**Fermentation Inquiry Lab**

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| **Step 1** | **Read the case study and then research fermentation.**  |
| **Step 2** | **Design an experiment to test one parameter that affects the rate of fermentation. Be sure to have a control group. Identify your independent and dependent variables.** |
| **Step 3** | **Conduct your experiment. Keep in mind you will need pictures of yourself doing the lab. You will also need to bring in a sample from your experiment** |
| **Step 4** | **Mini-poster presentation. You will present your research to members of the class and showcase your product(s) from your experiment.** |

**Bakery Case Study**

Nicole Bailey has just taken over as chief operating officer for a small bakery. The bakery has had difficulty recently because several of the more experienced staff have retired or resigned. Nicole has called a meeting of the key bakery personnel to review current status and hear recommendations for future operations.

“OK, let’s get started. Mike, tell me about our current situation in white bread production.”

Mike Copeland, a new supervisor, begins, “Bread production has been declining in terms of quality. I’ve checked out the quality of the flour and sugar, and they seem OK. It could be the pH or the temperature, or it could be the supplements provided the yeast during fermentation. There are salts necessary for fermentation, and these have optimal concentrations, but I don’t yet know what those are. Clearly fermentation is too low to get adequate CO2 production for the dough to rise properly.”

“Thanks, Mike. Mrs. Kinsley, what do you have to report from your investigation of the specialty bakery?” said Nicole. Mrs. Kinsley was new to the bakery but also new to the bakery business itself. “It looks to me like the specialty bakery could use new ideas. We use the basic glucose for the yeast to ferment, but I’ve been wondering if we could add a different sugar – with a sweet flavor – and produce bread that not only rises, but also tastes sweet.”

“Interesting idea,” commented Nicole. “Do you know whether yeast can metabolize any other sugars than glucose? And what sugars do you have in mind?”

“Sucrose, I believe, is ordinary table sugar, and maltose and lactose I believe are also sugars.”

“Those are disaccharides, but there are also the monosaccharides like fructose and galactose,” said Larry Brinkwell, the lab chemist.

“And I don’t know whether yeast can use any of these,” Mrs. Kinsley replied. “OK, thanks, Mrs. Kinsley,” said Nicole. “Anybody else?”

“In response to Mike’s problem, what I’m wondering,” said Arthur McLain, the accountant, “is whether we can’t get more production out of the yeast by simply fermenting longer.”

“Perhaps so,” responded Larry. “But the yeast will only do what they can do in a particular set of conditions. I’ve heard reports from the wine-making industry that yeast, when allowed to go too long, simply stop fermenting when the alcohol reaches some level. Remember that fermentation in yeast produces ethanol.”

“Still thinking about the economics of the process,” interrupted Arthur, “is it possible to achieve the same level of rising with less yeast, so that we could cut down on yeast costs?”

“OK, I think we have enough to go on here,” said Nicole. “Let’s meet in a week and see if we can bring in answers to the questions you’ve posed.”

Now that you have read the Case Study, you have some idea about things that could be tested as parameters for fermentation.

Consider the following questions / information when designing your experiment:

What experimental parameter do you intend to vary in your inquiry lab? What solutions do you need?

What is your hypothesis regarding the effect of this variable on alcohol or CO2 production?