

Pathogens in septage in Vietnam



Disposal of septage, operating and maintaining septic tanks is an increasing problem in developing countries like Vietnam. Septage is widely acknowledged as a major source of infectious pathogens like enteric bacteria, viruses, protozoa and helminthes. It has been recently reported that 75% of Ho Chi Minh City's septage is discharged directly into the environment (Cuong 2008). Moreover septic tanks in Vietnam are in general only emptied when blockages and odors occur, which happens when the tank is full and untreated septage flows through the tank. Yet the microbiological character of septage in Vietnam is not well documented, especially given the variety of helminthes whose infections are considered a burden in Vietnam (Trang et al. 2007). The objective of this study was to examine the pathogenic content and indicator organisms in septage in Can Tho City, Southern Vietnam.

Methods

Samples were taken from 20 septic tanks when they were being emptied by a vacuum truck. Two samples were taken from each tank: one at a depth of 10 cm (untreated septage), the other from the centre (septage sludge) as the tanker had extracted half the contents. Samples were measured for pH, dry matter (DM) and somatic coliphages (SC), male-specific bacteriophages (MSB), *Escherichia coli*, *Salmonella* spp., *Streptococcus* spp. and helminth ova.

Table 1 Concentration of micro-organisms in untreated septage samples

Organism tested	Unit	Range	Mean	Median
SC	PFU/mL	ND - 1.9 x 10 ⁵	1.8 x 10 ⁴	1.5 x 10 ³
MSB	PFU/mL	ND - 1.0 x 10 ³	5.2 x 10 ²	6.0 x 10 ²
<i>E. coli</i>	CFU/mL	2.0 x 10 ¹ - 3.5 x 10 ⁵	6.8 x 10 ⁴	1.1 x 10 ⁴
<i>Salmonella</i> spp.	MPN/100mL	ND - 7.0 x 10 ³	1.3 x 10 ³	3.1 x 10 ²
<i>Streptococcus</i> spp.	CFU/mL	6.4 x 10 ² - 2.4 x 10 ⁴	8.5 x 10 ³	5.3 x 10 ³
Helminth ova	No./L	ND - 1,200	450	240

ND = not detected

The samples originated from 19 single-family dwellings and one company. All septic tanks were full at sampling. The emptying intervals ranged from 1 to 12 years.

Table 2 Concentration of micro-organisms in septage sludge samples

Organism tested	Unit	Range	Mean	Median
SC	PFU/g dry weight	ND - 9.7 x 10 ⁶	1.3 x 10 ⁶	2.5 x 10 ⁴
MSB	PFU/g dry weight	ND - 6.2 x 10 ³	2.1 x 10 ³	3.5 x 10 ²
<i>E. coli</i>	CFU/g dry weight	7.2 x 10 ² - 6.2 x 10 ⁶	1.1 x 10 ⁶	2.3 x 10 ⁵
<i>Salmonella</i> spp.	MPN/g dry weight	ND - 1.9 x 10 ³	5.7 x 10 ²	4.6 x 10 ²
<i>Streptococcus</i> spp.	CFU/g dry weight	1.5 x 10 ¹ - 4.0 x 10 ⁵	7.8 x 10 ⁴	1.1 x 10 ⁴
Helminth ova	No./L	1,000 - 50,000	16,000	13,300

ND = not detected

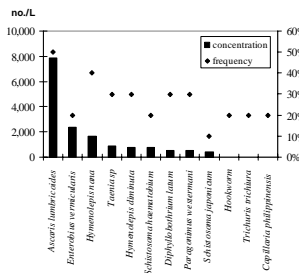


Figure 1 Frequency and average concentrations of helminth ova (n = 20) in septage samples



Septage desludge

The removable access covers were not installed on the surveyed septic tanks. Thus the workers had to damage the floor to access the tank placed in the basement of the houses.



Discharge of septage into a dump located in Hau Giang province

Somatic coliphages and MSB were counted by the single-agar-layer technique as described in ISO 10705-2 and ISO 10705-1. *E. coli* was counted on Chromocult® Coliform Agar, and *Enterococcus* spp. on Enterococcus Slanetz and Bartley Agar. *Salmonella* spp. was enumerated using the most probable number (MPN) method, with Rappaport-Vassiliadis broth and Hektoen agar. Helminth ova were determined by using WHO guidelines (1996).

Results

Untreated septage

Dry matter was low (average DM = 0.24%). The pH values ranged from 7.3 to 7.5. All samples were positive for the analyzed bacteria with the exception of *Salmonella* spp., which was detected in 70% of the samples (Table 1). SC and MSB were detected in 80% of samples while helminth ova were present in 95% of studied samples.

Helminth ova detected were *Ascaris lumbricoides*, *Enterobius vermicularis*, *Hymenolepis diminuta*, *Hymenolepis nana*, *Taenia* spp., *Capillaria philippinensis* and hookworm. The varieties' frequency ranged from 20 to 40% of the samples. When detected, the average concentration for each species ranged from 6 to 190 no./L.

Septage sludge

The average dry matter was 5.4%, pH varied from 6.7 to 7.4. *E. coli*, *Enterococcus* spp., and helminth eggs were detected in all samples (Table 2). SC and MSB were detected in 80% of samples, *Salmonella* spp. in 60% of samples. Helminth ova showed high concentrations (Table 2). The frequency of the varieties ranged from 10% to 50% and *Ascaris lumbricoides* predominated (Figure 1).

Conclusions

- Untreated septage contains high concentrations of indicator and pathogenic micro-organisms.
- Septic tanks should be emptied regularly to avoid untreated septage just flowing through the tank polluting the environment.
- Septage sludge poses a high hygienical risk.
- A large variety of helminth ova species can be found in high concentrations in septage. Hence proper protection measures should be deployed to minimize health risks.
- To decrease the risk of disease transmission the sludge emptied from the septic tank needs to be sanitized before it is disposed or reused in agriculture.

Reference

- Ayres, R. M. & D. D. Mara (1996) Analysis of wastewater for use in agriculture: a laboratory manual of parasitological and bacteriological techniques. World Health Organisation.
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 Trang, D. T., K. r. Molbak, P. D. Cam & A. Dalsgaard (2007) Helminth infections among people using wastewater and human excreta in peri-urban agriculture and aquaculture in Hanoi, Vietnam. *Tropical Medicine and International Health*, 12, 82-90