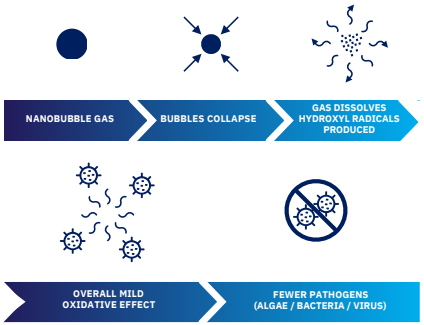
OXIDATIVE EFFECT

Hydroxyl radicals produced on nanobubble collapse



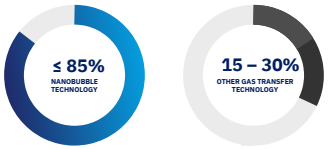
When nanobubbles do collapse and the gas is dissolved, a chemical reaction occurs whereby small amounts of hydroxyl radicals are produced. Hydroxyl radicals are very strong oxidisers, however because there is a limit to how many nanobubbles can be transferred to water, this results in a mild oxidative effect overall.

The benefit of this mild oxidative effect from nanobubbles is that it provides a long lasting chemical free treatment, against a wide range of pathogens, that negatively impact both plant and animal health.

The result: higher production from fewer inputs.

HIGH EFFICIENCY GAS TRANSFER

Nanobubbles have a much higher transfer rate



Nanobubbles have an extremely high gas transfer efficiency when compared to other technologies. This means that little gas is wasted, and the user gets all the benefit of whatever gas has been produced.

Gas flow rates can also be adjusted in real time, allowing users to match demand as needed and increase gas utilisation.

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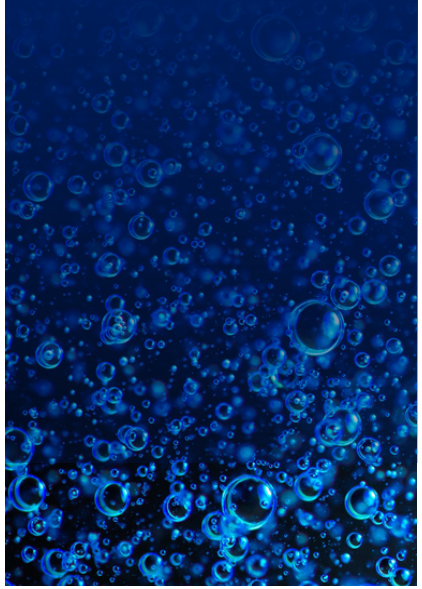
Nanobubble Irrigation

Summary of Key Benefits of Nanobubbles

- Hold up to 5x supersaturation of dissolved gas
- Long lasting, chemical free, oxidative effect that can reduce impact of pathogen-based animal and plant health issues
- Provide gas reserve, that maintains high and stable dissolved gas levels
- Highly efficient gas transfer efficiency for reduced gas wastage
- Improved water quality



WHAT ARE NANOBUBBLES?

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Nanobubble Irrigation

Cutting-Edge Technology

Nanobubble technology is a new, cutting-edge method for gas to liquid transfer. It has only been in the last few years that the technology to build efficient machines at scale, at prices that are cost effective for industry, have developed.

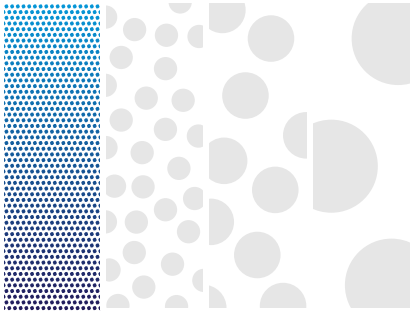
The technology is now becoming commonplace in several industries, including horticulture, aquaculture, medicine, agriculture, water and wastewater treatment.

Nanobubbles – what are they?

They are a bubble of any gas in water that is < 200nm in diameter.

BUBBLE SIZE

8 million nanobubbles fit into one microbubble



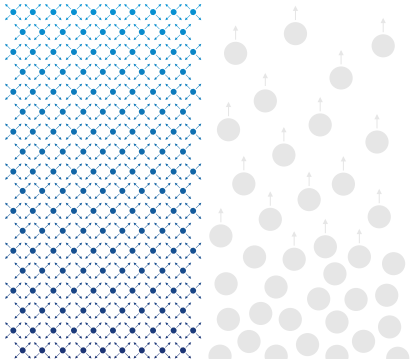
An average sized nanobubble produced by our machines sits at around 100nm, Malvern Nanosight 550, University of Osaka. If we compare this to the next smallest sized bubble available, the microbubble, at an average size of 20,000nm, this is a 200x smaller diameter. To put this into perspective, at this size, we could fit 8 million nanobubbles into one microbubble – a big difference!

This extremely small size gives nanobubbles several unique attributes, that can provide benefits for a range of applications, especially in agriculture and horticulture.

These unique attributes include:

NEUTRAL BUOYANCY

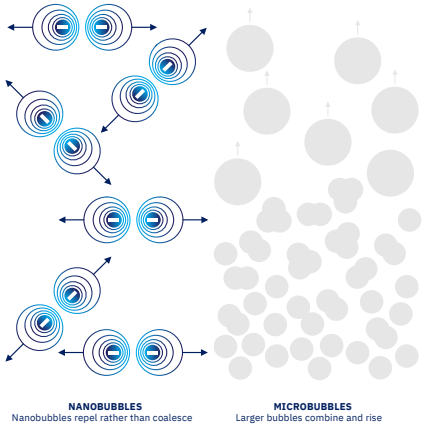
The smaller the bubble size, the slower the rise time



Unlike larger bubbles, nanobubbles do not rise. Rather, they spread out evenly via diffusion to all areas of a water body.

NEGATIVE CHARGE

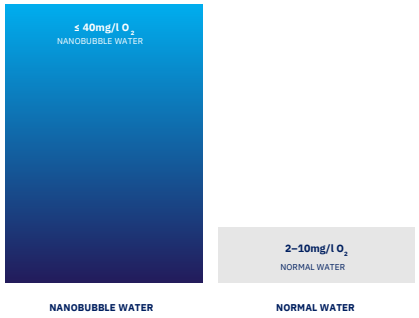
The smaller the bubble, the stronger the negative charge



Because nanobubbles repel each other, this reduces coalescence (bubbles joining to form larger bubbles that rise out) and allows bubbles to remain stable for long periods of time.

SUPERSATURATED WATER

Nanobubble water holds much more gas

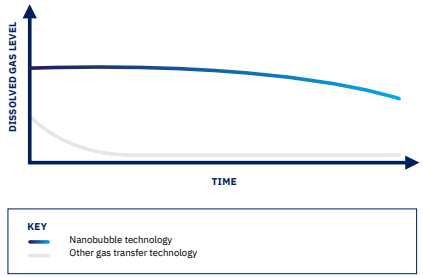


The strong negatively charged surface of the bubbles also increases the ability of the water to carry dissolved gas by up to 5x supersaturation.

Typically, it would require very high energy input (temperature/gas pressures) to reach and maintain these high dissolved gas levels in water. This can be very beneficial in industries where getting more gas to a process, e.g. oxygen to a root zone, is an inhibiting factor.

GAS RESERVE

Nanobubbles maintain higher levels of dissolved gas



There are two forms of gas transferred to water when it is passed through a nanobubble machine. The dissolved gas, and the stable nanobubbles in water that are yet to collapse and be dissolved.

Having a large reserve of available gas in the form of nanobubbles helps to maintain a higher and more stable dissolved gas level for a much longer time. This is helpful in many industries such as food sterilisation using ozone or chlorine, or for maintaining a highly aerobic environment in plant root zones.

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