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# Investigation into the Optimum Hydraulic Loading Rate for Selected Filter Media Packed in a Continuous Upflow Filter

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**Abstract :** Continuous upflow filters can combine the nutrient (nitrogen and phosphate) and suspended solid removal in one unit process. The contaminant removal could be achieved chemically or biologically; in both processes the filter removal efficiency depends on the interaction between the packed filter media and the influent. In this paper a residence time distribution (RTD) study was carried out to understand and compare the transfer behaviour of contaminants through a selected filter media packed in a laboratory-scale continuous up flow filter; the selected filter media are limestone and white dolomite. The experimental work was conducted by injecting a tracer (red drain dye tracer –RDD) into the filtration system and then measuring the tracer concentration at the outflow as a function of time; the tracer injection was applied at hydraulic loading rates (HLRs) (3.8 to 15.2 m h-1). The results were analysed according to the cumulative distribution function F(t) to estimate the residence time of the tracer molecules inside the filter media. The mean residence time (MRT) and variance σ2 are two moments of RTD that were calculated to compare the RTD characteristics of limestone with white dolomite. The results showed that the exit-age distribution of the tracer looks better at HLRs (3.8 to 7.6 m h-1) and (3.8 m h-1) for limestone and white dolomite respectively. At these HLRs the cumulative distribution function F(t) revealed that the residence time of the tracer inside the limestone was longer than in the white dolomite; whereas all the tracer took 8 minutes to leave the white dolomite at 3.8 m h-1. On the other hand, the same amount of the tracer took 10 minutes to leave the limestone at the same HLR. In conclusion, the determination of the optimal level of hydraulic loading rate, which achieved the better influent distribution over the filtration system, helps to identify the applicability of the material as filter media. Further work will be applied to examine the efficiency of the limestone and white dolomite for phosphate removal by pumping a phosphate solution into the filter at HLRs (3.8 to 7.6 m h-1).

**Keywords :** filter media, hydraulic loading rate, residence time distribution, tracer
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