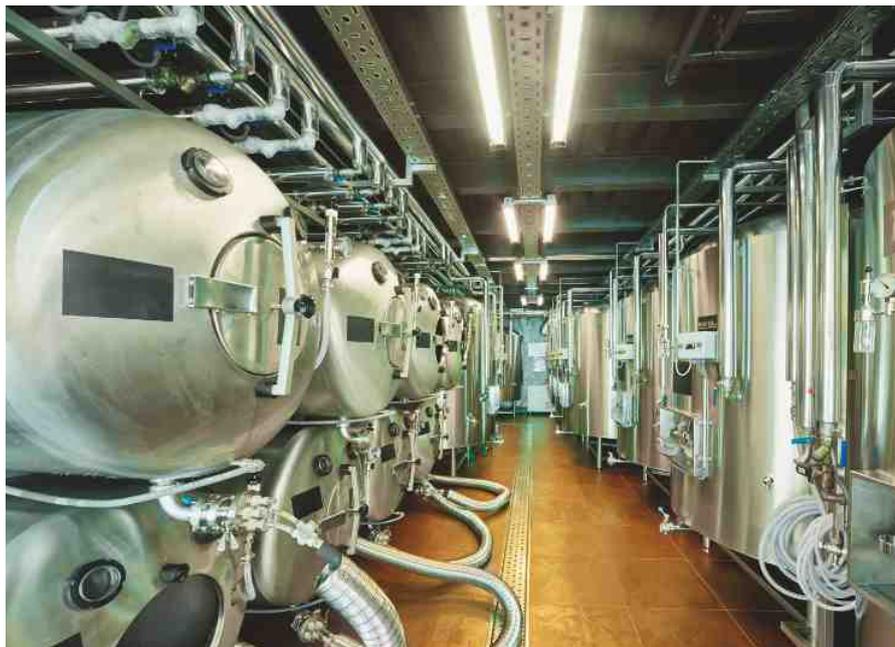


CO₂ Measurements for Fermentation



Fermentation Basics

Fermentation is a chemical change brought about by the action of microorganisms. In industrial fermentation, the term is used broadly to refer to the growth of micro-organisms on a growth medium.

Common everyday examples of fermentation: the souring of milk to yogurt, the rising of bread dough with yeast, or the conversion of sugar to alcohol in wine making or beer brewing.

The fermentation process itself typically takes place in a tank called a bioreactor or fermentor, but the whole production process can be composed of multiple process steps that refine the raw materials to the end product. These process steps include raw material treatments such as blending and sterilization as well as end product processing such as filtration, concentration, drying, and finally packaging.

In the heart of the fermentation process – the bioreactor – the control of acidity and temperature of the growth medium is important. The constant supply of nutrients as well as gases such as CO₂ and O₂ is also monitored. Oxygen is the most important gaseous substrate in aerobic fermentation, while carbon dioxide is the most important gaseous by-product of the process.

What are Enzymes?

Enzymes are proteins composed of amino acids. They are produced by all living organisms – in the fermentation industry by mold or bacteria, but they are not living organisms. The enzyme production process requires a strictly controlled environment within the bioreactor.

In the fermentation process the enzymes are produced in the microbial cells and then secreted into the fermentation broth. Prior to the production fermentor, the biomass serving as the growth medium is built up in several inoculum fermentors.

What are Enzymes Used for?

Enzymes work in various industrial production processes breaking more complex compounds into simpler ones. In baking, enzymes are used for example to increase baking volume, act as stabilizers, and extend the shelf-life of the product. Enzymes are used in the extraction of fruit juices in the beverage industry and in wine making. In the animal feed industry, enzymes are used for improved animal feed conversion. In the textile industry, enzymes are used for bio-finishing, cloth de-sizing, and denim finishing.

The pulp and paper industry uses enzymes for bleaching, deinking, and improved paper production.

The use of enzymes in industries results in reduced chemical costs, increased production capacity, and better quality of the end product. Using enzymes generally requires minor investments.

Enzyme Manufacturing

The production of yeast and alcohols is a large part of the fermentation industry. Besides this, it also produces antibiotics, enzymes, and amino acids. A growing field of fermentation is enzyme manufacturing. Most of the enzymes produced globally are used in detergents. In the future, more enzymes will be needed, for example, in the baking industry, which uses enzymes in bread manufacturing. Enzymes are also produced for food and animal feed as well as the pulp and paper industry.

Detecting CO₂

The demanding surroundings of enzyme production require reliable measurement instruments. The CO₂ concentration of the enzyme production process needs monitoring as the level of CO₂ is an indication of the metabolic activity of the mold or bacteria. The data is used to control the feed of new nutrient pulses to the process.

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