

# ABR™ + SMO®

## Integrated Water Intelligence Platform

Next-Generation Solution for



PFAS



Industrial Water



AI Cooling



Resource Recovery



ESG



PFAS  
Removal



Chlorinated  
Compounds



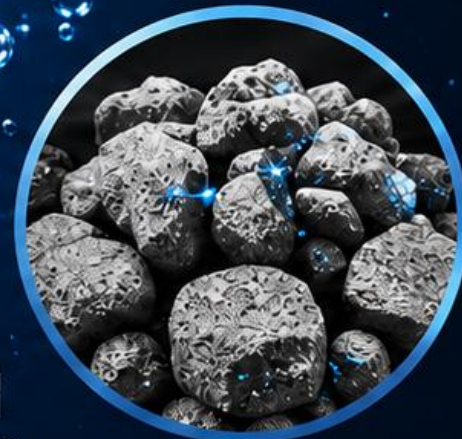
Heavy  
Metals



Microplastics  
Removal



Organic  
Pollutants



ABR™ Mineral  
*Adsorbent*



SMO® Reactor

Multi-Cross Shockwave  
NanoCavitation Technology



**ORP Innovation**  
Water Intelligence for the Future

# Global Water Challenges



## Emerging Contaminants

- ✓ PFAS
- ✓ Microplastics
- ✓ AI Cooling Water
- ✓ Semiconductor Water
- ✓ Mining Water



PFAS  
Forever Chemicals



Microplastics  
Invisible Threat



Industrial  
Chemicals  
Complex Mixtures



Mining Water  
Heavy Metals



Landfill  
Leachate  
High Toxicity



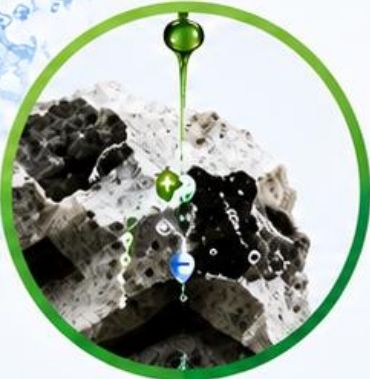
Cooling Water  
High Demand

## Conventional technologies suffer from

- ✗ High Cost**  
Expensive capital and operating costs
- ✗ Secondary Waste**  
Generation of sludge and spent media
- ✗ Slow Treatment**  
Long retention time and low treatment efficiency
- ✗ Difficult Regeneration**  
Limited regeneration ability and short media life
- ✗ Limited Destruction Capability**  
Cannot destroy persistent refractory pollutants

# OUR SOLUTION

## ABR™ + SMO® NanoCavitation Platform



**ABR™**

Adsorption



**SMO®**

NanoCavitation



Advanced  
Oxidation



Adsorption  
Amplification



Separation



Clean Water  
& Reuse



**High**  
Performance



**Low**  
Energy



**Closed**  
Loop



**Scalable**

### Key Advantages



**Positive Surface Charge**



**Semiconductor Activity**



**Regenerable**



**Lower Life Cycle Cost**

# WHAT IS ABR™?

Advanced Mineral Adsorbent



## Positive Surface Charge (+)

Attracts and captures negatively charged contaminants



## Photocatalytic Semiconductor

Enhances oxidation under visible light



## High Surface Area

Provides more active sites for adsorption



## Meso / Macro Porous Structure

Enables fast mass transfer and deep adsorption



## High Adsorption Capacity

Comparable to activated carbon and beyond



## Regenerable & Reusable

Easy regeneration with low chemical usage



## Effective for PFAS, Heavy Metals & Organics

Proven performance on a wide range of contaminants

## Key Advantages



### Positive Surface Charge

Attracts and captures negatively charged contaminants



### Semiconductor Activity

Enhances oxidation under visible light



### Regenerable

Easy regeneration with low chemical usage



### Lower Life Cycle Cost

Reduced replacement frequency and operating cost

# PROVEN PFAS PERFORMANCE

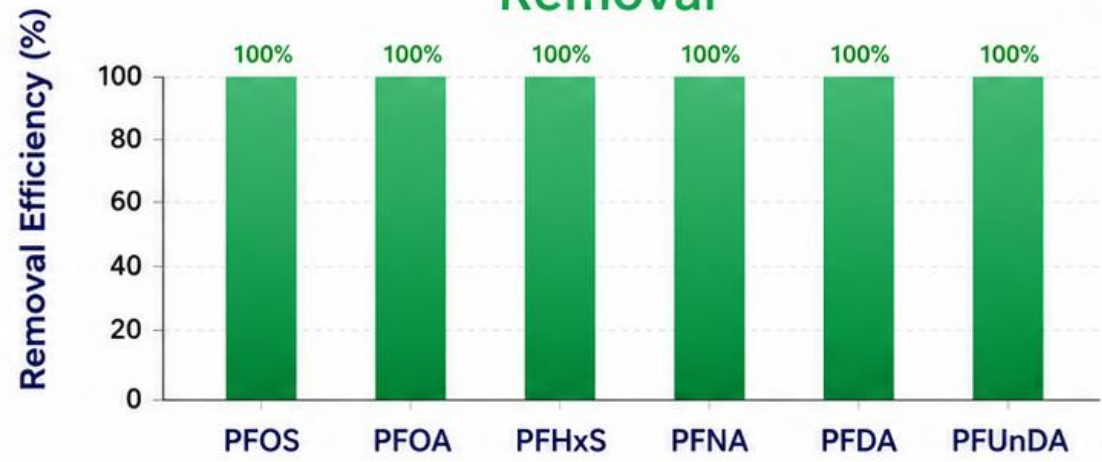
## University of Alberta Test Results

Laboratory test results under controlled conditions.



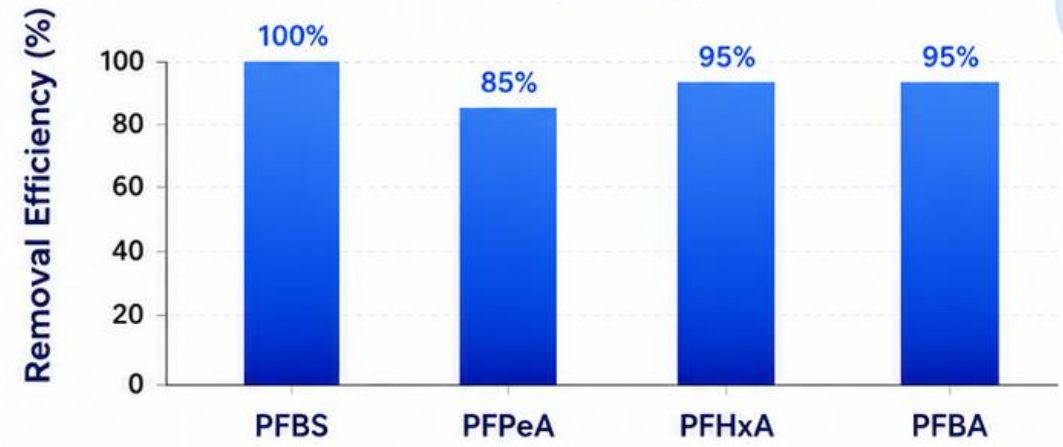
**Long Chain PFAS**  
(6 of 6 Compounds)

**100%**  
Removal



**Short Chain PFAS**  
(3 of 4 Compounds)

**80~100%**  
Removal



**No Heat**  
Ambient  
Temperature



**No Pressure**  
Atmospheric  
Operation



**No Complex  
Equipment**  
Simple & Robust  
Process



**Continuous  
Process**  
Steady & Reliable  
Performance



**Highly Scalable**  
For Industrial  
Applications

# WHY SMO®?

## SMO® Multi-Cross Shockwave NanoCavitation



~300 Million Nanocavities/mL  
( $3.0 \times 10^8$  bubbles/mL)



Average Bubble Diameter  
≈ 140 nm



Dissolved Oxygen  
Near Saturation



Multi-Radical Generation  
( $\cdot\text{OH}$ ,  $\text{SO}_4^{\cdot-}$ ,  $\text{O}_2^{\cdot-}$ ,  $^1\text{O}_2$ , etc.)



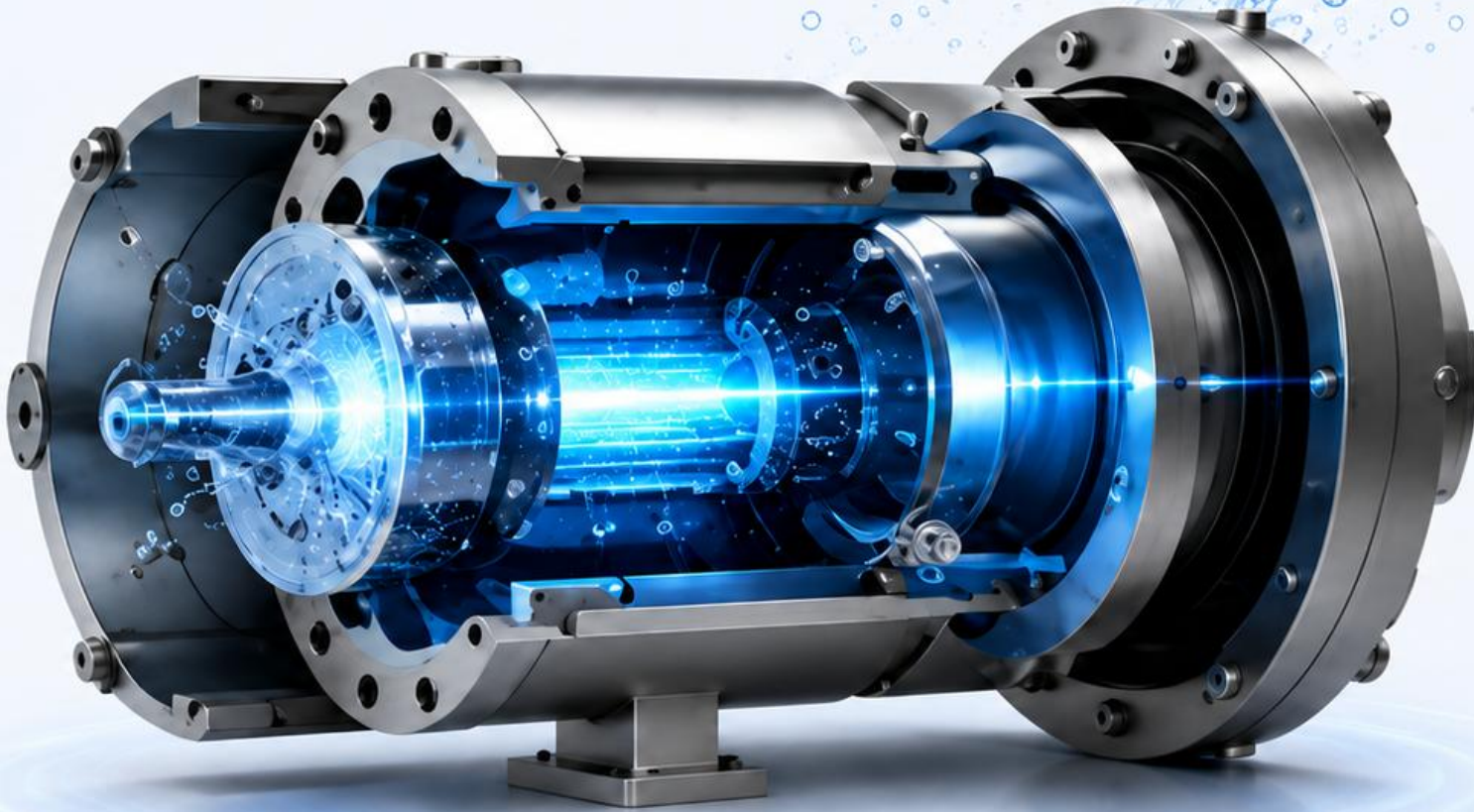
Low Energy Consumption  
High Efficiency & Low Operating Cost



Continuous Flow Operation  
Easy to Integrate & Scalable



Continuous Industrial Operation  
Stable, Reliable & 24/7 Performance



### SMO® Power Reactor

Engineered for Maximum Performance and Reliability



**High Efficiency**  
More Output  
Less Energy



**Robust & Durable**  
Industrial Grade  
Construction

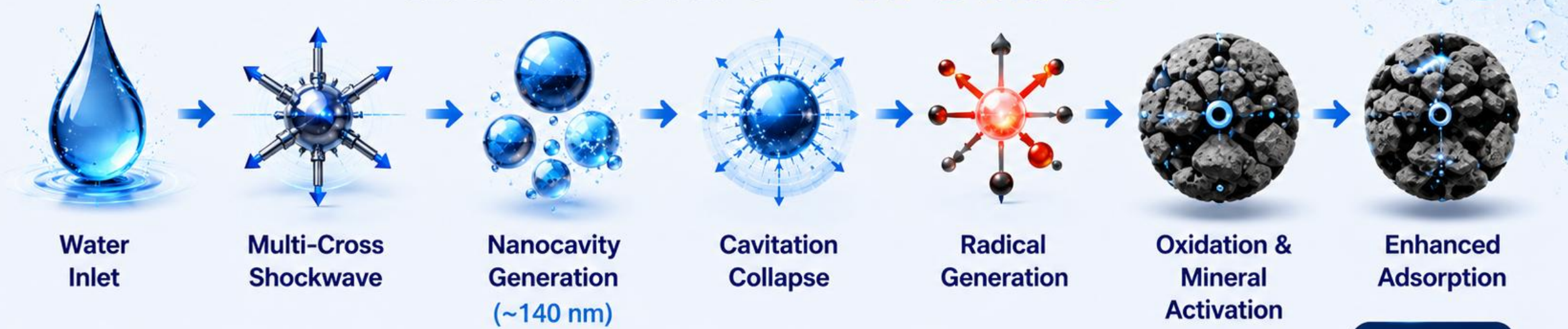


**Minimal Maintenance**  
Simplified Operation  
Long Service Life

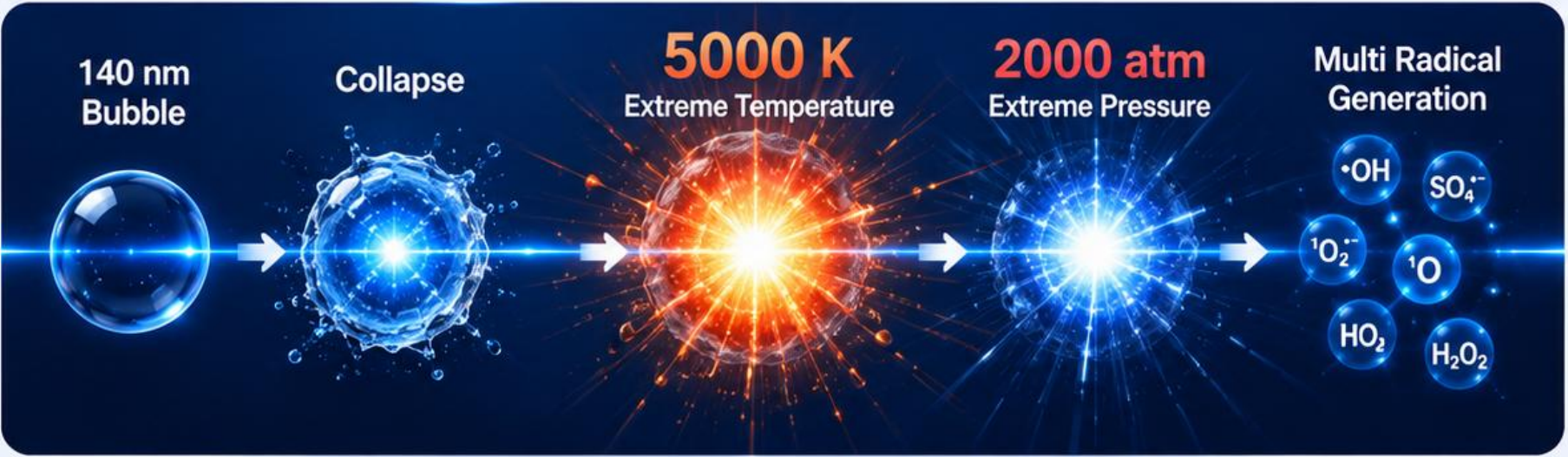


**Eco-Friendly**  
Lower Footprint  
Sustainable Solution

# HOW SMO<sup>®</sup> WORKS



Temperature  
5,000 – 10,000 K



Pressure  
1,000 – 10,000 atm

Time  
< 1 microsecond

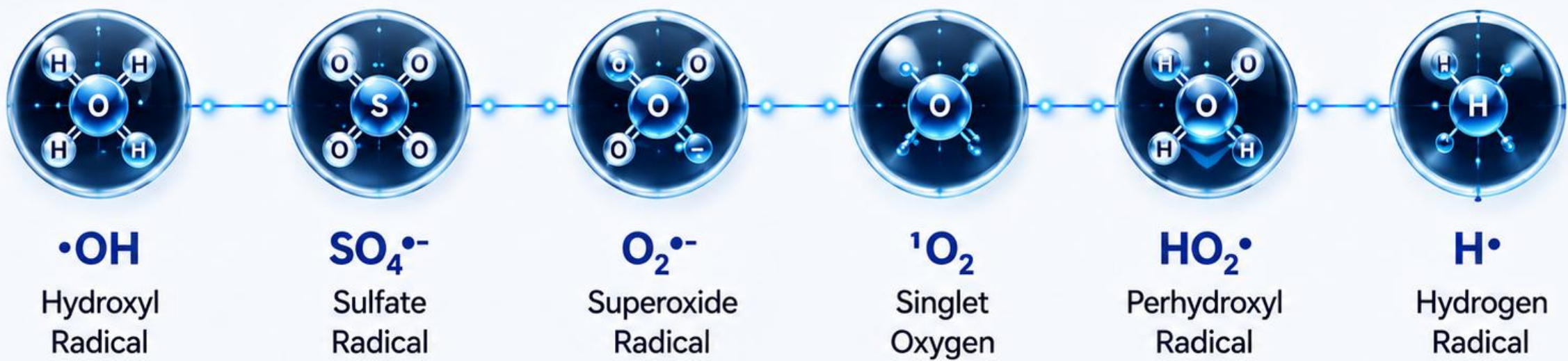
**Extreme Conditions in Nanocavity Collapse**  
Triggered in microseconds • Non-thermal process • Generates powerful oxidizing radicals

# THE ABR™ + SMO® + UV SYNERGY

Integrated Technology. Amplified Results.



# MULTI-RADICAL CHEMISTRY



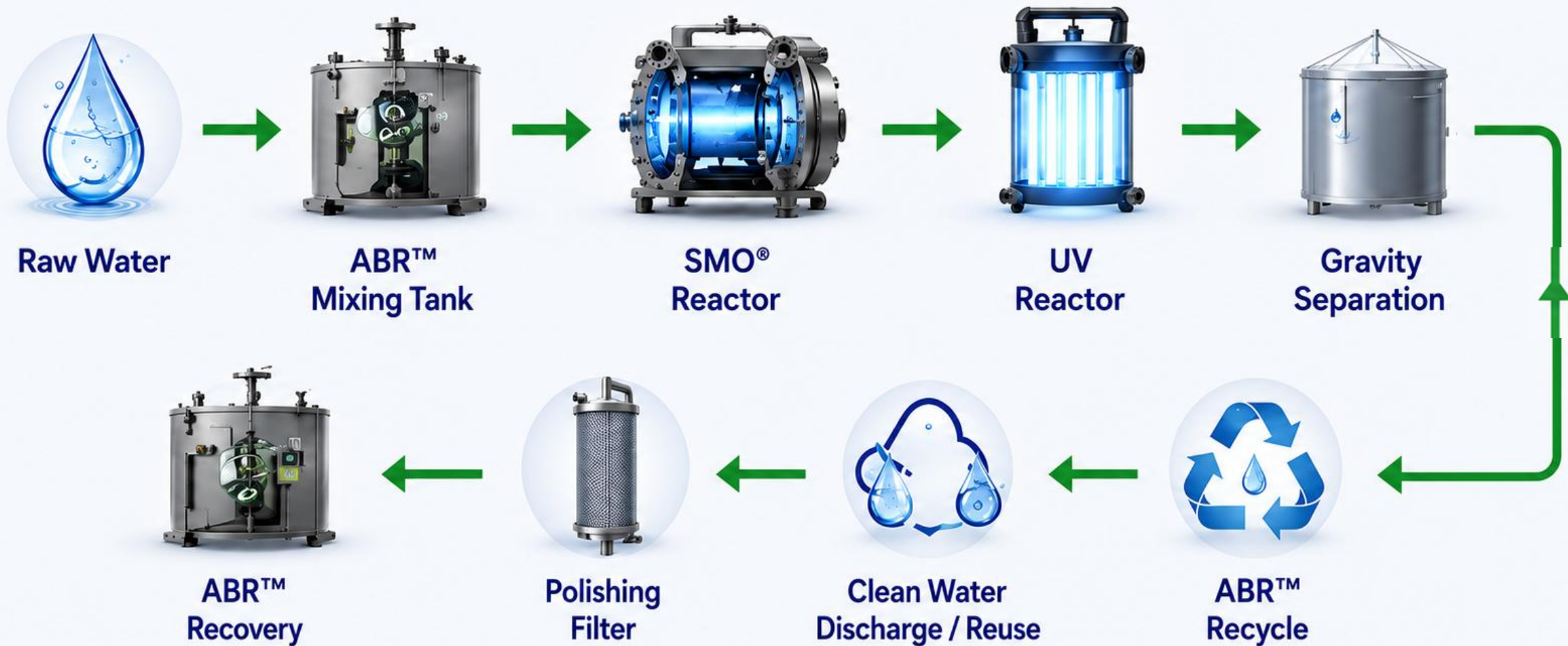
## Advanced Oxidation & Reduction

-  Breaks PFAS & Organics
-  Destroys Chlorinated Compounds
-  Removes Metals
-  Eliminates Toxins Odor & Biofilm

## Application Effects



# TREATMENT PROCESS FLOW



**Closed Loop System**

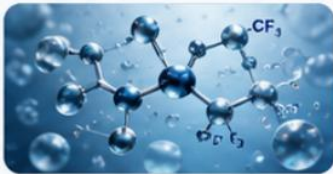
# PERFORMANCE ADVANTAGES



# TYPICAL APPLICATIONS



**PFAS**  
Treatment



**Groundwater**  
Remediation



**Industrial**  
Wastewater



**Mining**  
Water



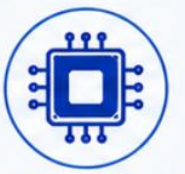
**Landfill**  
Leachate



**Cooling Water**  
(Industrial / AI DC)



**Food & Beverage**  
Industry



**Semiconductor**  
Industry



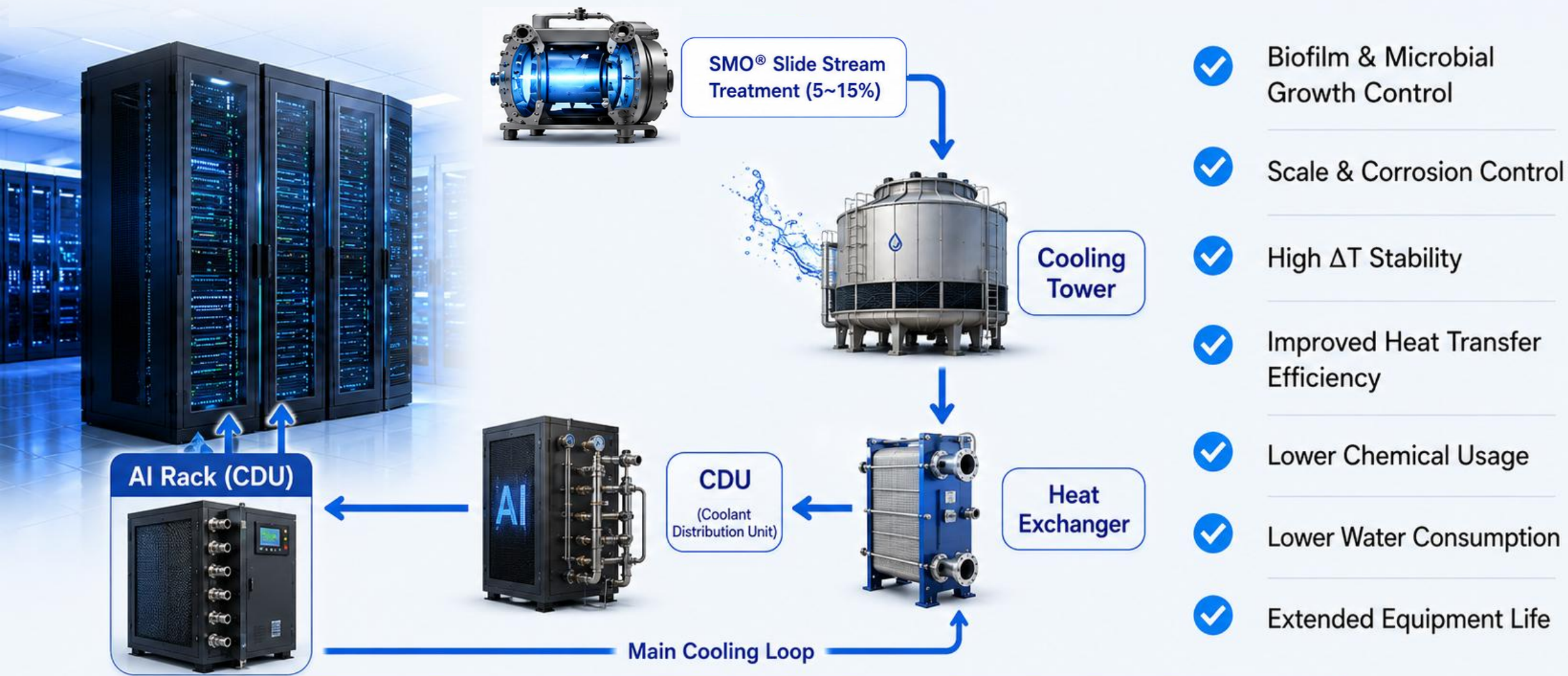
**Hydrogen**  
Production Water



**Aquaculture &**  
Fish Farming



# AI DATA CENTER COOLING WATER SOLUTION



- ✓ Biofilm & Microbial Growth Control
- ✓ Scale & Corrosion Control
- ✓ High  $\Delta T$  Stability
- ✓ Improved Heat Transfer Efficiency
- ✓ Lower Chemical Usage
- ✓ Lower Water Consumption
- ✓ Extended Equipment Life

 **Stable • Efficient • Sustainable Cooling for AI Infrastructure**

# MINING WATER TREATMENT

## Acid Mine Drainage (AMD)

- Low pH
- Heavy Metals (Fe, Mn, Al, Cu...)
- High TDS
- Color & Turbidity



SMO®  
NanoCavitation

↓

ABR™  
Adsorption



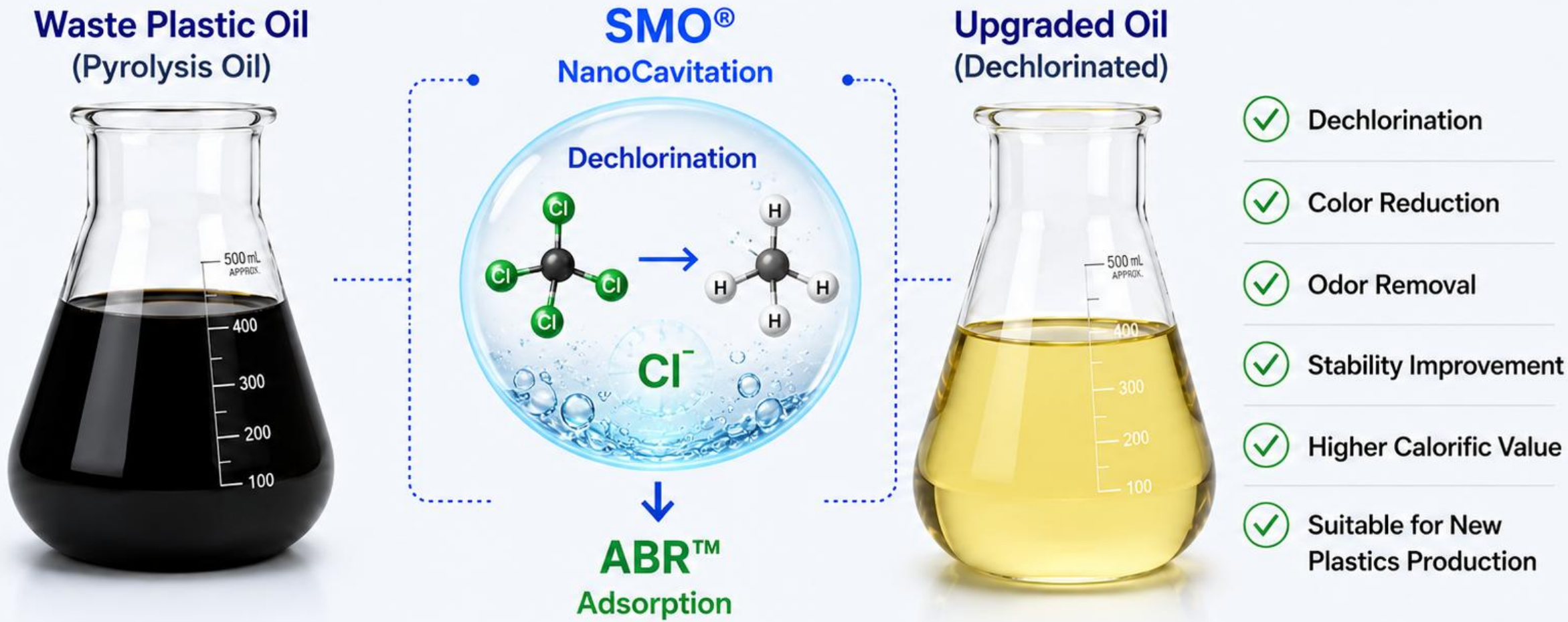
## Treated Water

- ✓ pH Neutralization
- ✓ Metal Removal
- ✓ Color Reduction
- ✓ Low Turbidity
- ✓ Compliant Discharge & Reuse

From Pollution to Resource

# PYROLYSIS OIL UPGRADING

Removing Chlorine & Harmful Compounds



**SMO® + ABR™ = Cleaner Oil, Higher Value**

# ENVIRONMENTAL & ECONOMIC BENEFITS



# COMPETITOR COMPARISON

## General Comparison

| Activated Carbon                                                                                         |                                                                                               | Ion Exchange                                                                                              |                                                                                             | Membrane Systems                                                                                            |                                                                                             | ABR™ + SMO®                                                                                                 |                                                                                             |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
|                         |                                                                                               |                         |                                                                                             |                          |                                                                                             |                          |                                                                                             |
|  <b>Advantages</b>       | Good overall removal for many contaminants                                                    |  <b>Advantages</b>       | Effective for specific ions (e.g., PFAS, heavy metals)                                      |  <b>Advantages</b>       | High removal efficiency, reliable & consistent performance                                  |  <b>Advantages</b>       | Broad-spectrum removal, regeneration & reuse, stable & sustainable                          |
|  <b>Limitations</b>      | Media saturation, needs frequent replacement                                                  |  <b>Limitations</b>      | High regenerant use, brine waste generation                                                 |  <b>Limitations</b>      | Fouling potential, high energy demand                                                       |  <b>Limitations</b>      | Higher initial investment, requires technical expertise                                     |
|  <b>Maintenance Cost</b> | Medium<br>   |  <b>Maintenance Cost</b> | High<br> |  <b>Maintenance Cost</b> | High<br> |  <b>Maintenance Cost</b> | Low<br>  |
|  <b>ESG Impact</b>       | Moderate<br> |  <b>ESG Impact</b>       | Low<br>  |  <b>ESG Impact</b>       | Low<br>  |  <b>ESG Impact</b>       | High<br> |



This comparison is a qualitative overview based on typical performance in general environmental service conditions.

 **Advantages**  
Key strengths

 **Limitations**  
Main challenges

 **Maintenance Cost**  
Relative OPEX level

 **ESG Impact**  
Environmental & sustainability impact

 Low

  Medium

   High

  High

  Medium

 Low

# VALIDATION & COMMERCIAL READINESS

## TECHNOLOGY VALIDATION

- ✓ University Test
- ✓ Pilot Demonstration
- ✓ Industrial Operation
- ✓ AI Cooling Application
- ✓ Mining Water Application
- ✓ Closed Loop Recycling



**COMMERCIAL READY FOR GLOBAL DEPLOYMENT**

INNOVATION, RELEVANCE

# Creating a Better World with Water Intelligence



WATER  
SOLUTIONS



AI &  
ANALYTICS



INDUSTRIAL  
SERVICES



ENGINEERED  
TECHNOLOGIES



OPERATIONAL  
EXCELLENCE

We innovate to solve today's  
challenges and secure a  
**sustainable future.**

PARTNERED WITH



[www.gronintl.com](http://www.gronintl.com)



[www.orpinnovation.com](http://www.orpinnovation.com)