Pengaruh Media Filter Zeolit, Karbon Aktif, dan Keramik terhadap Peningkatan Kualitas Limpasan Air Hujan dalam Sistem Pemanenan Air Hujan = The Effect of Zeolite, Activated Carbon, and Ceramic as Filter Media for Rainwater Runoff Quality Improvement in Rainwater Harvesting System

Luqman Ash-Shiddiqie, author

Abstrak

Air hujan yang turun di perkotaan telah terkontaminasi oleh polutan udara hasil kegiatan industri dan transportasi. Pemanenan air hujan melalui atap juga memberikan pengaruh terhadap kualitas limpasan air hujan yang ditampung. Teknik filtrasi merupakan salah satu cara yang dapat diterapkan untuk meningkatkan kualitas air hujan. Media filter zeolit, karbon aktif, dan keramik diketahui mampu meningkatkan kualitas limpasan air hujan yang dipanen. Penelitian ini bertujuan untuk menganalisis kualitas limpasan air hujan melalui variasi susunan zeolit, karbon aktif, dan keramik. Kemudian, menganalisis perbedaan variasi susunan zeolit, karbon aktif, dan keramik dalam meningkatkan kualitas limpasan air hujan, serta menganalisis tingkat hubungan antara variasi susunan zeolit, karbon aktif, dan keramik terhadap kualitas limpasan air hujan. Penelitian ini menggunakan tiga housing filter berukuran 10 inci yang diposisikan sejajar dengan cartridge reactor berukuran 10 inci berisikan media filter. Penelitian dilakukan pada reaktor filtrasi dengan objek penelitian variasi susunan media filter. Isi media filter pada ketiga housing filter akan berlainan pada setiap konfigurasi. Konfigurasi pada penelitian ini terdiri dari tiga susunan, yaitu Susunan I (Zeolit – Karbon Aktif – Keramik), Susunan II (Karbon Aktif – Keramik – Zeolit), dan Susunan III (Keramik – Zeolit – Karbon Aktif). Pengambilan sampel dilakukan enam kali dengan parameter uji kekeruhan, pH, mangan, dan total koliform. Hasil penelitian ini menunjukkan efektivitas penyisihan maksimum kekeruhan, mangan, dan total koliform serta peningkatan maksimum pH dimiliki oleh Susunan I dengan efektivitas penyisihan kekeruhan sebesar 51,78%, mangan 100%, dan total koliform 77,14%, serta peningkatan pH sebesar 21,05%. Rerata efektivitas penyisihan Susunan I, Susunan II, dan Susunan III untuk kekeruhan adalah 32,31%, -108,93%, dan 17,41%, mangan 45,83%, 30%, dan 87,5%, serta total koliform 67,93%, 72,28%, dan 60,51%. Sedangkan, rerata efektivitas peningkatan Susunan I, Susunan II, dan Susunan III untuk pH adalah 10,7%, 10,3%, dan 12,52%. Berdasarkan uji komparatif diperoleh nilai signifikansi (p) < 0,05 pada seluruh parameter, yang berarti variasi susunan menghasilkan perbedaan pada kualitas limpasan air hujan. Berdasarkan uji korelasi, ketiga susunan tidak memiliki hubungan yang signifikan (p > 0,05) terhadap parameter kekeruhan, pH, dan mangan, namun memiliki hubungan yang signifikan (p < 0,05) terhadap parameter total koliform. Susunan I memiliki hubungan yang terbaik terhadap parameter uji, dengan hubungan yang sangat kuat pada parameter total koliform (r = 0,986), hubungan yang kuat pada parameter mangan (r = -0,674), hubungan yang sedang pada parameter kekeruhan (r = -0,449), serta hubungan yang lemah pada parameter pH (r = 0,314).

.....Air pollutants from industrial and transportation activities contaminate the rainwater that falls in urban areas. Rainwater harvesting through the roof also affects the quality of the collected rainwater runoff. The filtration technique is one way that can be applied to improve the quality of rainwater. Zeolite, activated

carbon, and ceramic filter media can improve the quality of harvested rainwater runoff. This study aims to analyze the quality of rainwater runoff through variations in the zeolite, activated carbon, and ceramic arrangement. Then, analyze the differences in the zeolite, activated carbon, and ceramic arrangement in improving the quality of rainwater runoff, and analyze the relationship between variations in the zeolite, activated carbon, and ceramic arrangement on the quality of rainwater runoff. This study uses three 10-inch factory housing filters in a parallel position—each housing filter filled with a 10-inch cartridge reactor containing filter media. The researcher conducted the study in a filtration reactor, with the object of study being variations in the filter media arrangement. The content of the filter media in the three filter housings will vary with each configuration. The configuration in this study consisted of three arrangements, namely Arrangement I (Zeolite – Activated Carbon – Ceramic), Arrangement II (Activated Carbon – Ceramic – Zeolite), and Arrangement III (Ceramic – Zeolite – Activated Carbon). Sampling was carried out six times with parameters tested for turbidity, pH, manganese, and total coliform. The results of this study indicated the effectiveness of the maximum removal of turbidity, manganese, and total coliforms as well as the maximum increase in pH owned by Arrangement I with the effectiveness of removing turbidity by 51.78%, manganese by 100%, and total coliforms 77.14%, and increasing pH by 21.05%. The average effectiveness of the removal of Arrangements I, II, and III for turbidity is 32.31%, -108.93%, and 17.41%, manganese 45.83%, 30%, and 87.5%, and total coliforms 67.93%, 72.28%, and 60.51%. Meanwhile, the average effectiveness of increasing Arrangement I, Arrangement II, and Arrangement III for pH is 10.7%, 10.3%, and 12.52%. Based on the comparative test, a significance value (p) <0.05 was obtained for all parameters, which means that variations in the arrangement resulted in differences in the quality of rainwater runoff. Based on the correlation test, the three arrangements did not have a significant relationship ($p > 0.05$) to turbidity, pH, and manganese parameters. However, they had a significant relationship ($p < 0.05$) to the total coliform parameter. Arrangement I had the best relationship to the parameters, with a very strong relationship on the total coliform parameter ($r = 0,986$), strong relationship on the manganese parameter ($r = -0,674$), medium relationship on the turbidity parameter ($r = -0,449$), then weak relationship on the pH parameter ($r = 0,314$).</p>