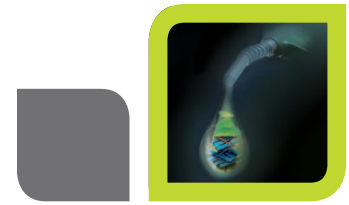


Biofuel Enzyme Kit



Mastering Inquiry Can Be Easy with Bio-Rad

Activity 6 of the Biofuel Enzyme Kit is an inquiry-based activity in which students select the mushrooms (samples) to be analyzed. This activity also allows for a discussion about evolution and ecological niches. Use the following 20 questions for additional student-based inquiry about the processes contained in this kit. Whenever possible let your students develop protocols and choose the variables to test.

Level 1 questions are simple to adapt and do not add extra days to the running of this laboratory. An example of how to organize and execute a Level 1 question is given below.

Level 2 questions may add a few days onto the lab and may require some additional materials to answer.

Level 3 questions are for students seeking a real challenge and will require additional days, techniques, and materials to answer.

EXAMPLE

Level 1, Question #10: Activity 6 — Can mushrooms' ecological niches predict cellobiase activity?

For Activity 6, obtain the following mushrooms from the store: oyster, shiitake, button, porcini, and chanterelle. You can find many of these mushrooms dried and they will work just as well as fresh ones. Have student groups make hypotheses as to which mushrooms will display the most activity based on their ecological niches. Shiitake and oyster mushrooms grow directly on dead wood and have high cellobiase activity compared to button mushrooms, which grow on partially degraded materials. Porcini and chanterelle mushrooms grow in association with tree roots and have very little cellobiase activity because they get most of their nutrients from the tree. Direct each student group to examine a mushroom for cellobiase activity and have students share data and compare their results to their hypotheses.



Biofuel Enzyme Kit

Level

1

1. What wavelength is optimal for reading *p*-nitrophenol?
2. **Activity 1** — Does changing the reaction volume change the rate of cellobiase enzyme activity?
3. **Activity 2** — What specific temperature causes cellobiase to fail?
4. **Activity 2** — Can cellobiase survive freezing and then thawing?
5. **Activity 2** — Can cellobiase be denatured by heat, cooled down, and still work?
6. Does the *p*-nitrophenyl glucopyranoside substrate break down at high temperatures?
7. **Activity 6** — Do parts of a mushroom (stem, cap, gills) have different levels of cellobiase activity?
8. **Activity 6** — Does the amount of mushroom used for extraction cause changes in the rate of reaction?
9. **Activity 6** — What other organisms have cellobiase activity besides mushrooms?
10. **Activity 6** — Can mushrooms' ecological niches predict cellobiase activity?

Level

2

11. **Activity 3** — At what low pH point does cellobiase stop working?
12. **Activity 3** — Can the high pH point of 8.6 be rescued by adding acid?
13. What is the optimal combination of temperature and pH? Prove it experimentally.
14. Can you competitively inhibit cellobiase's breakdown of the substrate?
15. How does cellobiase perform in higher salt concentrations?

Level

3

16. Is it the **amount** of cellobiase or the specific **type** of cellobiase from a mushroom that causes its difference in activity compared to other mushrooms?
17. What are the optimal pH and temperature conditions for a cellobiase that you've extracted from the environment?
18. Once you've found a good cellobiase, can you clone it and produce more?
19. Is there any other factor you can add to increase the cellobiase activity?
20. Are there factors of a mushroom's growth that affect its cellobiase activity?