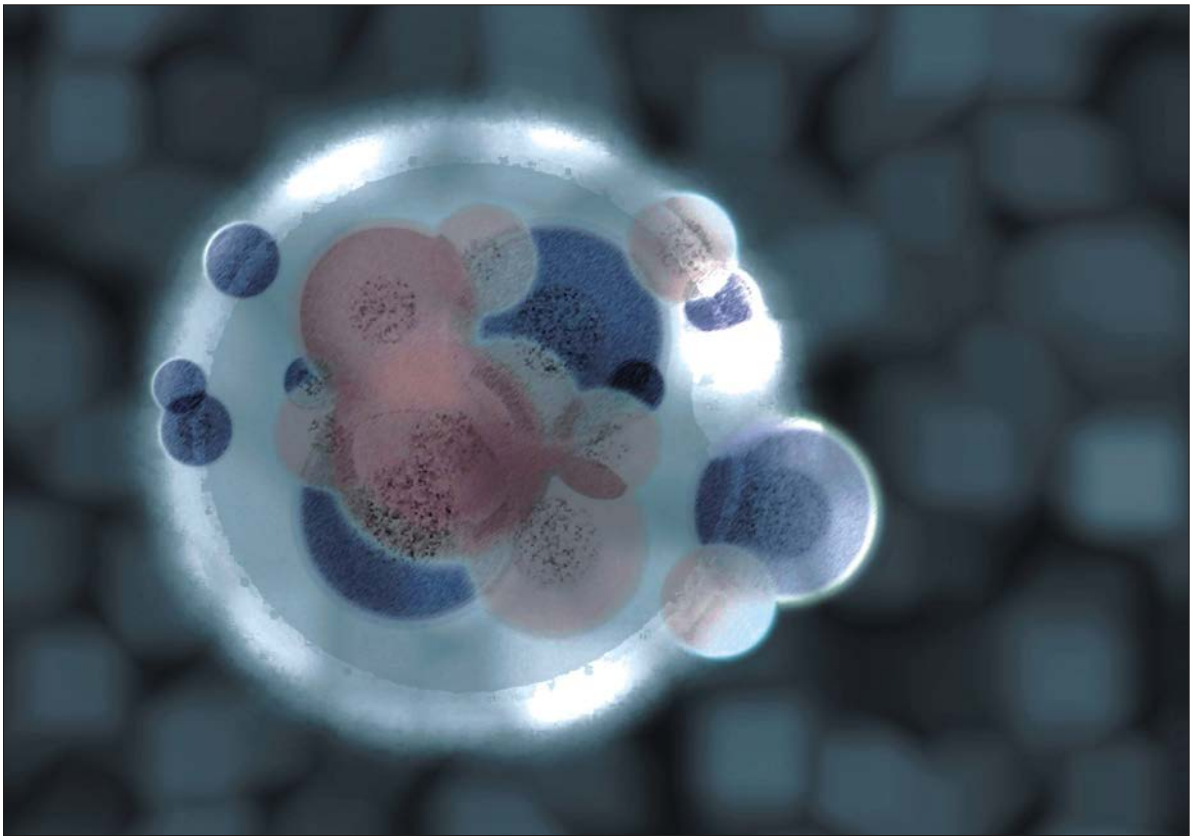

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Removal of Pathogenic Organisms from the Effluent of a Activated Sludge System Using Maturation Pond

M.B. Miranzadeh
Faculty of Environmental Health,
Medical Sciences University, Ravand Road, Kashan, Iran

Abstract: A maturation pond with 10 day hydraulic retention time was monitored to observe its ability to remove pathogenic orgamisms from the effluent of a activated sludge system. The activated sludge system received raw sewage from the Medical Sciences University. The effluent of activated sludge system had a very high concentration of fecal coliform and intestinal nematode eggs which were higher than recommended values by WHO. This effluent is not suitable for unrestricted irrigation. No intestinal nematode eggs were recovered in the pond effluent, making it suitable for unrestricted irrigation. The average of fecal coliform in pond effluent during the six month monitoring were 587 number per 100 mL which was compatible with WHO guidelines. The maturation pond with a retention time of 10 day, is an efficient treatment alternative to chlorine disinfection after activated sludge system.

Key words: Fecal coliform, nematode eggs, activated sludge, maturation pond, effluent, unrestricted irrigation

INTRODUCTION

Kashan Medical Sciences University commissioned since 1986 and at present has over 3000 students and employee in the field of medicine and health. The water consumption in university and related hospital is supplied by deep water well. The wastewater generation in this university is approximately 300 cubic meters per day. A activated sludge with extended aeration process was constructed to treat the raw wastewater. This system consists of a screening, followed by two aeration tank in parallel, one sedimentation tank and chlorine disinfection in series. Because of economical and technical problems the disinfection system was taken out of operation in two years ago. The effluent of activated sludge system discharged into absorption well without of reuse.

The reuse of wastewater in agriculture is a global practice of particular importance in arid and semi-arid regions of the Iran, such as those in the Kashan region. Wastewater reuse provides both an additional supply of water for irrigation and a source of nutrients and organic material which can act as crop fertilizer and soil conditioners[1,2].

The activated sludge system are now recognized as an efficient process to remove BOD, COD and TSS and is not able to produce high microbial quality effluent without disinfection and sand filtration the suitable for agricultural reuse[2,3].

The World Health Organization (WHO) has stated that the removal of pathogenic orgarisms is the principal objective for the treatment of wastewater that is destined for reuse in agriculture[4].

WHO guidelines, based on epidemiological assessment of health risks for treated wastewater to be reused in agriculture, recognize the considerable importance of the role that intestinal nematode play in transmitting disease through agriculture reuse[4].

This study describes investigative work carried out using a maturation pond as a tertiary treatment system for upgrading microbial quality of effluent from a activated sludge treatment plant in Kashan Medical Sciences University.

MATERIALS AND METHODS

A full-scale maturation pond was built to treat the effluent from a full-scale activated sludge treatment plant which itself received the institutional wastewater from the medical sciences university in the city of Kashan. Figure 1 shows the schematic of the treatment plant in this university. The pond were made from the compacted soil clay with 1.5 m effective depth and 10 day hydraulic retention time. Following a five month preliminary adaptation period which allowed the system to stabilize, the effluent of maturation pond was monitored in detail for six month from January to June 2004.

Grab samples of pond effluent for microbiology parameters were taken in sterile 2 L pyrex bottle at 08.00 h every morning each week. The samples were thoroughly mied before sub-samples were taken for subsequent

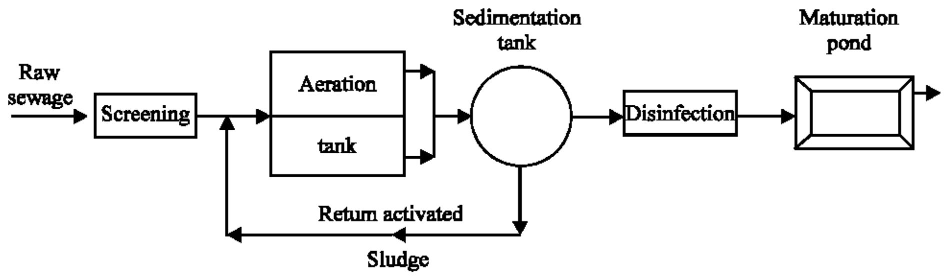

Fig. 1: Schematic of treatment plant in Kashan University

Table 1: Microbial quality of maturation pond effluent at January to June 2004

Nematode eggs	Total coliform Bac.	Fecal coliform Bac.	Nematode eggs	Total coliform Bac.	Fecal coliform Bac.
January 2004			**February 2004**		
Zero	1448	965	zero	797	797
Zero	847	113	Zero	5021	600
Zero	1632	147	Zero	2371	600
zero	1314	650	zero	1421	223
-	1310±335	469±411	-	2402±1861	555±240
March 2004			**April 2004**		
Zero	2168	1144	Zero	915	181
Zero	197	197	Zero	3903	199
Zero	2371	927	Zero	3578	915
Zero	1475	199	Zero	461	461
-	1552±981	616±491	-	2214±1777	439±342
May 2004			**June 2004**		
Zero	1762	1084	zero	1323	891
Zero	1122	825	zero	961	665
Zero	981	561	zero	892	519
Zero	1019	751	zero	762	472
-	1221±365	805±216	-	984±240	636±188

analysis. Total coliform, fecal coliform and intestinal nematode eggs including *Ascaris lumbricuides*, *Trichuris trichuria* and human hook worms were enumerated in accordance with methods described in standard method for the examination of water and waste water[5].

RESULTS AND DISCUSSION

As shown in Table 1 the number of fecal coliform in pond effluent at January were between 113 to 965 number per 100 mL, the mean concentration of fecal coliform at May and June were 805 and 636 number per 100 mL, respectively. No nematode eggs were recovered in maturation pond effluent during the six month monitoring period.

The previous study on the Medical Sciences University treatment plant with activated sludge process demonstrated that the final effluent has high concentration of fecal coliform and intestinal nematode eggs. Calculated mean values of fecal coliform and nematode eggs in the activated sludge effluent were more than 100000 number per 100 mL and 10 eggs L^{-1}, respectively. This means that such effluent quality are higher than the recommended values by WHO guidelines and isn't suitable for unrestricted irrigation[4].

The engelberge guidelines state that the wastewater treatment system should produce an effluent with≤1 intestinal nematode eggs L^{-1} and ≤1000 fecal coliform per 100 mL to permit its reuse in unrestricted irrigation (irrigation of edible crops, sports field, public parks and land scape).

The results of this research shows that no intestinal nematode eggs were detected in the maturation pond effluent through out the six month monitoring period. The mean concentration of fecal coliform in pond effluent during the study period were 587 number per 100 mL which is less than recommended values by engelbege guidelines for reuse in unrestricted irrigation[4]. Based on the results obtained by this research , a maturation Pond with 10 day hydraulic retention time was effective for 100% removal for intestined nematode eggs and 99.4% for fecal coliform in activated sludye effluent.

A series of a facultative pond followed by a maturation pond with a total retention time of 10 days in northeast Brazil showed 100% removal of nematode eggs[6]. Based on the WHO guidelines, no values set for total coliform in effluent that intended for agriculture reuse.

The removal mechanism of nemated eggs in stabilization pond is attributed to the sedimentation process due to high retention time and fecal coliform removal due to sunlight, predator, high pH and dissolved oxygen, long retention time and toxic produce by algae[6,7].

The findings of present study suggested that the substitution of chlorine disinfection by a maturation pond with 10 day hydraulic retention time after activated sludge system is able to produce the final effluent which is suitable for reuse in unrestricted irrigation.

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