

Simple biofuel cells: the superpower of baker's yeast

Answer sheet for the discussion questions

Activity 1

What does the colour change tell you?

- Beginner's classroom: the colour change tells us that methylene blue has undergone a chemical reaction.
- More advanced students could refer to the structures of methylene blue and conclude that a reaction is taking place, in which electrons are set free.

What kind of reaction is happening in the yeast cells?

Cell respiration takes place.

Where do the electrons come from that cause methylene blue to decolourize?

They come from the metabolism of yeast. (The current state of research is that the electrons are released in the citrate cycle. Where exactly is still an open question.)

Why does decolourization take less time at 30°C than at room temperature?

Because it is closer to the optimum temperature for the metabolism of baker's yeast.

Activity 2

What causes the measurable voltage in Activity 2?

The metabolism of baker's yeast and the electrons set free cause the voltage.

How could the performance be increased?

There are many ways to increase the performance, for example, a more compact setup, electrodes with a larger surface area and higher conductivity, or a different salt bridge.

Name the limitations of the fuel cell experiment – why is it just a model experiment?

The substrate is not refilled and the product is not removed during the operation of the cell – thus, the voltage decreases and finally drops off. This is also the case in experimental kits for hydrogen–oxygen fuel cells used for teaching purposes.