

10th Grade

# Microbes

# What are microbes?

1. Microbes are tiny living things that are found all around us and are too small to be seen by the naked eye.
2. They live in water, soil, and in the air. The human body is home to millions of these microbes too, also called microorganisms.
3. Some microbes make us sick, others are important for our health. The most common types are bacteria, viruses and fungi.
4. There are also microbes called protozoa. These are tiny living things that are responsible for diseases such as toxoplasmosis and malaria.

# 1) Streptococcus thermophilus

## Characteristics

*Streptococcus thermophilus* is a Gram-positive spherical to ovoid non-motile coccus, 0.7–0.9  $\mu\text{m}$  in diameter, occurring in pairs and chains, some of which can be very long. The bacterium has an optimum growth temperature of 40–45 °C, a minimum of 20–25 °C, and a maximum near 47–50 °C.

## Industrial Application

- ***S. thermophilus*** is one of the most widely used bacteria in the dairy industry. USDA statistics from 1998 showed that more than 1.02 billion kilograms of mozzarella cheese and 621 million kilograms of yogurt were produced from *S. thermophilus*.
- Although its genus, *Streptococcus*, includes some pathogenic species, food industries consider *S. thermophilus* a safer bacterium than many other *Streptococcus* species. In fact, yogurt and cheese that contain live cultures of *S. thermophilus* are thought to be beneficial to health.
- Live cultures of *S. thermophilus* make it easier for people who are lactose-intolerant to digest dairy products. The bacteria break down lactose, the sugar in milk, that lactose-intolerant people find difficult to digest.



## 2) Lactobacillus acidophilus

### Characteristics

Lactobacillus acidophilus is a Gram-positive rod with rounded ends that occur as single cells, as well as in pairs or in short chains. The typical size is 0.6–0.9  $\mu\text{m}$  in width and 1.5–6.0  $\mu\text{m}$  in length. It is non-flagellated, non-motile and non-spore-forming, and is intolerant to salt.

### Industrial Application

1. Acidophilus may be used to alleviate symptoms of different health conditions. Acidophilus may help treat:
2. **Diarrhea:** You may be able to take acidophilus to help reduce the risk of diarrhea caused by taking antibiotics. It may also help with diarrhea caused by an infection.
3. **Vaginal inflammation:** You may be able to take acidophilus to treat the symptoms of vaginal inflammation (bacterial vaginosis).
4. **Yeast infections:** You may be able to take acidophilus to treat and prevent vaginal yeast infections. It may also be used to treat yeast infections in your mouth (oral yeast infections).

# 3) acetobacter

## Industrial Application

### Acetic acid production

A. aceti is used for the mass production of acetic acid, the main component in vinegar. During the fermentation process of vinegar production, it is used to act on wines and ciders resulting in vinegar with acetic acid. It can be converted by a silicone tube reactor, which aids the fermentation process with oxidation.



# 4) *Saccharomyces cerevisiae*

## Characteristics

*Saccharomyces cerevisiae* is a species of yeast (single-celled fungus microorganisms). It is one of the most intensively studied eukaryotic model organisms in molecular and cell biology, much like *Escherichia coli* as the model bacterium. It is the microorganism behind the most common type of fermentation. *S. cerevisiae* cells are round to ovoid, 5–10  $\mu\text{m}$  in diameter. It reproduces by budding.

## Industrial Application

### 1) Brewing

*Saccharomyces cerevisiae* is used in brewing beer, when it is sometimes called a top-fermenting or top-cropping yeast. It is so called because during the fermentation process its hydrophobic surface causes the flocs to adhere to  $\text{CO}_2$  and rise to the top of the fermentation vessel. A variant yeast known as *Saccharomyces cerevisiae* var. *diastaticus* is a beer spoiler which can cause secondary fermentations in packaged products.

In May 2013, the Oregon legislature made *S. cerevisiae* the official state microbe in recognition of the impact craft beer brewing has had on the state economy and the state's identity.

## 2) Baking

Also called as **Baker's yeast**

*S. cerevisiae* is used in baking; the carbon dioxide generated by the fermentation is used as a leavening agent in bread and other baked goods. Historically, this use was closely linked to the brewing industry's use of yeast, as bakers took or bought the barm or yeast-filled foam from brewing ale from the brewers (producing the barm cake); today, brewing and baking yeast strains are somewhat different.

## 3) Nutritional yeast

*Saccharomyces cerevisiae* is the main source of nutritional yeast, which is sold commercially as a food product. It is popular with vegans and vegetarians as an ingredient in cheese substitutes, or as a general food additive as a source of vitamins and minerals, especially amino acids and B-complex vitamins.

## 4) Uses in aquaria

Owing to the high cost of commercial CO<sub>2</sub> cylinder systems, CO<sub>2</sub> injection by yeast is one of the most popular DIY approaches followed by aquaculturists for providing CO<sub>2</sub> to underwater aquatic plants. The yeast culture is, in general, maintained in plastic bottles, and typical systems provide one bubble every 3–7 seconds. Various approaches have been devised to allow proper absorption of the gas into the water.



## 5) Direct use in medicine

*Saccharomyces cerevisiae* is used as a probiotic in humans and animals. The strain *Saccharomyces cerevisiae* var. *boulardii* is industrially manufactured and used clinically as a medication.

Several clinical and experimental studies have shown that *S. cerevisiae* var. *boulardii* is, to lesser or greater extent, useful for prevention or treatment of several gastrointestinal diseases. Moderate quality evidence has shown *S. cerevisiae* var. *boulardii* reduces risk of antibiotic-associated diarrhoea both in adults and in children and to reduce risk of adverse effects of *Helicobacter pylori* eradication therapy. There is some evidence to support efficacy of *S. cerevisiae* var. *boulardii* in prevention (but not treatment) of traveler's diarrhoea and, at least as an adjunct medication, in treatment of acute diarrhoea in adults and children and of persistent diarrhoea in children. It may also reduce symptoms of allergic rhinitis.