

## Application Notes

### Fermentation & Dissolved Oxygen



Fermentation is a crucial process in many industries, ranging from beer-brewing to wastewater treatment. The process of fermentation can be broken up into 2 main stages: Aerobic or Primary Fermentation, which takes place in the presence of oxygen, and Anaerobic or Secondary Fermentation, which takes place in the absence of oxygen.

70% of the fermentation process is aerobic and does not typically last for more than seven days. Using oxygen, the yeast or bacteria convert glucose into carbon dioxide, water and energy, where most of the energy is devoted to generation of new cells. During this period of time, the yeast can multiply up to 100 – 200 folds. Control of dissolved oxygen is crucial at this stage as it determines the successful growth of the culture. Although adequate oxygen must be injected to ensure sufficient bacteria growth, when in excess, it can lead to a reduction in alcohol-producing activities and over-production of vicinal diketones—compounds that produce undesirable tastes.

The remaining 30% of fermentation takes place in the absence of oxygen and occurs over a period of 2 to 3 weeks. Without oxygen, bacteria cannot respire aerobically to produce energy. Growth ceases and the rate of activities slows down. The bacteria switch to anaerobic respiration, when glucose is broken down chemically with enzymes to produce energy. Alcohol and carbon dioxide are

produced as a side product in the process of anaerobic respiration. In comparison, anaerobic respiration produces significantly less energy than aerobic respiration. However, the amount of energy generated is still sufficient to sustain the bacteria's life processes.

Apart from oxygen, temperature control is also critical throughout the process of fermentation. It casts a strong influence on the product's taste by causing an alteration to the ester, production of higher alcohol and acetaldehyde level, as well as increase in amino acid uptake.

For reliable control of your dissolved oxygen levels and temperature, the alpha DO2000 pg features the amperometric mode of measurement that provides exceptional accurate readings, even at negligible flow rates. With a temperature range of up to 125°C, the controller is ideal even for a wide range of fermentation applications, from steam sterilisation to antibiotics production.

