Investigating the rate of aerobic respiration in yeast

Transcript

Aerobic respiration produces ATP, the universal energy currency of life.

The overall process can be represented by a simple equation.

However, the mechanism of aerobic respiration is far more complex, involving a number of sequential and dependent reactions, including dehydrogenation reactions.

This investigation explores the effect of varying temperature on the rate of respiration in yeast cells, using the decolourisation of a redox indicator.

Yeast-glucose suspension is measured into each of six boiling tubes.

The boiling tubes are labelled with a series of different temperatures, ranging from ice-cold to near boiling.

Methylene blue is added to a different set of six boiling tubes. These are labelled with the same set of temperatures.

Each pair of boiling tubes are placed in their respective water baths for at least 10 minutes to ensure the contents reach the desired temperature.

One pair of boiling tubes are removed from their water bath, and the methylene blue is poured into the boiling tube of yeast-glucose suspension. Methylene blue is an artificial hydrogen acceptor that decolourises during dehydrogenation reactions. The time it takes to decolour is used a measure of the rate of respiration. The mixture is inverted to mix it thoroughly.

The timer is immediately started, and the boiling tube is placed back into the water bath. The sample is not touched or agitated during the incubation period, because any movement will result in the reappearance of the blue colour.

The time at which the blue mixture decolorizes is recorded.

The contents of each pair of test-tubes are mixed in this way and the time to decolourisation is recorded, one pair at a time.

Comparing the colour of the reaction mixture with a tube containing fresh yeast suspension can make the end point of the reaction easier to deduce.

The whole experiment is repeated two more times for each temperature, in order to calculate a mean rate of reaction.

The mean rate of reaction is calculated by dividing 100 by the mean time taken in seconds.

The results are plotted on a suitable graph and can be explained by what we know about the effect of temperature on the rate of enzyme-catalysed reactions.

Investigations of this type are used to refine the conditions in biotechnology that employ yeast cultures. This enables bioengineers to improve the efficiency and productivity of many industrial processes.