

## Monitoring O<sub>2</sub> and CO<sub>2</sub> in Fermentation Processes

Fermentation processes are used in the manufacturing of countless products from simple yeasts to complex enzymes and pharmaceutical products. Without fermentation we would have very few of the modern foods and health products we have come to enjoy. There are a very large number of manufactures involved in fermentation around the world.



All fermentation processes require the active culturing of live biological components in various types of growth media. The control of the growth of these cultures provides the desired end products. Proper control of both liquid nutrients and atmospheric gas levels are important to these processes.

There are two basic types of fermentation; aerobic and anaerobic. In aerobic fermentation air is forced into the reaction vessel (fermenter) to provide the cultures with needed oxygen. The air is not cut off to the process until it is completed. Oxygen is converted into CO<sub>2</sub> by the cultures during the process and is released. CO<sub>2</sub> levels will rise in the fermenters, but not to extreme levels because the air is being continually replaced.

In anaerobic fermentation the air flow and corresponding oxygen level is controlled more closely. In some cases the reactor may be sealed and the initial headspace in the vessels provides all necessary oxygen. During the process of fermentation the oxygen level drops and the CO<sub>2</sub> rises with time. Eventually, the cultures stop growing. This is due to their O<sub>2</sub> supply being depleted or they produce the desired end product because their O<sub>2</sub> supply is artificially lower than would be found in ambient conditions.

Manufacturers involved in fermentation will have interests in monitoring the O<sub>2</sub> and CO<sub>2</sub> levels in their reactor vessels during these processes. This is particularly important in anaerobic processes because the yield of the reactor will be directly proportional to the ability to maintain desired O<sub>2</sub> and CO<sub>2</sub> concentrations during the fermentation cycle.

Fermentation produce off-gas hydrocarbons and this renders zirconia analysers ineffective. Therefore to measure oxygen requires an electrochemical analyser that is unaffected by CO<sub>2</sub>. One of the Systech Signum Models offer a combination electrochemical O<sub>2</sub> and CO<sub>2</sub> analyser that can effectively handle the fermentation process.

Fermentation processes also produce moisture saturated gas conditions. This requires care in the sample delivery system to be sure that moisture does not condense in the Signum analyser. Simple coiled copper tubing sample lines, installed prior to the analyser, are usually all that is needed. In extreme cases a sample chiller system may be desirable.

Where there is a requirement for a multipoint measuring system the ZR894 is worthy of consideration.

Some applications should also have an active carbon filter and a coalescing filter fitted.

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