

# IPS Oxygen Injection Unit

*Why adding dissolved oxygen to irrigation water is necessary*



## Where is oxygen in water used for?

Plants need oxygen for their growth. This oxygen is taken up in dissolved form via water intake through the roots. The oxygen is relevant for the active uptake of essential nutrients as nitrogen, phosphate and potassium, but also for the formation of proteins and the production of dry matter. An oxygen deficit in irrigation water will therefore cause growing problems. Plants will pass on anaerobe (oxygen-free) energy supply. Energy exhaustion will occur fast. Also less nutrients are taken up. The oxygen deficit leads furthermore to less activity of cell membranes, resulting in less water uptake. Less water uptake influences photosynthesis levels and production of dry matter will decrease rapidly.

Dissolved oxygen levels are also relevant for substrate quality. High dissolved oxygen levels increase competition in soil life which adversely effects development of pathogens. Dissolved oxygen levels also regulates the production of substances that suppress diseases and plagues. Substrate life is highly depended on oxygen!

## Behaviour of oxygen in water

Plants can only take up oxygen in dissolved form. When talking about dissolved oxygen, we consider unbound oxygen molecules in the water. This oxygen enters the plant when the plant takes up water and is then directly available for biological use. The oxygen used by the plants, must enter the water first. The maximum concentration of dissolved oxygen is based on the physical holding capacity of the water. This holding capacity decreases when temperature of the water increases. This phenomena results in low dissolved oxygen levels in summer, which is the time plants are most active and need the oxygen the most. For fresh water with a temperature of 25 °C the maximum oxygen concentration is 8.5 ppm (8.5 mg dissolved oxygen per litre of irrigation water). Plants fully need these amounts of oxygen to perform well.

The oxygen used by the plants, must enter the water first. In a natural way, this can happen by diffusion, when water is in contact with air. Due to a difference in oxygen concentration between water and air, oxygen enters the water and dissolves. However, diffusion is a slow process. Besides, the contact area and contact time of irrigation water in horticulture is mostly not sufficient to let enough oxygen enter the water.

Other ways of adding oxygen to the water are often based on injection of oxygen bubbles. However, oxygen bubbles cannot be taken up by the plant. The oxygen in the bubbles can get dissolved in the water (and thus be made biologically available) by exchange on the surface area between the water and the bubbles. This is another form of diffusion. Unfortunately, as mentioned, this process is slow. Injecting oxygen bubbles into water to increase dissolved oxygen levels is therefore an inefficient process.

## Adding dissolved oxygen to the water

In current practical applications, oxygen concentrations are often only 3-5 ppm, causing the plant to perform far below its optimal. The solution for this lays in adding dissolved oxygen to the water. This explains the need for the oxygen injection unit of IPS, which can easily increase dissolved oxygen levels up to the maximum possible amount of oxygen in water.

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