLR)*. Sebaran lengas tanah sebagai indikator sebaran nutrisi pada *wetland*. Selain itu dilakukan pengembangan model JST untuk memprediksi sebaran lengas tanah pada VSSF-CW. Penelitian ini menggunakan 3 buah maket VSSF-CW dengan 6 tanaman cabai. Perlakuan HLR berdasarkan pendekatan jumlah air limbah yang dihasilkan dalam rumah tangga dengan jumlah anggota keluarga yang berbeda-beda yaitu 3,3 cm/ hari (2 orang), 6,7 cm/hari (4 orang), dan 10 cm/hari (6 orang).

Hasil penelitian diperoleh performa VSSF-CW akan semakin menurun seiring dengan peningkatan HLR. Dengan hasil terbaik pada perlakuan HLR 3,3 cm/hari. Secara umum performa VSSF-CW yang dibuat cukup baik karena mampu mengurangi nitrat rata-rata antara 29 % sampai 51 %. Sebaran lengas tanah pada tiap jarak dan kedalaman VSSF-CW tidak merata di setiap titik. Dengan rata-rata lengas meningkat seiring peningkatan HLR. Model JST terbaik yang diperoleh untuk memprediksi sebaran lengas tanah dengan nilai R^2, RMSE, dan akurasi berturut-turut sebesar 1, 0,06 dan 99,57%. Tdiak ada pengaruh perbedaan HLR pada pertumbuhan tanaman fase vegetatif cabai. Namun tanaman cabai masih dapat tumbuh sehingga layak digunakan dalam pengembangan teknologi *constructed wetland* karena bernilai ekonomi.

Kata kunci: *constructed wetland*, JST, lengas, nitrat

ABSTRACT

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PERFORMANCE ANALYSIS AND SOIL MOISTURE DISTRIBUTION OF VERTICAL SUB-SURFACE FLOW CONSTRUCTED WETLAND (VSSF-CW) WITH DIFFERENCES IN HYDRAULIC LOADING RATE (HLR)

The presence of waste resulted from human activities can can cause negative impacts on the environment, especially on human health. One of the efforts developed to overcome the problem of liquid waste is constructed wetland (CW). CW considers the Hydraulic Loading Rate (HLR) which is an essential parameter in the effectiveness of its performance. The HLR CW varies per household depending on the number of family members. This study aims to determine the performance and distribution of moisture in Vertical Subsurface Flow Constructed Wetland (VSSF-CW) with variations in Hydraulic Loading Rate (HLR). The distribution of soil moisture is an indicator of the distribution of nutrients in the wetlands. In addition, an ANN model was developed to predict the distribution of soil moisture in VSSF-CW. This study used 3 VSSF-CW mockups with 6 chili plants. HLR treatment is based on the approach to the amount of wastewater generated in households with different family members, namely 3,3 cm/day (2 people), 6,7 cm/day (4 people), and 10 cm/day (6 people).

The results showed that the performance of VSSF-CW will decrease along with the increase in HLR. The best results in the HLR treatment of 3,3 cm/day. In general, the performance of the VSSF-CW was quite good because it reduced nitrate on average between 29% and 51%. The distribution of soil moisture at each distance and depth of VSSF-CW is not evenly distributed at every point. With the average moisture increasing with the increase in HLR. The best ANN model was obtained to predict the distribution of soil moisture with values of R^2, RMSE, and accuracy respectively 1, 0,06, and 99.57%There was no effect of differences in HLR on plant growth in the vegetative phase of chili. However, chili plants can still grow so they are suitable for use in the development of constructed wetland technology because of their economic value.

Keywords: constructed wetland, ANN, soil moisture, nitrate