



## TECNOLOGIA DE PANTANOS ARTIFICIALES S.A. DE C.V.



**At Tecnología de Pantanos Artificiales, SA de CV, we have a long tradition of breaking new ground. A clear set of principles and corporate values have allowed us to readily adapt to changes in the market without sacrificing the quality, honesty and integrity of our work. Since our founding, this has been our recipe for success.**

**Website:** [www.tecnologiadepantanosartificiales.com](http://www.tecnologiadepantanosartificiales.com)

**In Mexico:** 9933114552.

**In the United States:** 936-828-6180

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## TECNOLOGÍA DE PANTANOS ARTIFICIALES S.A. DE C.V.

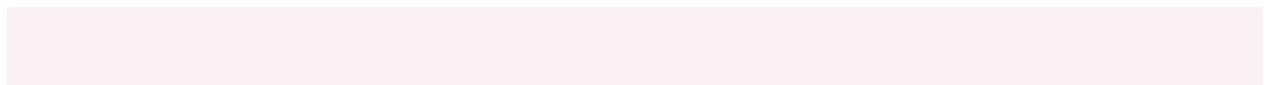
It is a company founded in 1999, combining the works and assets of Impulsora Nacional de Tecnología, S.A. de C.V., as well as the Center for Research Studies of the Southeast, A.C., institution that provides it with scientific support.

Our company to achieve its objectives optimally, has specialized staff that collaborates with leading international companies in its field and has had as its main mission to participate in the development of Mexico in various aspects of which two stand out:

- **Public Finance Consulting and The wastewater Treatment**

**Tecnología de Pantanos Artificiales, S.A. de C.V. (TPA)**, provides specialized services for Economic and Financial Consulting: State and municipal collection, administrative modernization and cadastral systematization for governments.

Our required services are provided with more efficient solutions to today's problems faced by businesses and governmental entities. These solutions are a combination of economic, financial, engineering, social, cultural and ecological factors, and therefore multidisciplinary work is the general way we proceed with all of our studies and consulting.



Our company to achieve its objectives optimally, has specialized staff that collaborates with leading international companies in its field and has had as its main mission to participate in the development of Mexico in various aspects of which two stand out:

For most of their adult lives, the people at TPA, have implemented sustainable solutions for water pollution problems in different parts of the World, through the design and construction of artificial wetlands that meet **International Standards, are very efficient, and have very low costs of maintenance and operation. The technology we promote is very robust**, and our treatment plants have operated with virtually no maintenance and often no operation for long periods of time. Furthermore, the habitat lost is recovered as a sustainable space.

**We offer sustainable cutting-edge technology for complete waste water treatment of any kind, including contaminated lakes and rivers through constructed wetlands of different types.**

**Firdaus Jhabvala, our senior partner, has designed, and built, in Mexico Constructed Wetland treatment plants. Our stellar plant at Macultepec in the State of Tabasco, Mexico, is the largest of its type anywhere, and receives raw sewage and turns out quality effluent.**

In Mexico, we have worked with governments of nine states (Campeche, Chiapas, Guanajuato, Michoacán, Oaxaca, Quintana Roo, Tabasco, Tamaulipas, and Tlaxcala) and a larger number of municipalities to develop projects in the area of water, public finance, administration, and planning. **We work in any capacity that the client requires**, including diagnoses of existing treatment plants, the design of new treatment plants, and partnerships for transferring technology. **TPA works very closely with all institutions interested in defending the Ecology, and especially with one of Mexico's premier universities in the area of Ecology, Juarez University of Tabasco.**

**TPA has constructed sanitation plants that have removed approximately 98% of the polluting materials found in the wastewater received by the facility. TPA was founded by Dr. Firdaus Jhabvala, who holds patents for subsurface and free water**



**flow wetlands.** (Patent Numbers 200096 and 248616 granted by the Mexican Institute of Industrial Property). TPA's technology has been certified by Mexico's National oil and gas firm, PEMEX, and TPA is considered a Scientific and Technological firm by CONACYT, Mexico's National organizer of Science and Technology.



**TITULO DE PATENTE DE INVENCION NUMERO: 200096**

TITULAR(ES):	FIRDAUS JHABVALA MARSHALL
DOMICILIO(S):	PASEO LA CEIBA N°. 119, COLONIA PRIMERO DE MAYO, VILLAHERMOSA, TABASCO, MEXICO
DENOMINACION:	TRATAMIENTO DE AGUAS RESIDUALES MEDIANTE PANTANOS ARTIFICIALES DE FLUJO SUBTERRANEO
CLASIF. INT:	C02F1/00
INVENTOR(ES):	FIRDAUS JHABVALA MARSHALL

**SOLICITUD**

NUMERO: 9406633	FECHA DE PRESENTACION: 30 DE AGOSTO DE 1994	HORA: 10:30
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**PRIORIDAD**

PAIS:	FECHA:	NUMERO:
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ESTA PATENTE CONCEDE A SU TITULAR EL DERECHO EXCLUSIVO DE EXPLOTACION DEL INVENTO RECLAMADO EN EL CAPITULO REIVINDICATORIO Y TIENE UNA VIGENCIA DE VEINTE AÑOS IMPRROROGABLES CONTADOS A PARTIR DE LA FECHA DE PRESENTACION DE LA SOLICITUD.

FECHA DE EXPEDICION  
8 DE DICIEMBRE DE 2000

EL DIRECTOR GENERAL

A handwritten signature in dark ink, appearing to read "Jorge Amigo", is written over a horizontal line.

LIC. JORGE AMIGO CASTAÑEDA





## **TÍTULO DE PATENTE NO. 248616**

<b>Titular(es):</b>	FIRDAUS JHABVALA MARSHALL.		
<b>Domicilio(s):</b>	Paseo La Ceiba # 119, Col. Primero de Mayo, 86190, Villahermosa, Tabasco, MEXICO		
<b>Denominación:</b>	PANTANOS ARTIFICIALES DE FLUJO SUPERFICIAL PARA TRATAMIENTO DE AGUAS RESIDUALES.		
<b>Clasificación:</b>	Int.CI.8: C02F3/06; C02F3/32		
<b>Inventor(es):</b>	FIRDAUS JHABVALA MARSHALL		

<b>SOLICITUD</b>		
<b>Número:</b>	<b>Fecha de presentación:</b>	<b>Hora:</b>
PA/a/2003/009620	13 de octubre de 2003	12:05

<b>PRIORIDAD</b>		
<b>País:</b>	<b>Fecha:</b>	<b>Número:</b>

ESTA PATENTE CONCEDE A SU TITULAR EL DERECHO EXCLUSIVO DE EXPLOTACIÓN DEL INVENTO RECLAMADO EN EL CAPÍTULO REIVINDICATORIO Y TIENE UNA VIGENCIA IMPRORROGABLE DE VEINTE AÑOS CONTADOS A PARTIR DE LA FECHA DE PRESENTACIÓN DE LA SOLICITUD.



Fecha de expedición: 10 de julio de 2007

EL DIRECTOR DIVISIONAL DE PATENTES

  
QUÍM. FABIÁN R. SALAZAR GARCÍA



MX/2007/B4787



Oficio

Remitente		SUBDIRECCIÓN DE AUDITORÍA DE SEGURIDAD INDUSTRIAL Y PROTECCIÓN AMBIENTAL		Fecha	Villahermosa, Tab., 26 de marzo de 2013	
Destinatario		OFICIO UNIDO		Número	PEP-SASIPA- GPSIPA-	259 055 -2013 -2013
Asunto:				Demostración Técnica de la Tecnología de Pantanos Artificiales.		
				Anexo <input type="checkbox"/>		

Ing. José R. Serrano Lozano.- Subdirector de Producción Región Marina Noreste.  
Ing. Juan Arturo Hernández Carrera.- Subdirector de Producción Región Marina Suroeste.  
Ing. Primo Luis Velasco Paz.- Subdirector de Distribución y Comercialización.  
Ing. Juan Javier Hinojosa Puebla.- Subdirector de Desarrollo de Campos.  
Ing. Baudelio Ernesto Prieto de la Rocha.- Subdirector de la Unidad de Negocio de Perforación.  
Ing. José Antonio Escalera Alcocer.- Subdirector de Exploración.  
Ing. José Luis Fong Aguilar.- Subdirector de Producción Región Sur.  
Ing. Antonio Narváez Ramírez.- E.D. Subdirección de Producción Región Norte.  
Ing. Manuel Alegría Constantino.- E.D. Subdirección de Servicios a Proyectos.  
Ing. José Guadalupe de la Garza Saldivar.- E.D. Subdirección de Mantenimiento y Logística.

Me refiero a la demostración técnica en materia de Seguridad, Salud en el Trabajo y Protección Ambiental, que el pasado 16 de octubre del 2012 se llevó a cabo durante la visita de nuestro personal, para conocer el funcionamiento de la Tecnología de "Pantanos Artificiales", presentada por la compañía **Pantanos Artificiales S.A. de C.V.** la cual se utiliza para el servicio de tratamiento de aguas residuales de la localidad de Villa Macultepec, de esta ciudad de Villahermosa, Tabasco.

Al respecto y conforme a la revisión del soporte documental, así como a la visita al sitio y con los resultados del laboratorio de la calidad del agua que se descarga, se puede considerar esta tecnología como una opción para el tratamiento de aguas residuales de tipo municipal que requieran en las instalaciones de PEP, analizando las ventajas y desventajas, las cuales manifestamos a continuación:

#### Ventajas

- Menor cantidad de equipos y reactivos utilizados para el tratamiento, por lo tanto se deduce que es de bajo costo la operación y mantenimiento, en comparación con otros tipos de tratamientos convencionales.
- El gasto de electricidad es menor a la que se usa para una planta convencional.
- Los pantanos artificiales son una reserva estratégica para una gran variedad de aves, mamíferos, insectos y reptiles.



## Treatment plants built by TPA in Mexico with Natural Technology:

- **Santa Cruz Quilehtla, State of Tlaxcala, México, 1995**

Quilehtla is a small community of 6,000 people east of Mexico City in the Central Highlands. The community wanted a simple wastewater treatment system that required little or no maintenance, was inexpensive to build, and had no machinery and the least number of movable parts. The requirements at Quilehtla are common in many small communities all over the World.

The Quilehtla treatment plant began in late 1993 with the development of diagnostic and executive project was approved in 1994 and construction began with the goal of reducing pollution in the Zahuapan River basin.

The Constructed Wetland was designed to treat 380 m<sup>3</sup>/day of wastewater generated by approximately 5,000 inhabitants. The design of the treatment plant consists of modified Imhof tanks for primary treatment, subsurface flow constructed wetlands for advanced secondary treatment, and reed beds for digesting the sludge produced in the tanks. **This is a totally passive system.**

**This system was built with local labor and 90% of local materials. No energy is required for treatment, only to locate sewage pretreatment section of the plant. The treated water is used for irrigation purposes.**



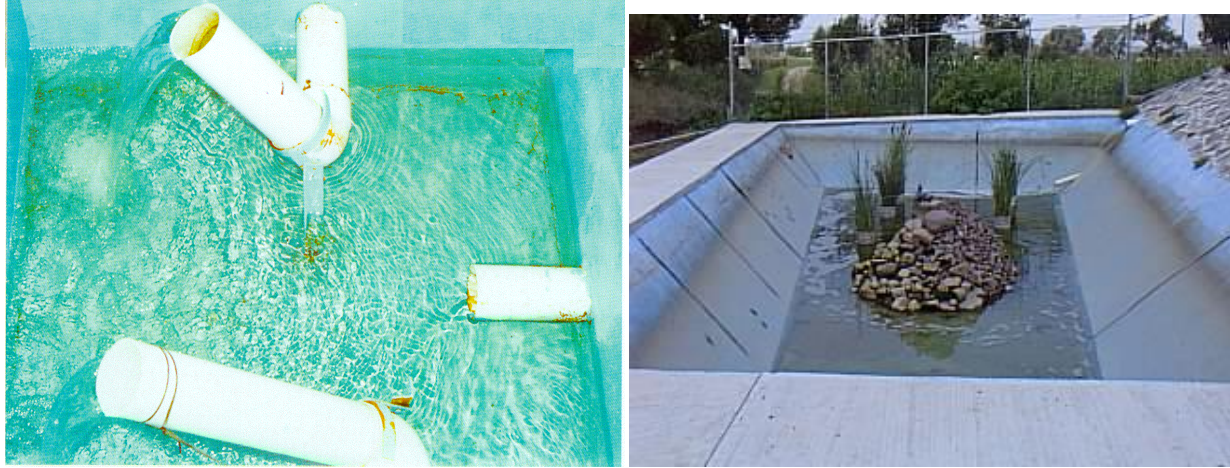
The Plant uses scoria as substrate material, which increases the wetland's porosity percentages of conductivity in comparison with gravel.

**The operating cost is only 10 US cents/m<sup>3</sup>.**

**The results are spectacular with little operational, human and mechanical stress, due to the fact that nature works tirelessly to treat wastewater.**



Effluent from the Constructed Wetland



The Treatment plant at Quilehtla removes 94.30% of the BOD, significantly decreases Biological Oxygen Demand (BOD) by 94.10%, and Total Suspended Solids (TSS) by 97.50 %.

- **Constructed Wetland of El Carmen Tequexquitla, Tlaxcala, 1998**

El Carmen Tequexquitla, located in the eastern region of the state of Tlaxcala, has a population of almost 20,000 inhabitants. The sewage used to drain into the Totolcingo Lake, one of the last reservoirs of reasonably clean water left in the Mexican Highlands.

The design of the constructed wetland was for a capacity of 1,728 m<sup>3</sup>/day, and consists of Pretreatment, Settling Tank, Sludge Digestion, Biofilter, Wetland Cells and Sand Filters.







**The results are outstanding**, because with this type of system BOD removal went from 600mg/l in the Influent to 6 mg/l in the Effluent, and TSS was reduced by 99.01%, **standards of good tertiary treatment.**



Simple to Operate and Maintain  
**Operating cost is just 6 US cents/m3**  
Requires minimal use of electricity





- **Constructed Wetland of Cuitzeo del Porvenir, Michoacán, 2000**

Cuitzeo del Porvenir is a town nestled on the shores of Lake Cuitzeo. The Treatment Plant has Pretreatment, Clarifier, Sludge Cells, and Free Water Wetland Cells, with a capacity of 1,728 m<sup>3</sup>/day.

BOD Influent: 349 mg/l de DBO

BOD Effluent: 29 mg/L

The operating cost is only 3 US cents/m<sup>3</sup>.



## Macultepec, the Largest Complete Wetland Treatment Plant of its Kind

Macultepec is a small town with 60,000 inhabitants spread around it located in the State of Tabasco of Mexico. The municipal sewer had been discharging untreated sewage into the nearby Centla Wetlands Biosphere Reserve, a biologically diverse area that is **home to more than 550 species of flora and fauna.**

**Integral Sanitation Strategy:** Treatment consists of a primary sedimentation tank, a reed bed for treatment of solids, and surface flow constructed wetland, plus a UV Disinfection Unit.

**Ecological Objectives:** Defend Nature, no use of chemicals, and zero electricity use in processing the waste water.

**Time for Construction:** 1 year.

**Investment:** 2.9 million US Dollars (including the cost of land and the final design).  
**= \$ 48.33 per capita.**

**Total Life Cycle Cost (50 years) per m<sup>3</sup>: 2.94 US Cents.**



Cost of Operation, Maintenance, Repair and Replacement (OMRR) represents 2% of the annual investment.

**Flow Capacity=** 10,800 m<sup>3</sup>/day

**Influent BOD =** 350 mg/L

**Effluent BOD:** 18 mg/L



## Ecological Education Program implemented in 2004

The first step towards the sustainability of our resources is to change the attitude and culture of present-day education.

**Guided Tour of the Wastewater Treatment Plant in Macultepec with students from different schools.**

### High School No. 37



### Juarez University of Tabasco



## Diverse Schools and Colleges





## ¿Why should you choose Constructed Wetland Technology for Clean Wastewater?

- ◆ High Productivity and Efficiency with great Simplicity.
- ◆ Has very low investment, operation and maintenance costs.
- ◆ No chemicals, biological additives or electricity for Treatment.
- ◆ Eliminates odor problems, mosquitoes and Total Sludge Disposal, not just Sludge Transfer.
- ◆ Can be operated by members of the community for its simplicity.
- ◆ Creates a new environment for local flora and fauna.
- ◆ Does not cause more air pollution as with conventional mechanical treatment technologies.
- ◆ Can be combined with most existing Treatment Plants.
- ◆ A flexible size and can be installed anywhere without much additional work to collect the wastewater.
- ◆ Allows use of materials and labor from the region for both its operation and construction.
- ◆ No movable parts or large structures.





## Our Staff:

**Firdaus Jhabvala.** Firdaus is dedicated to wastewater treatment and water technology in general. He has written and published in the field of wastewater treatment with wetlands, and holds two patents in the field. He has designed treatment plants for private companies and public institutions in several parts of Mexico. Firdaus has a PhD from the University of Pennsylvania in Economics, and has advised the Mexican government, as well as many state and municipal agencies on financial matters, and links Water Issues to Financial Topics. Firdaus also specializes in developing strategies for financing of infrastructure projects, which are often essential to the realization of many water supply and wastewater treatment and reuse infrastructure.

**Eric M. Kofoed.** Eric holds a Ph.D. in Molecular and Cell Biology, University of California, Berkeley, 2012. His degree was in Biological Sciences from the prestigious Reed College, Portland, Oregon, 1999. He has worked in a dozen countries and is a specialist in biological, genetic and ornithological research.

**Darío Vásquez Antonio.** Expert in Social Development. With a Doctorate in Planning from the Technological Institute of Oaxaca, Dario has a life of working with communities in the Southeast part of Mexico on issues related to water.

**Josefina Osorio Avalos.** Administration. Josefina has a Masters in Applied Economics for Business from the University of the Vale of Mexico, 2002. Her areas of work and interest include Studies in the Economics of Water, Planning, Accounting, and Finance.

**José Ledesma Rosique.** Jose has a degree in Industrial Chemical Engineering from the Technological Institute of Villahermosa, 1979. Jose has extensive experience with the technology of Constructed Wetlands, having participated in all aspects of the plants in Macultepec and in Cuitzeo. Jose has experience in the areas of Environmental Safety Planning, Safety Inspections and Environmental Protection, Environmental Audits, Environmental Diagnostics Development, and Environmental Management.

**Farida Jhabvala Romero.** Farida has a degree in Biology from Reed College, Portland, Oregon, 2000. Her main areas of work are in the areas of research in biology, technology and society. Farida is a Public Health Specialist and reports on social issues for Bilingual Radio out of San Francisco, and National Public Radio in the United States.

**Jesus Jaime Cervantes Cervantes.** Legal and Tax Specialist. Jesus has a Bachelor of Business Administration and a Bachelor of Law from the University of Guadalajara, 1975 and 1985.

**Héctor Osorio Avalos.** Hector is an Electrical Engineer from the Universidad Juarez Autonoma de Tabasco, 1991. He has worked extensively as Electrical Planner and as an Analyst of Unitary Prices.

## **Main Studies and Wastewater Projects:**

- **Executive Project for a Wastewater Treatment Plant with Constructed Wetlands, Santa Anita Huiloac, Tlaxcala (1993).**
- **Study and Management Plan for the Illusions Lagoon in Villahermosa, Tabasco (1993-1994).**
- **Executive Project for a Wastewater Treatment Plant with Constructed Wetlands for up to 500 m<sup>3</sup>/day in the Municipality of Santa Cruz Quilehtla, Tlaxcala (1993-1995).**
- **Executive Project for a Wastewater Treatment Plant with Constructed Wetlands for up to 1,728 m<sup>3</sup>/day, Municipality of El Carmen Tequexquitla, Tlaxcala (1997-1998).**
- **Executive Project for a Wastewater Treatment Plant with Constructed Wetlands capable of 6,912 m<sup>3</sup>/day, Municipality of Comalcalco, Tabasco (1999-2000).**
- **Executive Project for a Wastewater Treatment Plant with Constructed Wetlands with a capacity of 3,456 m<sup>3</sup>/day in the Municipality of San José Iturbide, Guanajuato (1999-2000).**
- **"Constructed Wetlands: Alternatives for treatment of waste water", presented at the Universidad Iberoamericana, Mexico, D. F., 2001.**
- **"Municipal Health Planning", presented at the First Meeting of Healthy Municipalities, Tlaxcala, 2000 at the site of the Wastewater Treatment Plant of El Carmen Tequexquitla, Tlaxcala, 2000.**
- **"Executive Project for the Design and Construction of the Wastewater Treatment Plant with capacity of 1,728 m<sup>3</sup>/day in Cuitzeo, Michoacan. 2000-2001."**
- **"Executive Project of the Wastewater Treatment Plant of the metropolitan area of Villa Union," 2003.**
- **Construction, commissioning and Operation of the Wastewater Treatment Plant of Villa Union, Tabasco, 2004-2005.**
- **Diagnosis and Rehabilitation of the Wastewater Treatment Plant at Cuitzeo, Michoacan, 2010.**

- "Executive Project for the Design and Construction of the Wastewater Treatment Plant Residential subdivision Los Bosques en Nacajuca, Tabasco. Mexico, 2016."
- "Executive Project for the Design and Construction of the Wastewater Treatment of Frontera City, Municipality of Centla, Tabasco. Mexico, 2017."
- "Executive Project for the Design and Construction of the Wastewater Treatment of Emiliano Zapata City, Municipality of Emiliano Zapata, Tabasco. Mexico, 2017."
- "Cost-Benefit Study of measures to lessen the Impact of Climate Change in the Metropolitan Area of San Salvador" to the United Nations, 2011.

