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Septic tank with up flow anaerobic filter compact unit for treating domestic wastewater in low-lying areas

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Improper disposal of domestic wastewater to free water bodies and ground, leading to contamination ofwater bodies and ground water, has become a significant issue. Especially in high water table areas, wastewater is in direct contact with ground water. When constructing a proper disposal system, it is required to have well engineered design that matches with available space. Therefore, construction of site specific septic tank and anaerobic filter is not common due to lack of expertise, and therefore installation of readymade septic tank units, which are easy to install, is popular. This research is aimed to design and develop a compact treatment unit consisting of a septic tank and up-flow anaerobic filter, using construction aggregate and bio char as filter media for treating domestic wastewater, and to estimate its performance.

The septic tank treatment systems, circular and rectangular, were designed according to SLS 745 guidelines and fabricated using grade 20 concrete. Circular units were designed to be lighter in weight and to have sufficient strength. Rectangular and circular units with 0% of bio char with metal packing were considered as control units. To achieve flexural stability of tank walls and base, they were constructed with 75mm thick walls and 100mm thick base. The bio char, 10%, 20% and 50%, was added to the metal media with 25mm-50mm range, and the hydraulic design was prepared considering the daily discharge of 5 person per dwelling. The retention time was considered as 14.5hrs. The internal diameter of the treatment unit was 1200mm, while the total length was 1900mm. The discharge water was tested for pH, TN, phosphate, BOD5 and COD following APHA wastewater examination methods.

With the introduction of bio char, the percentage removal rate of Nitrate and BOD5 increases. The designed units with metal filter media showed considerable removal of COD, BOD5, and TN,at around 73mg/l, 43mg/l and 45mg/l, respectively. After introduction of bio char, all parameters met stipulated guidelines. The designed compact unitsgave good performance for removal of organic matter satisfactorily. The space requirement for circular section was 5ftx12ft. It is required to de-sludge the septic tank component annually to get better performance and interruption free function. The system with circular section has shown easy installation and promising results, and therefore is recommendedfor use specifically in areas with high water tables to protect ground water from contamination.

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