Abstract

Despite of the several advantages of the up flow anaerobic sludge blanket (UASB), such as low cost, operational simplicity, and low biosolids productions, it has difficulties in producing effluent that can comply with the environmental standards. Therefore, a post treatment stage is crucial to complement the organic matter removal, and to achieve reduction of nutrients and pathogens. This study proposes a new development in post-treatment, which entails a two-stage biofilter system.

An anaerobic filter (AF) was installed to reduce the suspended and colloidal particles from the UASB effluent at higher organic loading rates (OLR). The reduction of nutrients by a passive aerated rapid filter (RF) at lower hydraulic retention times (HRT) justified the use of two stage biofilters (AF+RF) as a post treatment system. Crushed recycled plastic and anthracite were used as filter media for AF and RF respectively.

During the three run phases (variable OLR and HRT), the pilot scale treatment system(UASB+AF+RF) was fed with domestic wastewater from Birzeit town at an average flow rate of 500 L/d. The applied HRT for the treatment chain along three run phases were (32.5, 2.2 and 1 h), (19.5, 1.3 and 0.7 h) and (14, 1, and 0.4 h). The applied OLR in (gCODm-3.d-1) were (159, 1898 and 6967), (1533, 10684 and 10539) and (566, 6171 and 20388).

The overall removal efficiency of the treatment chain for CODt was (42, 83 and 50%), during the three run phases respectively, however the achieved CODt removal efficiency of UASB was (18.5, 53 and 29%). At the same time, the suspended solids removal efficiency for the complete treatment chain was (70, 65 and 55%) at variable OLR and HRT, the UASB suspended solids removal efficacy was around (35, 27 and 21%) for the three run phases respectively.

During the first run phases (Highest HRT), an average removal efficiency of 8 and 14% for ammonia and phosphorous in the RF were achieved, high OLR applied

during the second and third run phases might be behind low nutrients removal efficiency. Removal of total Kjeldahl nitrogen (TKN) in the AF and RF was associated with similar reduction tendency in BOD. The TKN and BOD removal efficiency after the over all treatment chain were (20, 24 and 18 %) and (48, 50 and 34 %) respectively for the three run phases. Hence, the TKN removal rates can be attributed to biomass assimilation.

The over all treatment efficacy of the developed post treatment system revealed that, the design and operation of UASB reactor is a limiting factor for the envisaged process performance of any post treatment.

Finally under variable HRT and OLR, it is recommended that, the AF effective volume should be 50 liters in order to achieve adequate nutrient removal rates in the RF at a surface loading rate of 1 g COD/m2.d and a specific surface area of 17.5m2/m3