Cavitox

Filter-free, Microbubble Advanced Oxidation Process

FILTER FREE

CHEMICAL FREE
DEGRADATION

PFAS PFOA PFOS

TOXIC CHEMICAL
TOTAL ORGANIC CARBON

SAFER WATER FOR YOU
AND FOR OUR PLANET

FUST Lab.

Filter-free, Microbubble Advanced Oxidation Process(AOP)

What is Advanced Oxidation Process?

- Degradation using oxidation reaction through OH radicals
- Used primarily to remove persistent organic pollutants
- Conventionally, industries relied on additives like ozone, hydrogen peroxide to create oxidation for treatment

Choosing Ultrasonic as new AOP solution

Sustainable Solution

Removing ozone and hydrogen peroxide from treatment that cause secondary pollution

Strong Degradation Ability

OH radicals formed by ultrasound is 2,000 times stronger than ozone

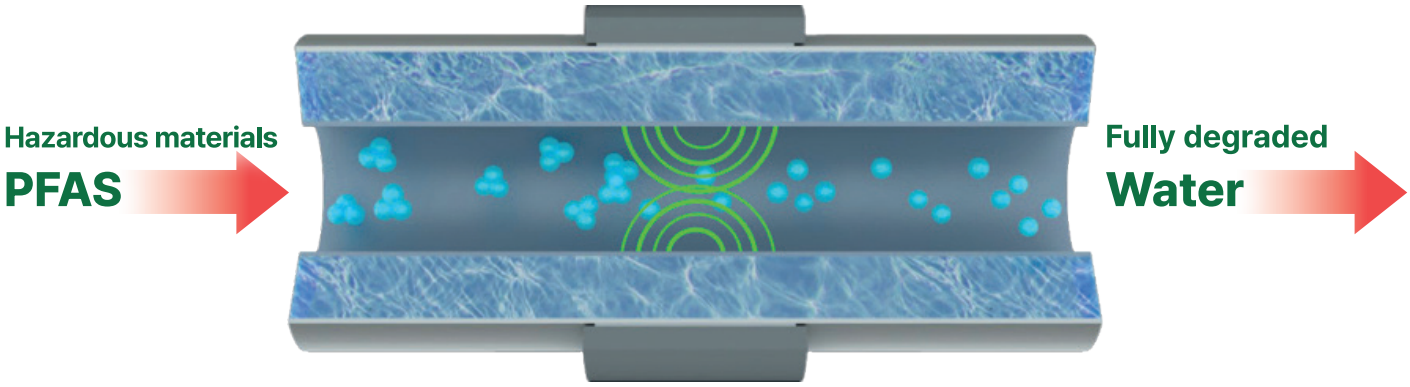
Energy Efficient

No additional reaction makes the process highly energy efficient

» **No Ozone** **No Filter** **Direct Degradation**

Degradation through Microbubble Cavitation

When ultrasonic energy is exposed, a constant creation and collapsing of microbubbles (known as cavitation) occurs. This creates strong microjet energy and free-floating ions occur for oxidation without filter, ozone, and hydrogen peroxide. FUST Lab has maximized this power by concentrating ultrasonic energy in the center, allowing the full degradation of persistent organic pollutants.



Introducing CAVITOX

Filter-free, Microbubble Advanced Oxidation Process

CAVITOX Standard Model

Advantages

1 PFAS Degradation

- Tight bonds of PFAS can be broken down for full degradation

2 Filter-free Treatment

- No filters are used
- Direct degradation prevents usage of filters, making the whole process highly sustainable

3 Chemical Additive-Free

- No chemical additives like Ozone, Hydrogen Peroxide, Catalysts, etc. are used
- No toxic chemical by-products found

4 In-line Continuous Process

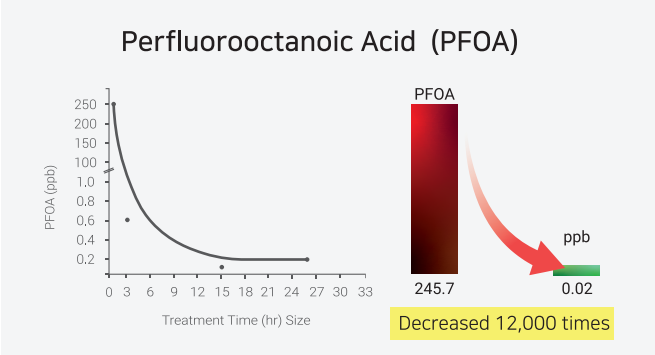
- Equipped with cooling system that ensures long equipment operation time
- Energy efficiency secured through efficient ultrasonic concentration

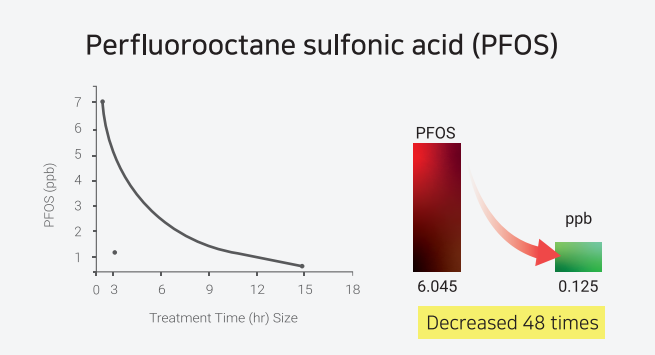
Applications

Ultimate Technology for Sustainable Toxic Waste Treatment

PFAS Removal

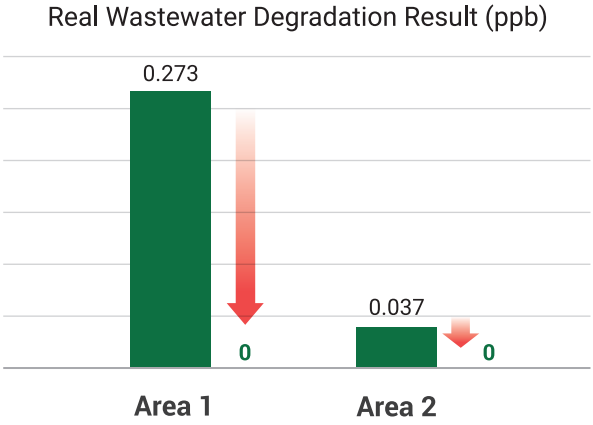
Focused Ultrasonic Energy of CAVITOX breaks the strong bond between carbon and fluorine and reduces the long carbon chains which prevented biodegradation of toxic chemicals





After Focused Ultrasonic treatment, PFOA and PFOS concentration decreased dramatically below EU regulations

Real PFAS Wastewater Treatment

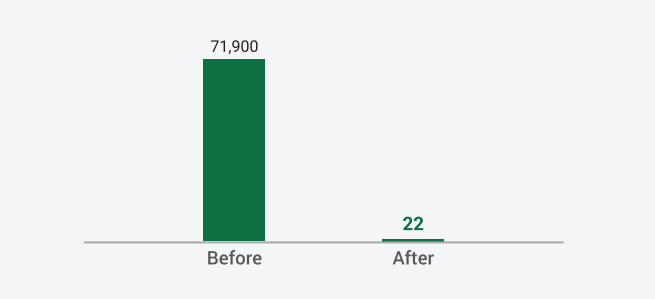


- PFAS compounds are toxic even in very small amounts
- Real wastewater from three sites were sampled with 10 different types of PFAS found
- CAVITOX can break down even the smallest amount down to a not-detectable level.
- Result analyzed by KOTITI

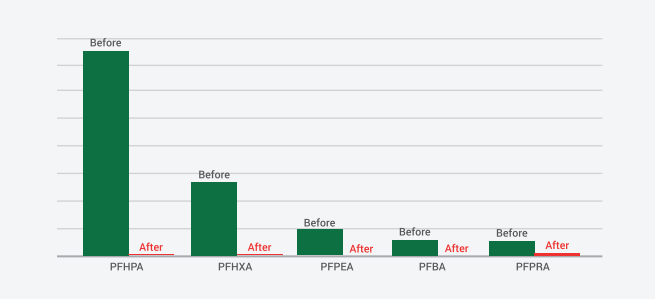
Sample	Ultrasonic Treatment	Results per toxin (ppb)											
		PFOA	br_PFOS	L_PFOS	PFBA	PFPeA	PFDA	PFHpA	PFHxA	PFNA	br_PFHxS	L_PFHxS	8;2diPAP
Area 1	Before	2.07	0.104	-	1.86	1.09	0.127	0.449	1.24	0.130	-	0.251	0.045
	After	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Area 2	Before	0.592	0.155	-	0.782	0.390	-	0.202	0.515	-	0.097	0.325	0.045
	After	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Area 3	Before	10.4	0.336	0.325	4.32	1.13	0.300	1.72	2.16	1.00	0.184	0.605	-
	After	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected

- The data confirms that various types of PFAS, not limited to specific ones, can be simultaneously removed.

PFAS Short-chain Degradation



High Concentration PFOA Treatment Data
(Before/After) [ng/mL]



Intermediate Product Analysis
(Before/After)

Results:

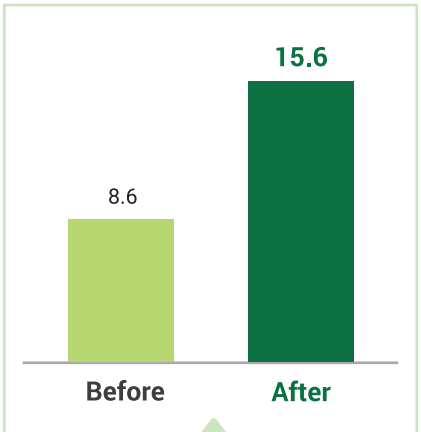
- All byproducts were removed during the treatment process
- This study demonstrates that **short-chain intermediates** formed during PFOA (high concentration)
- treatment **can also be effectively removed** using CAVITOX

PFAS : Toxicity Test with Zebra Fish embryo

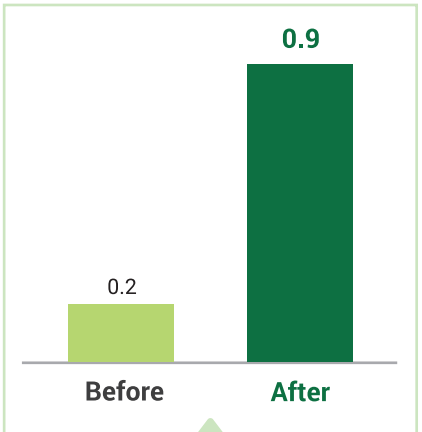
LC_{50} Result

Note: Meaning of Increased LC_{50} Value: LC refers to the concentration at which toxicity is observed in fish; as the LC_{50} value increases, it indicates reduced toxicity.

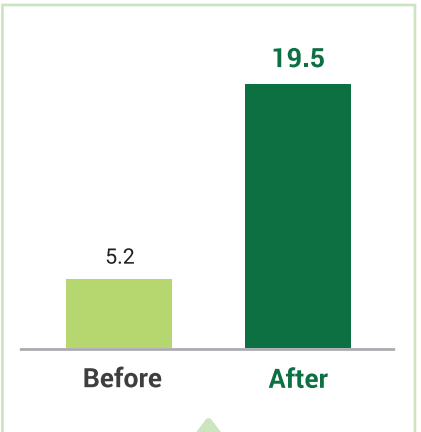
Zebra Fish Embryo Survival Comparison Graph



Wastewater from Household Chemical Manufacturing Company



Wastewater from Furniture Manufacturing Company



Wastewater from Wastewater treatment company

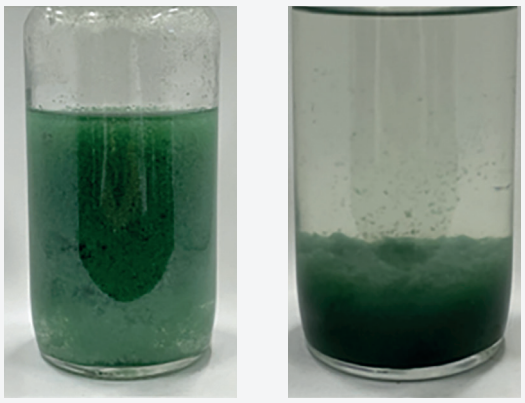
- The toxicity of the wastewater was initially high before ultrasonic treatment.
- However, after the treatment, **a significant reduction in toxicity was observed,** with up to a fourfold decrease in toxicity depending on the industry.

Chemical-free Algae Bloom Removal

Problems of Algae Bloom

- Algae blooms have become increasingly frequent over the past few decades, leading to numerous issues such as eutrophication, the creation of dead zones, and elevated water toxicity.

Result of Algae Bloom Ultrasonic Treatment



Comparison of Turbidity Levels After 7 Days of Sunlight Exposure

Results

- This study demonstrated that ultrasonic treatment can reduce algae turbidity in a short period.
- Furthermore, even under favorable environmental conditions for algae growth, such as sunlight and water temperature, the turbidity of the algae remained controlled.

Total Organic Carbon

Problems of high Total Organic Carbon (TOC)

- High levels of TOC can damage the performance of semiconductor, microelectronics
- High TOC levels cause adverse health effects

CAVITOX, however, breaks the long carbon chains into shorter chains for biodegration without filters or pre-treatment.

Removal of Dye Toxicity

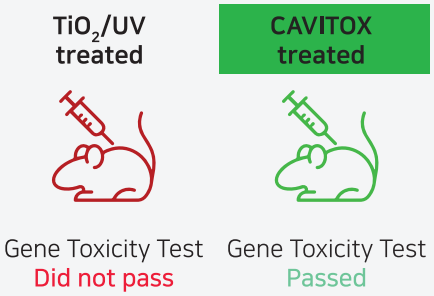
1. For the purpose of dye wastewater treatment, Methylene Blue treatment experiement was conducted and confirmed the effectivness of CAVITOX

2. Compared with TiO2/UV treated water CAVITOX treated water passed the genetic toxicity evaluation with no evidence of bacterial reverse mutation found.

Dye wastewater degradation performance test

	Toxicity (Daphnia survival rate)
Water	100%
Methylene Blue	0%
TiO_2/UV 1 hr treament	20%
TiO2/UV 2 hr treament	10%
CAVITOX 1 hr treament	90%

Gene Toxicology



*S. typhimurium TA98 used

Korea Institute of Toxicology Official Report

For Safer Water and a Safer Planet

CAVITOX, a next-generation wastewater treatment solution powered by ultrasonic technology, utilizes a highly dense microbubble advanced oxidation process. This filter-free, ozone-free, and hydrogen peroxide-free solution offers powerful degradation capabilities, effectively breaking down PFAS chains and other persistent contaminants. By enabling direct degradation, it provides a sustainable alternative to the incineration of filters and toxins. Together, let's create a future with cleaner, safer water for all.

About FUST Lab.

Introducing filter-free, chemical-free Microbubble Advanced Oxidation Process.

FUST Lab aims to provide sustainable wastewater treatment solution to degrade PFAS and other persistent organic pollutants.

FUST Lab, a spin-off from the Korea Research Institute of Standards and Science, is dedicated to transforming conventional wastewater treatment with its original Circle-Type Focused Ultrasonic Technology. By targeting persistent organic pollutants and hazardous chemicals, we aim to provide effective and sustainable wastewater treatment solution. Together, let's create a future with cleaner, safer water for all.

FUST Lab.
Focused Ultra-Sonic Tech. Lab.

T. 042.862.9990(HQ), 9991(Lab) / F. 042.862.9992
HQ 11-3, Techno 1-ro, Yuseong-gu, #N102, Daejeon, KOREA
Seoul Office 122, Mapo-daero, Mapo-gu, FrontOne 14th Floor, Seoul, KOREA

www.fustlab.com