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Performance Evaluation of On-Site Sewage Treatment System (Johkasou)

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Abstract : The efficiency of an on-site wastewater treatment system named Johkasou was evaluated based on its pollutant removal efficiency over 10 months. This system was installed at IIT Roorkee and had a capacity of treating 7 m3/d of sewage water, sufficient for a group of 30-50 people. This system was fed with actual wastewater through an equalization tank to eliminate the fluctuations throughout the day. Methanol and ammonium chloride was added into this equalization tank to increase the Chemical Oxygen Demand (COD) and ammonia content of the influent. The outlet from Johkasou is sent to a tertiary unit consisting of a Pressure Sand Filter and an Activated Carbon Filter for further treatment. Samples were collected on alternate days from Monday to Friday and the following parameters were evaluated: Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and Total Nitrogen (TN). The Average removal efficiency for Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and Total Nitrogen (TN) was observed as 89.6, 97.7, 96, and 80% respectively. The cost of treating the wastewater comes out to be Rs 23/m3 which includes electricity, cleaning and maintenance, chemical, and desludging costs. Tests for the coliforms were also performed and it was observed that the removal efficiency for total and fecal coliforms was 100%. The sludge generation rate is approximately 20% of the BOD removal and it needed to be removed twice a year. It also showed a very good response against the hydraulic shock load. We performed vacation stress analysis on the system to evaluate the performance of the system when there is no influent for 8 consecutive days. From the result of stress analysis, we concluded that system needs a recovery time of about 48 hours to stabilize. After about 2 days, the system returns again to original conditions and all the parameters in the effluent become within the limits of National Green Tribunal (NGT) standards. We also performed another stress analysis to save the electricity in which we turned the main aeration blower off for 2 to 12 hrs a day and the results showed that we can turn the blower off for about 4-6 hrs a day and this will help in reducing the electricity costs by about 25%. It was concluded that the Johkasou system can remove a sufficient amount of all the physiochemical parameters tested to satisfy the prescribed limit set as per Indian Standard.

Keywords : on-site treatment, domestic wastewater, Johkasou, nutrient removal, pathogens removal
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