

Abstract

The amount of water available per person has been declining throughout the world as a result of expanding populations and environmental changes. Industrialization and urbanization in Palestine are polluting groundwater and degrading the quality of surface waters by overloading them with more organic material than can be assimilated naturally. So wastewater management should be viewed as an important component of water resource management. In view of the economical situation existing in Palestine and the necessity for pollution control, wastewater treatment technologies should be sustainable, cost effective and environmentally sound. These technologies should combine a high efficiency with simplicity in construction and operation and maximize the opportunities for efficient removal of pollutants.

Particular attention is given to the up flow anaerobic sludge blanket (UASB) - septic tank technology to be the key point to be the affordable on-site sanitation alternative for household instead of the cesspits which consider as the known and commonly on-site method for wastewater disposal and sewage pre-treatment in Palestine. However, the performance of this technology has not been investigated especially under Palestine winter conditions.

The main objective of this thesis was to formulate design criteria for designing the UASB-septic tank for pre sewage treatment under Palestinian\Middle East conditions namely at low temperature period of the year. Moreover, Attempts were made to evaluate the effect of HRT on performance of UASB-septic tank.

An on-site two pilot scale UASB-septic tank reactors treating domestic sewerage under different HRT (2 days for R1 and 4 days for R2). The two reactors were operated in parallel at Al-Bireh wastewater treatment plant in Palestine. The two reactors were operated for six months at ambient temperature fluctuates between 2 to 27 °C with an average value of 14.7 °C, the average sewage temperature was 17.3 °C with 12 °C and 25 °C extreme values. The domestic sewage treated in the research period classified as (medium strength) regarding to the Metcalf and Eddy (1991) and EPA (1999), with average concentration COD_{tot} of 905 mg/l with (COD/BOD_5) of 1.97. The COD_{ss} in the raw sewage represented a high fraction of the total COD, viz. about 43.7% from the COD_{tot} .

The performance data obtained During the period of the research showed for R1 with HRT of 2 days that the average removal efficiency for COD_{tot}, COD_{sus}, COD_{col}, COD_{dis}, were 51%, 83%, 20%, 24% respectively also the BOD₅ and TSS average removal efficiency of 45% and 74% respectively. And so for R2 of HRT of 4 days the average removal efficiency for COD_{tot}, COD_{sus}, COD_{col}, COD_{dis}, were 54% , 87 % , 10% , 28% respectively with BOD₅ and TSS average removal efficiency of 49% and 78% respectively. Moreover, Results show that R1 and R2 are not efficient for removing nutrient from wastewater but also it shows an increase in the (NH₄⁺ - N), Nkj-N removal efficiency comparing to the summer period.

The evolution of biogas production (CH₄ (gas form + liquid form)) was strongly affected by temperature. The average total methane production from both reactors was 0.11 N m³/kg COD removed and 0.10 N m³/kg COD removed for R1 and R2 respectively.

The sludge hold-up time of the system is so long and withdraw of sludge could be done once every 4 years for this system. The (VS/TS) ratio for the sludge was about average ratio of 67.9 and 67.02 for R1 and R2 respectively those values can indicate a well-stabilized sludge and this proofed with the stability tests. Also stability tests show that the retained sludge in R2 was more stable than R1. The results obtained in this research shows that the longer HRT R2 (4 days) gave better efficiency than R1 (2 days) in most the tested parameter during this research, even if most of them not statistically significant. As a general conclusion the anaerobic systems can be easily applied at any scale, and it could be applied to the Palestine and Middle East region.