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Removal of Drinking Water Taste and Odour Causing Compounds using Modified Sand Filter; Green Solution via Biotechnology

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Abstract

Formation of odorous and tasty compounds in drinking water, specially earthy and musty taste and odour (T and O) compounds have been a common and recurrent issue in drinking water sector. Although the health aspects of water are the primary focus, consumers generally judge the quality of water by its aesthetic value. T&O compound episodes are the cause for most consumer complaints and rejections related to portable water where flavour and smell of the water is the only measure of water quality for the end-user. Geosmin (trans-1, 10-dimethyl-trans-9-decalol) and 2-MIB (2-Methylisoborneol) are the responsible earthy and musty taints in drinking water. Hence, removing these two odorants from drinking water is a necessity for worldwide water authorities and consumers. Although there are several other methods available to remove T&O compounds in drinking water, with the inherent drawbacks and higher costs in all other methods, biodegradation has been proved to be a better approach to provide a sustainable solution. Therefore, the current study was designed to construct a modified sand filter entrapped with Geosmin and 2-MIB degrading bacteria in order to remove T&O from water. Gram positive aerobic B. subtilis was selected and entrapped into rice husk-based biochar in the biological layer of the sand filter where biological degradation occurred. Experimental results revealed that the modified biochar layer with aeration removed over 36% of Geosmin and over 50% of 2-MIB from water within 18 hours. In contrary the non-aerated experiment showed only 22% of removal of Geosmin and 25% of 2-MIB. Interestingly, although the non-aerated experimental setup showed complete removal of Geosmin within 48 hours, the aerated experiment showed a complete removal of Geosmin within 30 hours. Similarly, aerated setup removed 2-MIB in 30 hours while the non-aerated setup removed 2-MIB within 54 hours. Thus, the series of experiments clearly depicted that the modified biological layer with biochar and flow aerator significantly ($p<0.01$) increased the degradation rate and drastically reduced the time of incubation, making this solution more industrially feasible.

Keywords: Modified sand filter, Biodegradation, Geosmin, 2-methylisoborneol, Aeration