

Respiration

Instrumentation through innovation

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SPECIAL
POINTS OF
INTEREST:

Counter flow impeller

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A bio-technology news letter

Cells generate and consume energy for their metabolic processes. If the cells have to continue to function, discrete units of energy should be generated and consumed in the process. Adenosine Triphosphate '1' is the energy "currency" of the cells (ATP). ATP generating metabolic processes uses either organic or inorganic compounds as electron donors. Where Oxygen is used as a terminal electron acceptor the process termed aerobic respiration. On the other hand when nitrate or sulfate is used the process is termed anaerobic.

Respiration occurs through removal of electrons by substrate and passage through electron transport chain to the terminal acceptor. Aerobic process yields almost a tenfold more energy per mole of glucose consumed than anaerobic process. To monitor the Oxygen levels normally two methods are employed. The most important being the dissolved Oxygen in the medium. The other is the % O_2 present above the medium. In the free space of the reactor vessel.

Monitoring the diffusion of Oxygen through a permeable membrane using galvanic cell performs the measurement of DO level in the medium.

The DO measurement is a simple experiment just like the pH since the DO electrode when introduced into a medium responds and produce a corresponding current that is a measure of the Oxygen level. On the other hand if one has to monitor the O_2 levels in the free space of the reactor, an online gas sampling device and ana-

lyzer that work on polarographic or paramagnetic principle is to be employed. The instrumentation is more expensive.

An on line gas sampling probe is to be fitted to the reactor and the line between the analyzer and the reactor is to be instrumented by using valves and vacuum not to contaminate the analysis circuit.



Example: Importance of Oxygen monitoring:

Duke University medical center researchers had observed that the level of Oxygen present during the transformation is a key factor for stimulating the stem cells to change (i.e.) adult stem cells turn fat into cartilage depending on percentage of Oxygen. When the % is 20 they tend to proliferate and when it is less than 5.0% they transform into chondrocytes.

This finding is important, that researchers say, because this low oxygen level

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more closely simulated the natural conditions of cartilage, a type of connective tissue that cushions many joints throughout the body.

However since it is a tissue type very poorly supplied by blood vessels, nerves and the lymphatic system, the cartilage has a very limited capacity for repair when damaged.

“Our findings suggest that oxygen is a key determinant between proliferation and differentiation, and that hypoxia or low oxygen levels, is an important switch that tells cells to stop proliferating and start differentiating”, said Mr. David Want.



The head plate with spragging coil



Various vessel options available with us



Counter flow impeller at work



Multi direction mixing in action

In our next issue:
Fluid flow & mixing

We also offer projects for biotechnology students in reactor design, process control, fermentation, DSP,



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