

1. Introducing PAITAR: A compact, AI-driven solution for streamlined wastewater management

PAITAR is our patent-pending technology, engineered as a modular, decentralized, and self-operated solution. Its design ensures adaptability, without compromising efficiency, across a wide spectrum of challenging influent qualities. By seamlessly integrating advanced artificial intelligence control with proprietary nanomaterials within its high-speed tubular reactors, PAITAR not only optimizes treatment time and delivers energy efficiency, but also ensures rapid deployment and scalability, thereby fundamentally facilitating the valuable resource recovery.

2. Proven Performance & Development Milestones

Independent validation by accredited water quality laboratories confirms PAITAR's treatment effectiveness. Since 2023, our rigorous development efforts have yielded significant milestones, clearly demonstrating PAITAR's potential for industrial scaling and deployment in challenging environments like the Oil & Gas sector:

- **Unprecedented Treatment Speed:** In 2023-2024, we successfully developed and tested high-speed reactors (1 LPS prototype) that dramatically reduced treatment time for complex industrial wastewaters (e.g., textile and polymer fabrication) from 48 hours to just 20 minutes. This unparalleled operational efficiency of our proprietary advanced oxidation and selective adsorption technologies demonstrates effectiveness against diverse and challenging contaminants, including hydrocarbons and suspended solids, often found in produced water. (Appendix 1)
- **Scalability & Intelligence:** By 2024, we engineered a 15 LPS "Smart Pipelines" pilot plant (Appendix 2), integrating an AI microcontroller for in-line optimization of the treatment process. This system proves its readiness for large-scale industrial deployment and modular integration within existing O&G infrastructure.
- **Robust Intellectual Property:** We are actively pursuing 6 patent applications in 2025. This ensures the uniqueness and defensibility of the PAITAR solution, providing a secure foundation for licensing and long-term partnership.
- **Autonomous AI-Powered Operations:** Our in-house SaaS, also developed in 2025, provides real-time control, remote monitoring, and predictive maintenance capabilities. This ensures optimal system performance with minimal operational oversight, critical for remote and autonomous O&G operations.

3. Independent technical & economic validation for O&G applications

Recognizing that the adoption of advanced technology in the Oil & Gas sector demands rigorous, independent verification, PAITAR is undergoing comprehensive technical and economic validation at the **Brackish Groundwater National Desalination Research Facility (BGNDRF)**. This crucial assessment is scheduled for completion by **September 2026**. The entire validation process would be rigorously conducted and directly supervised by the **New Mexico Produced Water Research Consortium (NMPWRC)** and its associated entities, ensuring an impartial and scientifically robust evaluation of PAITAR's performance for produced water treatment.

During these critical trials, there will be evaluated key parameters for successful industrial applications, directly addressing the core concerns of O&G operators:

- **Hydraulic Retention Time (HRT):** Demonstrating the rapid processing speed and efficiency of our treatment, which translates to a smaller system footprint and higher throughput for your operations.
- **Operating Expenses (OPEX):** Quantifying the significant economic advantages of PAITAR's operation, offering substantial cost savings compared to conventional treatment methods.

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- **Treated Water Quality (Chemical Composition Output):** Ensuring the treated water consistently meets quality standards, enabling regulatory compliance and opening pathways for beneficial reuse.
- **Effluent Toxicity:** Verifying the environmental safety and compliance of the treated water, mitigating environmental risks and supporting responsible water management.

This detailed evaluation, with results available by September 2025, will provide definitive, third-party proof of PAITAR's superior technical performance and compelling economic viability for your produced water management needs.

OPUS_{2g}
Two great challenges

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APPENDIX 1: PAITAR's Rapid Treatment of Complex Industrial Wastewater: Performance Data and Applicability to Produced Water

This appendix details the proven, rapid treatment capabilities of PAITAR's proprietary technology, demonstrating its effectiveness against challenging contaminants and its direct applicability to the complex nature of produced water in Oil & Gas operations.

1.1 PAITAR 1 LPS Prototype & Core Technology

Our 1 Liter Per Second (LPS) prototype, developed and tested in 2024, embodies PAITAR's core advanced oxidation and selective adsorption technologies. The system operates through a multi-stage process:

- **Advanced Oxidation:** Utilizes proprietary technology to generate highly reactive oxygen species (ROS) through in-situ nano-diffusion from atmospheric air. These powerful oxidants rapidly break down complex organic molecules.
- **Mechanical Cavitation:** Complementing the oxidation, mechanical cavitation effectively reduces large organic molecules and suspended solids to micron-sized particles (typically <math><10\ \mu\text{m}</math>). This significantly increases their surface area, enhancing their susceptibility to oxidative degradation and subsequent removal.
- **Selective Adsorption & Removal:** The process incorporates specialized tubular reactors for the efficient and selective adsorption and removal of challenging inorganic and organic species, including nitrogen, sulfate, and carbonate compounds. This capability is critical for achieving stringent water quality targets and managing scaling/corrosion risks.



Figure 1. PAITAR 1LPS prototype

1.2 Demonstrated Treatment Speed & Efficacy

The prototype was rigorously tested across various industrial wastewater streams characterized by high Chemical Oxygen Demand (COD) and complex contaminant profiles. The objective was to achieve final effluent quality compliant with stringent discharge standards, such as Mexico's NOM-001-SEMARNAT-2021 for water disposal to receiving bodies. The results consistently demonstrated ability to achieve substantial contaminant reduction within minutes, significantly reducing overall treatment time compared to conventional methods:

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Case 1: Polymer Capsule Manufacturing Wastewater

This wastewater contained high concentrations of organic biomolecules, resulting in elevated COD. Conventional treatment typically requires extended retention times. PAITAR demonstrated rapid initial reduction and continued improvement over time.

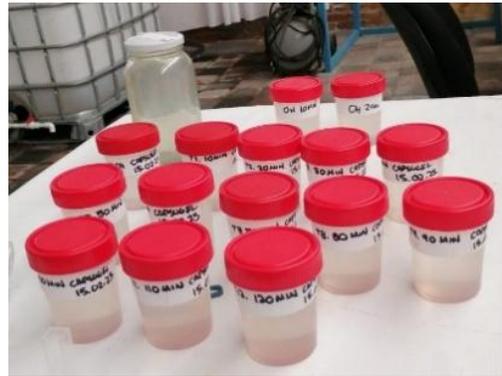


Figure 2. Capsugel samples

Table 1. Capsugel results

Date	Sample	Sample	pH	Conductivity (µs/cm)	TSS (mg/L)	COD (mg/L)
January 27 th 2025	Sample 1	Raw	11.62	1923	37	1614
		10 minutes	9.38	1301	58	408
	Sample 2	Raw	9.65	1319	436	N/D
		10 minutes	9.42	1352	132	N/D
February 17 th , 2025	Sample 1	Raw	8.6	890	N/D	814
		10 minutes	8.6	830	N/D	224
		30 minutes	8.8	830	N/D	190
		50 minutes	8.8	830	N/D	166
		70 minutes	8.6	840	N/D	170
		100 minutes	8.8	830	N/D	161
		120 minutes	8.8	830	N/D	148
		140 minutes	9.0	820	N/D	163
		150 minutes	8.8	830	N/D	219

Note: N/A indicates data not provided in the original source.

Key Observations (Case 1):

- A significant DQO reduction of approximately 75% (from 1614 to 408 mg/L) was achieved within just 10 minutes in the first sample.
- For the second sample set, DQO was reduced by approximately 72% (from 814 to 224 mg/L) within 10 minutes.
- The lowest DQO value of 148 mg/L was achieved at 120 minutes, demonstrating the technology's ability to reach stringent discharge targets.

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Case 2: Textile Dyeing Wastewater

Characterized by complex, bulky organic dyes with stable chemical structures (double bonds and resonant rings), notoriously difficult to oxidize using traditional methods.

Table 2. Textile wastewater results

Date	Sample	Sample	Conductivity (µs/cm)	TSS (mg/L)	DQO (mg/L)
June 11st, 2025	Sample 1	Raw	4633	97	6300
		2 minutes	4400	66	1701
	Sample 2	Raw	4633	97	6300
		5 minutes	4661	30	3244

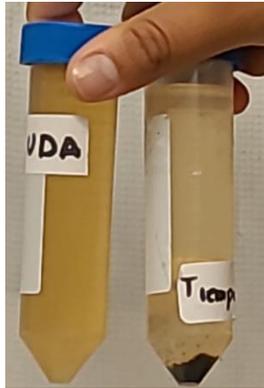


Figure 3. textile sample

Key Observations (Case 2):

- An impressive DQO reduction of approximately 73% (from 6300 to 1701 mg/L) was achieved within just 2 minutes.
- Suspended Solids (SST) were also significantly reduced, by approximately 32% (from 97 to 66 mg/L) in 2 minutes, and by 69% (from 97 to 30 mg/L) in 5 minutes.
- These results highlight PAITAR's unparalleled speed in breaking down highly recalcitrant organic compounds.

1.3 Applicability to Oil & Gas Produced Water

The demonstrated performance against the complex and diverse contaminants found in textile and polymer fabrication wastewater directly translates to PAITAR's potential in treating produced water. The key parallels and benefits for Oil & Gas operations include:

- **Hydrocarbon & Organic Removal:** The technology's proven capability to rapidly oxidize and reduce high concentrations of complex organic molecules (biomolecules, dyes) indicates its strong efficacy in breaking down and eliminating hydrocarbons (e.g., BTEX, PAHs) and other organic components prevalent in produced water.
- **Suspended Solids Reduction:** The rapid and significant reduction in Suspended Solids (SST) observed in these trials is critical for produced water treatment, where suspended solids contribute to fouling, scaling, and operational issues.
- **Rapid Treatment & Footprint:** The ability to achieve substantial contaminant reduction within minutes allows for significantly smaller system footprints and higher throughput capacities, which are invaluable for space-constrained and high-volume Oil & Gas facilities.
- **Broad Contaminant Spectrum:** The combined advanced oxidation and selective adsorption approach provides a robust solution for the diverse and challenging contaminant profiles in produced water, including both organic and inorganic species.

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- **Compliance & Reuse Potential:** The ability to consistently achieve significant contaminant reductions, and ultimately stringent discharge quality standards (as demonstrated in Case 1 over a slightly longer duration), suggests PAITAR's strong potential to meet or exceed regulatory requirements for produced water, opening pathways for beneficial reuse and reducing disposal costs.

This data underscores PAITAR's transformative potential for the efficient, rapid, and cost-effective treatment of produced water, addressing critical operational and environmental challenges faced by the Oil & Gas sector.

To ensure the complete reliability and objectivity of the results presented in this appendix, the wastewater samples were analyzed by an independent, external laboratory: **INGENIERÍA DE CONTROL AMBIENTAL Y SANEAMIENTO S.A. de C.V. (ICAYS)**.

ICAYS is an environmental laboratory specializing in Puebla, Mexico, recognized for its trajectory since 1987. It holds accreditation from the **Mexican Accreditation Entity (EMA A.C.)** under ISO-17025 Certification for water and wastewater analysis. Furthermore, it is approved by key regulatory bodies in Mexico such as **CONAGUA (National Water Commission)**, **STPS (Secretariat of Labor and Social Welfare)**, **PROFEPA (Federal Attorney's Office for Environmental Protection)**, and holds a **SMADSOT** registration.

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APPENDIX 2: PAITAR's Scalable & Intelligent Pilot Plant: Real-time Optimization and Field Readiness Demonstrated at 'Chiles la Morena'

This appendix details the successful deployment and operation of PAITAR's 16 LPS "Smart Pipelines" pilot plant, showcasing its scalability, intelligent control capabilities, and potential for integration into diverse industrial environments, including Oil & Gas infrastructure.



Figure 4. "Chiles la Morena" Pilot plant

Engineered in 202-2025, our "Smart Pipelines" pilot plant is a testament to PAITAR's commitment to scalable and intelligent water treatment solutions.

- **Capacity & Flexibility:** This pilot system is designed to handle variable flow rates, with a demonstrated capacity ranging from 1 to 16 Liters Per Second (LPS). Its primary purpose was to validate the efficiency and robustness of PAITAR's treatment process when scaled up to larger industrial streams.
- **Compact & Modular Design:** The entire pilot module measures a remarkably compact 3 x 1.5 x 2 meters. This small footprint enables mobility and flexibility, making it ideal for deployment in space-constrained areas, such as wellhead facilities or existing O&G sites with limited available space.
- **Robust Construction:** The pilot was designed to treat challenging industrial wastewater from the "Chiles la Morena" food processing facility. This particular stream presented high concentrations of oils and greases, alongside elevated levels of acetic acid and sodium chloride. The corrosive nature of this influent necessitated a robust, corrosion-resistant design, proving the system's durability in harsh chemical environments.

2.2 AI-Driven Real-time Optimization

A core feature of the "Smart Pipelines" pilot is its integrated AI microcontroller.

- **In-line Optimization:** This AI system enables continuous, in-line optimization of the treatment process. By analyzing real-time data from the pilot plant, the AI dynamically adjusts operational parameters to maintain optimal treatment efficiency, even with fluctuating influent quality.

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- **Algorithm Training:** The "Chiles la Morena" pilot served as a platform for training and refining PAITAR's proprietary AI control algorithms with real-world data. This extensive data collection and iterative refinement process has polished our control algorithms, ensuring precise and autonomous operation.
- **Enhanced Efficiency & Reliability:** The AI-driven control minimizes human intervention, reduces operational costs, and significantly enhances the overall reliability and consistency of the treatment process.

2.3 Readiness for Oil & Gas Deployment



Figure 5. Interior view, "Chiles la Morena" pilot plant

The successful operation of the "Smart Pipelines" pilot at "Chiles la Morena" demonstrates PAITAR's readiness for large-scale industrial piloting and modular integration within existing Oil & Gas infrastructure:

- **Scalability Proven:** The pilot's ability to maintain high treatment efficiency across a 1-16 LPS range confirms the scalability of PAITAR's technology for high-volume produced water streams.
- **Contaminant Versatility:** The effective removal of high concentrations of oils and greases (O&G) from the food processing wastewater directly correlates to PAITAR's capability to handle similar contaminants in produced water.
- **Corrosion Resistance:** The necessity for a corrosion-resistant design due to acetic acid and sodium chloride in the "Chiles la Morena" stream underscores the system's suitability for the often-corrosive nature of produced water.
- **Compact Footprint for O&G Sites:** The remarkably compact size addresses a critical need in the Oil & Gas sector, where space on platforms, well pads, and remote sites is often limited. This allows for flexible installation and integration without extensive civil work.
- **Intelligent Automation:** The proven AI-driven control system offers significant advantages for remote and autonomous operations common in O&G, reducing the need for constant on-site human supervision and optimizing performance.

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