"DOMESTIC WASTEWATER A RESOURCE THAT CREATES LIFE IN THE DESERT"

Autor: Mgr. Blgo. Cesar Huanacuni Lupaca
Av. Bolognesi N° 965- Tacna -Perú
e-mail: chuanacuni@yahoo.es

ABSTRACT:

The reuse of wastewater from secundary pond in the Magollo wastewater treatment plant (WWTP) in Tacna (Peru) which is located in the head of the Atacama Desert one of the driest places in South America has allowed the implementation of water purification technology also known as green filters. At this zone known as Ecological Surroundings of Magollo a volume flow rate of 15 l/s treated wastewater is channeled to create an artificial forest with a surface area of 104 hectares (1'040,000 m^2) as a result of utilization of treated wastewaters for tree irrigation like eucalyptuses, casuarinas, pines and molles.The implementation of this integral system has allowed create life and a great "green lung" in these desert and the consequent formation of green areas, recreational camping areas, an ecological zoo and botanical garden to improve the local environmental and to create new job opportunities.

INTRODUCTION:

The City of Tacna-Peru, located in the head of the Atacama Desert, one of most barren of South America, presents hydric deficit, which forces to consider wastewater a sustainable alternative to the creation of artificial forests and one ways to save drinking water *(Metcalf & Eddy, 1996).* The City of Tacna has two wastewater treatment plants (WWTP of Cono Sur and WWTP of Magollo). The WWTP of Magollo treats a flow rate of 310 l/s altogether, the treatment is based stabilization ponds, from which derives a flow rate of 35 l/s to an artificial forest. The WWTP of Cono Sur is based in a facultative pond and treats an average flow rate of 60 l/s *(Technical Reports, 2010).*

METHODS:

The WWTP of Magollo is located in the Southwest of Tacna, between the Km- 3,2 and 5,2 of the highway to Boca de Rio beach. Nowadays five pairs of stabilization ponds are operative (five primary ponds and five secondary ponds). The first pair of ponds is in maintenance mode (primary pond N°01 and secondary pond N°01). The plant has grates, by-pass systems, Palmer Bowlus flume, and channels of distribution *(Technical Reports, 2010).*

At exit of the secondary pond an average flow of approximately 15 l/s is derived to Ecological Surroundings irrigation, treatment system using green filters with intermittent irrigation system every 7 days is applied *(Salas et al, 2010).*

Water purification treatment has allowed the use of 104 hectares (1 ' 040.000 m^2) between tall tree, with emphasis on the species *Eucalyptus spp* "eucalyptuses", *Casuarina cunninghamiana* "casuarinas", P*inus spp* "pines", *Schinus molle Linneo* "molle".

For soccer fields irrigation the Municipality of Tacna has implemented an additional experimental treatment with terrestrial annelid worms of the Family Lumbricidae of the genus *Lombricus (L. terrestres)* for obtaining worm humus.

The main wastewater and effluents parameters for each process was realized by standard methods 2510 B, 9221 E, 5210 D, 4500–H+B, 5520 *(Standard Methods, 2005).*

RESULTS AND DISCUSSION:

Derived values from wastewater treatment processes was taken on August 11, 2010, for main microbiological quality parameters at the entrance and exit of the WWTP of Magollo, as well as from flow rate of secondary pond derived to the Artificial Forest, are shown in Table 1.

Tabla 1: Microbiological results of wastewater samples from WWTP of Magollo.

Evaluation Parameters	*Entrance WWTP of Magollo*	*Exit WWTP of Magollo*	*Derived wastewater from Secondary ponds to Ecological Forest*	*LMP D.S. 003–2010 MINAM*[1]
Conductivity	*1897 uS/cm*	*1671 uS/cm*	*1519 uS/cm*	*–*
Fecal coliforms (NMP/100 mL)	*33000000*	*150000*	*10000*	*10000*
DBO_5	*473 mg/L*	*115 mg/L*	*76 mg/L*	*100 mg/L*
Eggs of Helminths	*01 Organism/L*	*Absence /L*	*Absence /L*	*Absence/L*
pH	*7.1*	*7.7*	*7.4*	*6.5 – 8.5*
Oils and Grease	*56.3 mg/L*	*12.8 mg/L*	*3.2 mg/L*	*20*

Source: Own elaboration based on ***microbiology laboratory analysis*** *EPS Tacna*

1 *MINAM:* ***Ministry of the Environment***

The quality of effluent derived to the ecological forest according to the legislation currently in force, corresponds to the category A, this means that is apt only for sport fields and tall trees irrigation or for forestation, landscapes (green surroundings) *(OMS, 1989).*

Photographic views of the Ecological Wastewater Treatment Systems in Magollo.

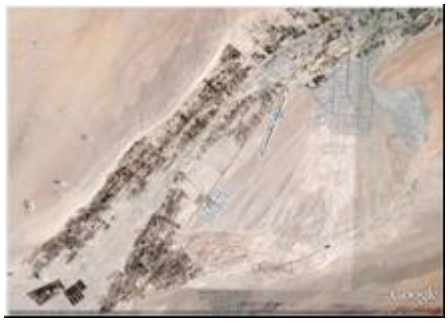

Fig 1: Satellite Image of Tacna in desert

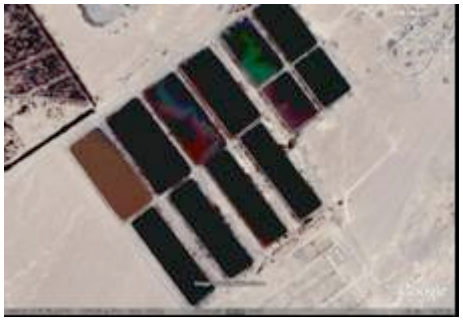

Fig 2: Satellite Image WWTP of Magollo

Fig 3: Entrance WWTP of Magollo

Fig 4: Exit WWTP of Magollo.

Fig 5: Wastewater effluent for forest irrigation.

Fig 6: Refining Worm System.

Fig 7: Refining wastewater used for soccer fields.

Fig 8: Green Areas Irrigated with Wastewater.

Fig 9: Relaxation Area in Magollo

irrigation.

Considering the physical contact and the falls of the people on green areas and soccer fields, the Municipality of Tacna has implemented an additional experimental treatment with biofilters inoculated with earthworm (Family: Lumbricidae, Genus: Lombricus *(L. terrestres),* for obtaining worm humus, which effluent prototype was of 0,03 l/s and it was not experience odor problems.

Wastewater treatment applications at ecological forest in Magollo:

Fig 10: Treatment with green filters system

Fig 11: Green filters with Eucalyptuses

Fig 12: Ecological Zoo

Fig 13: Ostrich in the ecological zoo

Fig 14: Wild birds

Fig 15: Buffalos in the zoo

Fig 16: Botanical Garden

Fig 17: Cactus at the Botanical Garden

Fig 18: Environmental Education

CONCLUSION:

- The reuse of treated wastewater in Tacna (Peru), has allowed create in its first stages an artificial ecosystem in the desert with 104 hectares altogether and the consequent formation of artificial forests, zoos, botanical gardens and relaxation areas, contributing to the formation of ecological culture and the environmental care through water purification treatments combined with ponds and green filters.

REFERENCES:

- **Metcalf y Eddy,I.;** (1996). Ingeniería de Aguas Residuales Tratamiento, vertido y Reutilización. 3ra Ed. Edit. McGraw-Hill. México. 191-209 p.
- **OMS**, (1989). Directrices de Calidad Microbiológica y Parasitológica recomendadas para el reuso de aguas residuales en agricultura.
- **Reportes Técnicos**; (2010). Informes Técnicos Mensuales EPS Tacna S.A. División de Operaciones.
- **Salas,R.J.J.,Pidre B.J.R. y Cuenca F**. (2010). Manual de Tecnologías No Convencionales para la Depuración de Aguas Residuales.Coria Grafica.España.
- **Lara Borrero, A.; (1999)**. Depuración de Aguas Residuales Municipales con Humedales Artificiales. Tesis de Posgrado Universidad Politécnica de Cataluña. Barcelona-España. 38-45 p.
- Depuración de Aguas Residuales.23 de Julio del 2009. http://www2.cbm.uam.es/jalopez/personal/SeminariosVarios/ERARtexto.htm
- Centro de Nuevas tecnologías del agua. 20 de julio del 2009. http://depuranat.itccanarias.org/index2.php2.option=com.proyectos&func=ver&.id=9