



Vibrations in Water as a Solution to Severe Water Challenges in Multiple Countries – PureFlow

Water always contains microorganisms, and in nature it is constantly in motion – the more movement, the fresher the water. However, in water distribution systems such as pipes, the risk of biofilm, bacterial growth, and corrosion increases.

Problem: Stagnant Water

This affects not only water quality but also the pipes that carry it — and ultimately the people who drink and use it.

Even if water leaves the treatment plant clean, its quality may deteriorate along the way through the distribution network.

Biofilm is a slimy layer of microorganisms that protects bacteria from external influences. Chlorine, membrane filtration, and UV light have limited effect, as biofilms can be up to **1,000 times more resistant** to disinfection than free-floating bacteria.

Once established, a biofilm acts as a **reservoir of bacteria** that can multiply, exchange DNA (including resistance genes), and release pathogens back into the water — turning otherwise clean water into a potential health risk.



Example from Bangkok, Thailand

In 2023, a study measured levels of **nontuberculous mycobacteria (NTM)** in tap water, shower water, and Point-of-Use (POU) treated samples.

It showed that **stagnant taps or showers** had up to **10 times higher** bacterial levels than frequently used ones

(source: Mycobacterial contamination in tap and shower waters in Thailand).

This reinforces the argument that **moving water is healthier water**.

Even in modern taps and showerheads, stagnant water provides ideal conditions for bacterial growth — especially in regions where biofilm formation in pipes is common.

Corrosion and Hard Water Challenges

Corrosion

Corrosion naturally occurs in pipes due to chemical reactions between metal, water, and oxygen.

When bacteria and biofilm accumulate on the pipe's inner surface, they create microenvironments with different pH and oxygen levels — a process known as **microbially induced corrosion (MIC)**.

MIC accelerates pipe degradation and increases maintenance costs.

Hard Water

Hard water — rich in calcium and magnesium — is another major challenge worldwide. When such water remains stagnant or heated in pipes, **calcium carbonate (CaCO_3)** can precipitate as **scale deposits**, causing corrosion, clogging, reduced pressure, and high maintenance costs.



Solution: PureFlow

Using **vibrations at optimized frequencies**, **PureFlow** prevents and reduces both **biofilm** and **scale** formation in pipes.

The vibrations make it harder for biofilm or mineral crystals to adhere to surfaces and also help dislodge what has already formed.

In short, **PureFlow prevents bacteria from building their "defensive walls" inside pipes**— and weakens the ones already there.

When it comes to hard water, **PureFlow** does not remove minerals from the water like ion exchange or reverse osmosis.

Instead, it changes how the minerals crystallize.

Calcium and magnesium ions form small, suspended crystals that remain in solution rather than sticking to pipe walls or equipment.

As a result, the water behaves like **"softer" water**, with fewer scaling and corrosion problems — and **without any chemical additives**.

Stagnant Water vs. Flowing Water

Water naturally has micro-movements, but **PureFlow adds continuous mechanical vibration**, amplifying these effects – even in stagnant sections of a system.

Property	Stagnant Water (Glass)	Flowing Water (Pipe)	Water with PureFlow
Macro-movement	None	Yes (flow, turbulence)	Yes – continuous vibration even without flow
Radical Formation	Possible but limited	More likely near turbulence	Increased via vibration + cavitation → more ROS (OH·, H ₂ O ₂)
Biofilm Control	Minimal	Partial – flow weakens biofilm	Active inhibition and removal – vibration + ROS
Scale Control	None	Partial – ions kept in suspension	Highly effective – prevents deposits, removes existing scale

The difference is that **flowing water depends on physical movement**, whereas **PureFlow delivers energy directly into the water** – creating both the "flowing-water effect" and an **additional chemical antibacterial effect** through **Reactive Oxygen Species (ROS)**.

Reactive Oxygen Species (ROS) at the Atomic Level

In addition to vibration, PureFlow also produces **cavitation energy**, giving water molecules (H_2O) extra energy that can temporarily split them into reactive atoms and radicals — collectively known as **Reactive Oxygen Species (ROS)**.

Hydroxyl Radical ($OH\cdot$)

- Extremely reactive attacks bacteria, biofilm, proteins, and DNA.
- Lacks an electron and "steals" one from nearby molecules, including bacteria.
- Two $OH\cdot$ radicals can combine to form hydrogen peroxide (H_2O_2).

Hydrogen Peroxide (H_2O_2)

- Less aggressive but more stable and long-lived.
- Acts as stored disinfection, keeping water clean over time.
- Used in medicine and water treatment for its effectiveness.
- Can diffuse into biofilms and release $OH\cdot$ locally a **"Trojan horse"** effect.

In simple terms:

- $OH\cdot$ is like a **rapid soldier** attacking instantly.
- H_2O_2 is like a **guard** maintaining a protective presence over time.

Process Overview

Vibration from PureFlow



Cavitation / added energy in water



Splitting of $\text{H}_2\text{O} \rightarrow \text{OH}\cdot$ (hydroxyl radical)



Formation of additional ROS ($\text{OH}\cdot$, H_2O_2)



ROS attack bacteria and biofilm



Result: Cleaner pipes, fewer bacteria, no biofilm

What PureFlow Does Not Solve

PureFlow is **not a replacement for water treatment plants**, but a **secondary technology** ensuring that clean water **stays clean** all the way to the user.

It does **not** remove:

- Microplastics
- Heavy metals (lead, arsenic)
- Dissolved salts (TDS)

However, neither chlorine nor UV light removes these either.

Only **membrane or reverse osmosis (RO)** systems can, but they are expensive and require intensive maintenance.

Problem	Chlorine	UV	Membrane/RO	PureFlow
Bacteria	✓ short-term	✓ localized	✓	✓ (ROS + biofilm inhibition)
Viruses	✓ partial	✓	✓	✓ (ROS)
Biofilm in pipes	✗	✗	✗	✓
Plastics	✗	✗	✓	✗
Salts (TDS)	✗	✗	✓	✗
Chemical use	High	Low	High	None
Maintenance	Medium (dosing)	High (lamp replacement)	High	Low

Interestingly, since **micro- and nanoplastics often adhere to biofilm**, PureFlow — by reducing and breaking down biofilm — can indirectly **help detach plastic particles**, allowing them to be captured in existing filtration systems.

Why This Matters and Global Impact

Beyond health and safety, PureFlow offers strong **economic benefits**:

- Reduces use of chemicals like chlorine and ozone → **lower operating costs**
- Limits corrosion → **longer pipe lifespan**
- Simple installation → **minimal maintenance**
- Works as a **low-cost alternative to UV systems**, without consumable parts

Result:

Lower costs, longer infrastructure life, and cleaner water — sustainably.

Where PureFlow Can Have the Greatest Impact

The main challenge lies not only in water treatment plants but in **distribution networks**. PureFlow is therefore most effective in **regions where water quality deteriorates in pipes**, not at the source.

According to the **WHO**, around **30% of the world's population** lacks access to safe drinking water at home — a vast potential market for such technology.

When selecting pilot locations, three factors matter most:

1. **Climate and biofilm risk**: Warmer regions have higher bacterial growth rates.
2. **Existing infrastructure**: A functioning distribution network allows measurable results.
3. **Institutional openness**: Authorities and universities must be willing to collaborate.

Why Southeast Asia – and Especially Thailand

Southeast Asia combines a warm climate, developed infrastructure, and water quality challenges — a perfect context for testing PureFlow.

In **Thailand**, water is treated centrally but often becomes contaminated in pipes before reaching users.

This allows PureFlow to demonstrate measurable results within a functioning network. The country also has strong institutional capacity, with research universities and public utilities already engaged in smart water initiatives and leak-reduction programs.

This makes Thailand — or a similar country in the region — an ideal environment for collaborative pilot testing and validation.