Effective depth, initial head loss and backwashing criteria as the key factors of burned oil palm shell (BOPS) granular filtration

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ABSTRACT

These studies are mainly focused on effective depth, initial head loss and backwashing criteria that have been identified as the key factors in relation to the fundamental parameters and also, indicated possible operation performance. Granular filter media used in this study are limited to burned oil palm shell (BOPS) and sand. The study on the bed depth in relation to effluent over influent turbidities ratio (C_e/C_o) has been found to exhibit an exponential relation which showed a strong correlation coefficient ($R^2 = 0.9$) for different effective sizes of BOPS (ES, 1.0–2.5 mm) and sand (ES, 0.4–0.9 mm). By approximating relatively constant C_e/C_o for both BOPS and sand at different effective sizes, an exponential equation ($R^2 = 0.98$) is proposed to link all effective bed depths. This enabled a determination of the effective depth of BOPS and sand media which were not executed in the experiment. Initial head loss of single media of BOPS and sand which involved comparison of different models, such as Ergun and modified Kozeny–Carmen equations with experimental results, at different flow rates, showed a good agreement with modified Kozeny-Carmen equation for non-sphere. In backwashing criteria, studies that showed the relation between the difference in granular settlement velocity with backwashing water velocity, confirmed that the best combination of dual-media are sand of ES = 0.5 mm with UC of 1.5 and BOPS of ES = 1.0 mm with UC of 1.3.

Keywords: Effective depth; Initial head loss; BOPS; Sand

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