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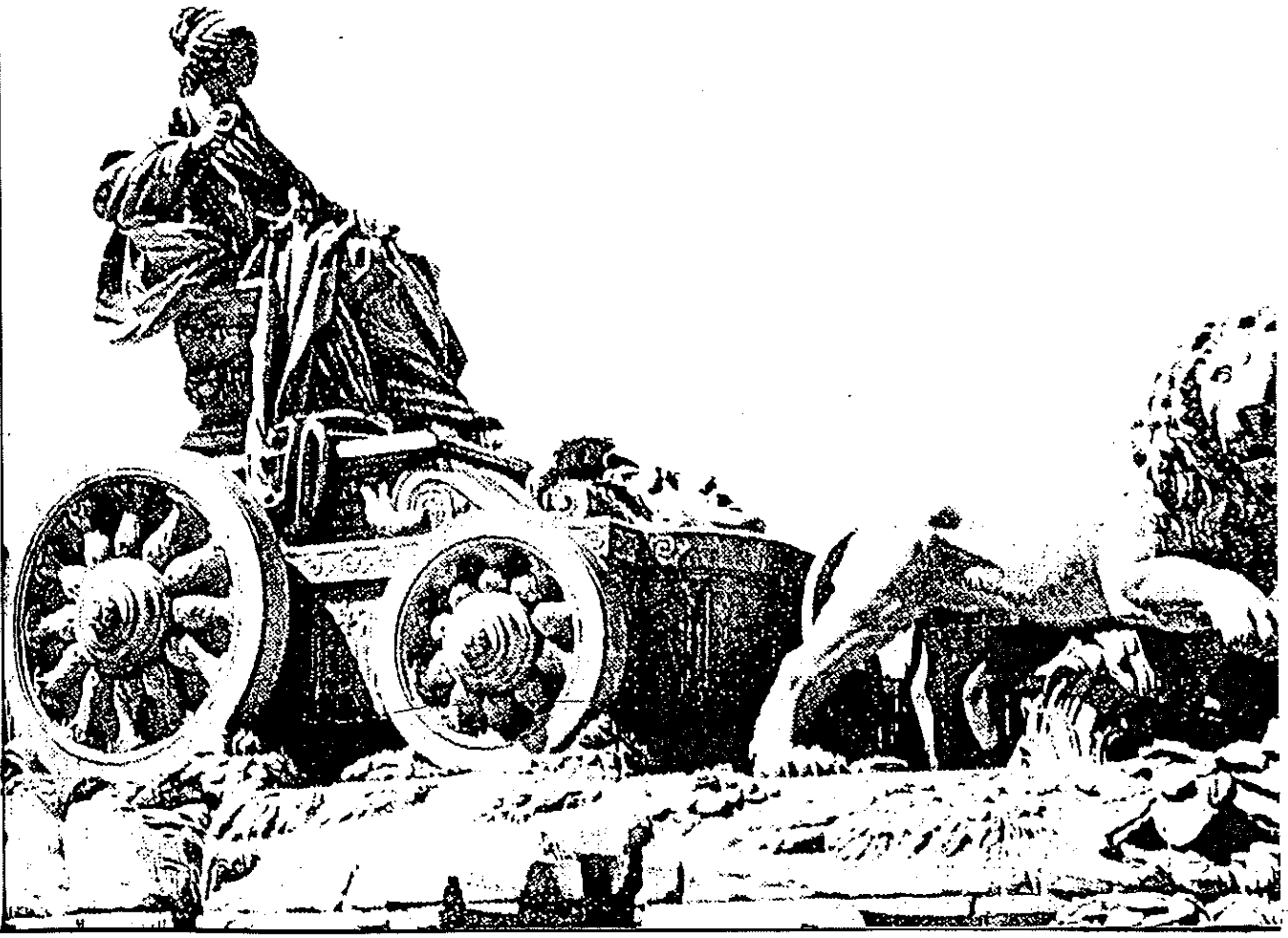

Feasibility of reuse of waste stabilization pond effluents for irrigated agriculture

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2155 f *Damasceno, S. (*), Campos, J.R.*
Department of Hidraulics and Sanitation, São Carlos School of Engineering, University of São Paulo, Brazil

Introduction

The reuse of wastewater for irrigation is being encouraged as a means of its adequate disposal. The necessity of high quality waters for domestic and industrial consumption has created the need for reuse of wastewaters, specially in arid and semiarid regions. Several countries make the reuse of wastewaters for irrigated agriculture with success(1). The reuse of wastewater for agricultural purposes offers several benefits, where the most important is the increase in the crop yield due to the expansion of irrigated areas.
Wastewater treatment, as well as the restrictions concerning type of crops irrigated with this water, have been shown to be very efficient in reducing risks of desease transmission in reuse systems. In this respect, the World Health Organization (WHO) recomended in 1989 some guidelines aimed at the protection of public health in such systems focalizing crop type to be irrigated and the intestinal nematodes and faecal coliforms concentrations on water.
In general, the conventional wastewater treatment processes without posterior disinfection, are not efficient for pathogenic organisms removal. However, waste stabilization pond systems, besides BOD removal has demonstrated to remove effectively worms and a large number of bacteria and viruses, producing very high quality effluents for irrigation. This system of treatment is characterized mainly by high efficiency, low cost and simple operation. This system is highly indicated for urban sewage treatment as well as in rural areas.
The purpose of this work is to study the feasibility of reuse of effluents of a waste stabilization pond system for irrigation, keeping in view water quality recomended for this use. This system consists of anaerobic, facultative and maturation ponds.

Methods

The study was conduced on Ajapi waste stabilization pond system in the district of Rio Claro (SP), Brazil, which receives domestic sewage produced by a population of 3,000 inhabitants. This system is shown in the figure below.

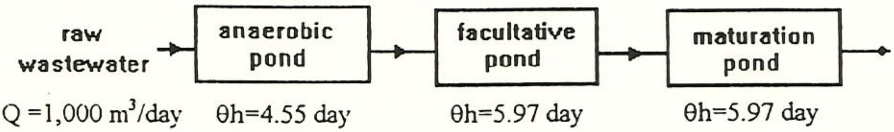

FIGURE 1: Simplified sketch of waste stabilization pond system

Samples of the effluent were collected and analysed for the pH value, alcalinity, electrical conductivity, COD, BOD_5, suspended solids, N, P, Ca, Mg, Na and heavy metals: Zn, Pb, Cr, Cu, Cd, Ni, Mn and Fe which are the important parameters for the characterization of irrigation water. Also sludge samples from each pond were collected and analysed for heavy metal concentrations.

Results

The Table 1 shows the results of average values obtained from the samples.

TABLE 1: Pond system effluent water quality parameters.

Parameter (mg/l)	Value	Parameter (mg/l)	Value	Maximum permissible for irrigation(1)
COD	92	Mg	8.3	—
BOD_5	27	Na	43.9	—
Suspended solids	73	Cr	ND	0.10
Sodium adsorption ratio	6.86	Cu	ND	0.20
Total nitrogen	7	Mn	0.20	0.20
Ammoniacal nitrogen	1.8	Fe	0.37	5.00
P	2.4	Ni	ND	0.20
Ca	73.6	Cd	ND	0.01
Alcalinity	58	Pb	ND	5.00
Electrical conductivity (ms/m)	36	Zn	ND	2.00
pH	7.1			

ND: not detected

As seen in Table 1, the effluent water quality is such that it can be utilized for irrigation. The oligoelement concentrations are lower than maximum permissible concentrations for irrigation and the others parameters also are in agreement with the patterns for wastewater irrigations(1). The sodium adsorption ratio (SAR) shows acceptable value for irrigation purposes. In another study conducted on this same system of ponds(2) concentrations of total coliforms for the effluent, before and after disinfection with ultraviolet radiation, were found to be 9,100 and 23/100ml respectively. This result further shows that the effluent without disinfection can be used for agriculture as long as the guidelines proposed by the WHO are obeyed. In the case of the disinfected effluent its unrestricted use should be permitted for irrigated agriculture.

The sludges retained in these ponds also showed low concentrations of oligoelement and thus, can also be applied to the soil on the ocasion of pond cleaning.

As a conclusion, one can state that this system of ponds is very efficient for wastewater treatment and generates a very high quality effluent for irrigation. It can provide the water crop requirements besides the essential nutrients like N, P and others shown in Table1, leading to economy of fertilizer and lower production costs.

(1) AYERS, R.S.; WESTCOT, D.W. *A qualidade da água na agricultura.* Campina Grande, PB, UFPB, 1991. 218p. (Estudos FAO Irrigação e Drenagem, 29 Revisado I).

(2) DANIEL, L.A.; CAMPOS, J.R. *Desinfecção de efluentes de sistemas de tratamento aeróbio e anaeróbio. Parâmetros cinéticos de desinfecção de coliformes com radiação ultravioleta.* XXXVI Congresso nacional y 2o. Internacional del Caribe. Cartagena de Indias, Colombia, octubre 7 al 10 de 1993.