

Microbiology Laboratory 13

Food Microbiology

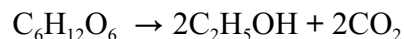
Cereal grains were fermented to beer. An Assyrian tablet states that Noah took beer aboard the ark. Cultures that produced fermented drinks used the agricultural products that were available to them. So Japan fermented rice into Sake. Northern Europeans used cereal grains to produce beer and Southern Europeans used the sugar in grapes to produce wine.

Fermentation is actually used to preserve foods. The acids that are formed and the reduced environment retard the growth of many spoilage microbes.

Wine is essentially fermented fruit juice. The organism most commonly used to produce wine is *Saccharomyces cerevisias* var. *ellipsoideus*. Although we usually associate wine with fermented grapes, it may also be made from berries, dandelions, rhubarb, and others.

Three conditions are required: monosaccha-

rides, yeast, and an anaerobic environment. The chemical formula for the fermentation reaction is shown below.

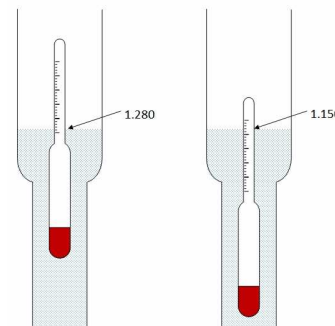


Commercially, wine is produced in three forms, white, red, and rosé. To produce white wine, either red or white grapes are used, but the skins are discarded. Red wines are produced with red grapes and the skins are left on during the initial stage of fermentation. To make rosé wines the skins of red grapes are left on but only for a limited time (one to three days).

In this lab you will set up a grape juice fermentation. The balloon attached to the top of the flask is to exclude oxygen and trap the CO₂ that will be produced.

Lab Assignment - Fermentation

- Obtain a 125 ml Erlenmeyer flask and label.
- Transfer 100 ml of grape juice to the flask (be sure to use a graduated cylinder to measure the grape juice - never use the numbers on the flask for measurement).
- Pour some of your juice into the hydrometer test-tube.
- Measure the specific gravity of the juice at the level of the meniscus and record below.
- Transfer all of your juice to your 125 ml Erlenmeyer flask.
- Weigh out 0.20 g of yeast and transfer to your flask with the juice.
- Cover the flask opening with a balloon.
- Incubate at room temperature.



Specific gravity _____



Food production is the largest worldwide industry. In industrialized nations the money spent on food can account for at least 20-30% of the household budgets. Over the generations of humans, the food industry has diversified into specialist areas and industries. While small local producers still thrive, there are now national and multinational organizations involved in the manufacture and distribution of food on a worldwide scale. Today, the food industry supplies society with high-quality, good to eat foods, all year round, and often at a considerable distance from the site of production.

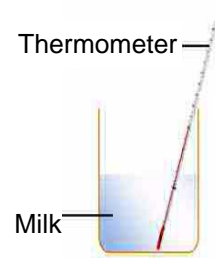
Microbiology has long been involved in the production and processing of food. Microbial processing alters the food to form a product that is more nutritious, more digestible, has improved flavor, and is often safer for the consumer. For the most part, the procedures

developed were done without the knowledge of microorganisms. Earliest records of fermented foods date to the Sumarians, the Egyptians, and the Babylonians who produced alcoholic beverages. Fermented dairy products are found in early Sanskrit and Christian writings.

People have been making food products from milk with the purpose of extending the shelf life of milk. The principle organisms used have been yeasts and lactic acid producing bacteria. Examples of products are yogurt from eastern and central Europe, Kefir from the Cossacks, koumiss from central Asia, and leben from Egypt. All of these products involve the use of lactobacilli along with other microorganisms that produce acid to curdle (denature and precipitate) the milk proteins. This thickens the milk and provides the desired flavor.

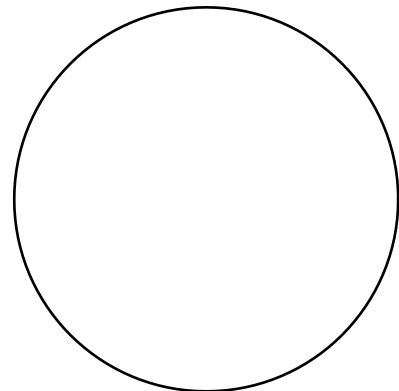
Lab Assignment - Yogurt Production

- Obtain a large beaker (400 or 600 ml).
- Measure 100 ml of milk in a graduated cylinder. Then transfer the milk to a beaker.
- Weigh out 4 g of powdered milk and add it to the milk in your beaker.
- Place your beaker on a hot plate and heat the milk till it just begins to boil. (You do not want a roaring boil.)
- Remove the beaker from the hot plate and place on the bench top. Allow the milk to cool to 45°C.
- Add one teaspoonful of yogurt to the cooled milk and stir well.
- Transfer the mixture to a designated capped container.
- Rinse out the beaker. (Especially if you have burnt milk in the bottom.)
- Place the cap on your container, label it, and put it in the incubator.



Lab Assignment - Microscopic examination

- Using a sterile loop, prepare a smear on a microscope slide of the store bought yogurt.
- Once completely dry, fix the smear.
- Stain the fixed smear with methylene blue.
- Observe and record the bacterial morphologies observed under the oil immersion lens on your microscope.



Magnification _____