SUCCESSFUL IMPLEMENTATION OF FULL-SCALE BAFFLED SEPTIC TANK WITH ANAEROBIC FILTERS FOR WASTEWATER TREATMENT IN VIETNAM

Nguyen Viet Anh[1], Pham Thuy Nga[1], Nguyen Huu Thang[1], Antoine Morel, SANDEC[2]

[1] Centre for Environmental Engineering of Towns and Industrial Areas (CEETIA), Hanoi University of Civil Engineering, Hanoi, Vietnam.

[2] Department of Water and Sanitation in Developing Countries (SANDEC), Swiss Federal Institute for Aquatic Sciences (EAWAG), Switzerland.

(1) Corresponding author. Address: CEETIA, DHXD, 55 Giai Phong Road, Hanoi, 10000, Vietnam. [Tel. (+84)-4-869 8317, (+84)-91320 9689. Fax. (+84)-4-6281580. E-mail. vietanhctn@yahoo.com, vietanhctn@gmail.com.

Abstract

With the aim of investigating the applicability of improved septic tank systems in real conditions, 20 full-scale baffled septic tanks (BAST) or baffled septic tanks with anaerobic filters (BASTAF) have been designed and constructed from 2002 up to now, with 14 units being in operation, in different places around Hanoi area. The COD and SS treatment performance of BASTAF P-01 in the period February 2003 – November 2005 show high and stable removal rates in terms of both organic matter and suspended solids were recorded, amounting to 77% (45.9 – 95.8%) and 86.2% (69.1 – 97.3) in the terms of COD and SS, respectively.

Based on collected information from our lab and pilot experiments, the use of BAST and BASTAF systems are recommended for the treatment of domestic wastewater instead of conventional septic tanks. The system proposed can significantly improve the on-site treatment performance in terms of organic matters and solids. For houses connected to the communal sewer and in case the septic tank is placed in the house basement, the BAST is recommended, comprising an equalizing – settling chamber (equal to the first septic tank compartment), plus 2 up-flow chambers.

Anaerobic filtration is recommended only in cases where easy access to the filter chambers is guaranteed, and where high removal performance of solids is required. Examples are where wastewater is further treated in infiltration trenches, or in a sand filter, where excessive solids concentrations could lead to clogging of following treatment steps.

Key words: Baffled septic tank (BAST), baffled septic tank with anaerobic filter (BASTAF), decentralized sanitation, pilot project, Vietnam, wastewater,

1. Introduction

With the aim of investigating the applicability of improved septic tank systems in real conditions, 20 full-scale baffled septic tanks (BAST) or baffled septic tanks with anaerobic filters (BASTAF) have been designed and constructed from 2002 up to now, with 14 units being in operation, in different places around Hanoi area. The design of the systems was based on the outcomes of the laboratory scale experiments on improved septic tanks, as described on another paper of the same authors (see page).

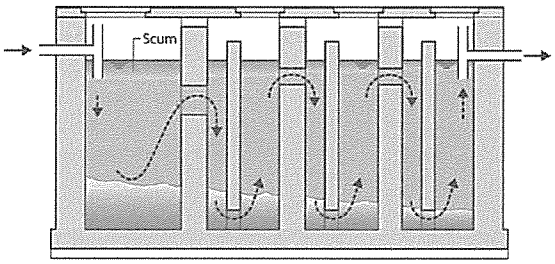

Figure 1. Working principle of the baffled septic tank (BAST). Can also be constructed as BASTAF with filter media in the last chamber(s).

The systems defer in size, from single household systems to community systems for the treatment of domestic wastewater of 50 households. These units are being monitored in terms of treatment performance and operation and maintenance requirement. The acquired knowledge, together with findings on suitable design and construction, will be used for the development of technical guidelines on how to design, operated and maintain such systems.

2. Implemented BAST(AF)s

The first full-scale BASTAF (P-01) was installed in Dr. Viet Anh's house in Hai Ba Trung district, Hanoi in 2002 as alternative to a conventional septic tank. The system treats toilet wastewater only, greywater being discharge directly to the drainage channel. The BASTAF consists of one settling chamber, two up-flow chambers and two anaerobic filter chambers, with a total wet volume of 3 m^3 (for 5 users).

Picture 1. BASTAF implemented in PC building, Ta Thanh Oai commune, Thanh Tri Dist., Hanoi

The latest BASTAF system was implemented in cooperation with IWEET in 2006 on request of VEPA for a group of households in Huu Hoa commune, Thanh Tri Dist., Hanoi. Systems were also implemented e.g. in the Primary School (Picture 2), or for a PC office building (Picture 1).

3. Treatment performance

Figure 2 shows the COD and SS treatment performance of BASTAF P-01 in the period February 2003 – November 2005. High and stable removal rates in terms of both organic matter and suspended solids were recorded, amounting to 77% (45.9 – 95.8%) and 86.2% (69.1 – 97.3) in the terms of COD and SS, respectively.

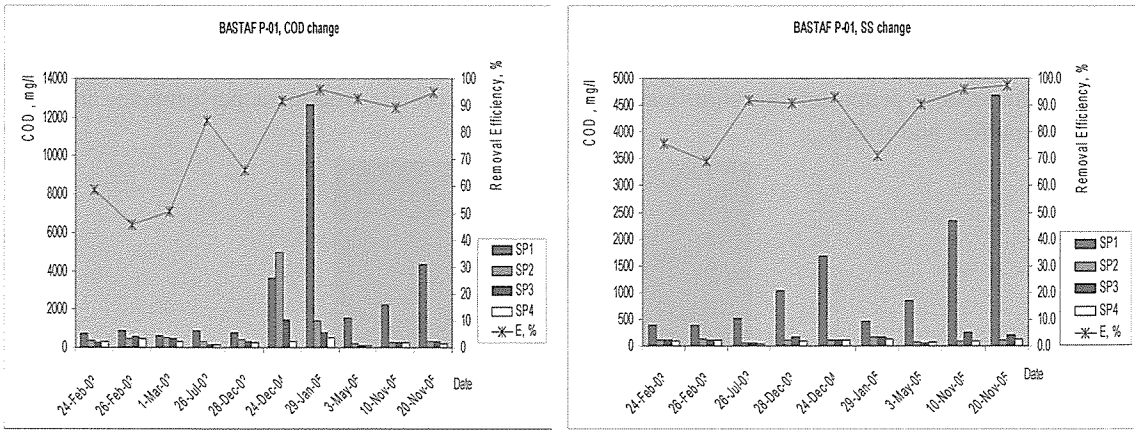

Figure 2. COD (a) and SS (b) removal efficiency of BASTAF P-01

Despite the very high strength of the raw toilet wastewater (COD of almost 3000 mg/l), the BASTAF was able to produce an effluent with average COD and SS concentrations as low as 300 mg/l and 100 mg/l, respectively. The other systems perform similarly, but more data needs to be collected for more accurate evaluation of the treatment performance.

Picture 2. BASTAF implemented in Primary School in Thai Binh Province (CEETIA – MOET project)

4. Main findings from pilot BASTAFs

Despite strong fluctuations of wastewater flows and concentrations, the BASTAFs can provide high removal efficiencies in terms of SS, COD and other parameters, with stable effluent concentrations. The BASTAF treatment system works very much well for the treatment of high-strength wastewater, as observed in alcohol and food processing villages or for the treatment of toilet wastewater.

High sludge accumulation rates in the settlement chamber were observed in some units. Proper design of the inlet structure (with screens) and provision of efficient ventilation appear to be decisive to avoid excessive scum formation. Excessive scum formation or sludge accumulation was not observed in the filter chambers.

The anaerobic filter chambers do not play a significant role for the biological treatment of wastewater in BASTAF, as originally expected. In the pilot BASTAF P-01, the removal efficiency of the anaerobic filtration chambers were rather low compared to the previous chambers. However, the filter plays an important role in avoiding washing out of solids. Over the 2.5 years of operation of unit P-01, there was limited biofilm growth on the filter media (charcoal) in the filtration chambers. This may be due to limited concentrations of biodegradable solids remaining in the wastewater reaching the filtration chambers (low BOD/COD ratio).

5. Conclusions and first recommendations

Based on collected information from our lab and pilot experiments, the use of BAST and BASTAF systems are recommended for the treatment of domestic wastewater instead of conventional septic tanks. The system proposed can significantly improve the on-site treatment performance in terms of organic matters and solids.

Picture 4. First BASTAF implemented for a household in Hai Ba Trung district, Hanoi.

For houses connected to the communal sewer and in case the septic tank is placed in the house basement, the BAST is recommended, comprising an equalizing – settling chamber (equal to the first septic tank compartment), plus 2 up-flow chambers.

Anaerobic filtration is recommended only in cases where easy access to the filter chambers is guaranteed, and where high removal performance of solids is required. Examples are where wastewater is further treated in infiltration trenches, or in a sand filter, where excessive solids concentrations could lead to clogging of following treatment steps.

Vietnam Environment Award 2006

The DESA research team of CEETIA was distinguished for its work on improved septic tanks with the Vietnam Environment Award at the First International Trade Fair and Exhibition held in Hanoi, April 2006.