

FDE 328

INDUSTRIAL MICROBIOLOGY

Instructor:

Res. Assist. Dr. Simel BAĞDER ELMACI

e-mail: sbagder@eng.ankara.edu.tr

Phone: +90 (312) 203 3300 (3628 ext.)

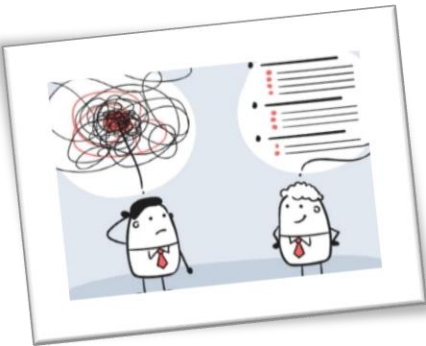
Learning Objectives

- ▶ The aim of the course is to give information about the use of microorganisms in the production of industrial products and services and related calculations.
- ▶ The aim of the course is to give information about importance and production methods of products with industrial potential formed by microorganisms.

Course Content

- ▶ General Features of Industrial Microorganisms
- ▶ Industrial Applications of Some Microorganisms
- ▶ Kinetics and Stoichiometry of Microbial Growth and Product Formation
- ▶ Fermentation Systems, Production Methods
- ▶ Culture Collections, Maintenance of Microbial Cultures
- ▶ Production of Potential Industrial Products

Course Outline



1	Introduction to industrial microbiology, General Features of Industrial Microorganisms
2	Microbial Growth
3	Effects of Environmental Conditions on Microbial Growth
4	Yield coefficients for cell mass and product formation
5	Fermentation Systems, Production Methods, Starter Culture Preparation
6	Culture Collections, Maintenance of Microbial Cultures
7	Substrate Formulations, Selection of Industrial Substrates
8	Mid-term exam
9	Production of Baker's Yeast
10	Production of Single Cell Protein
11	Production of Ethyl Alcohol
12	Production of Acetic Acid
13	Production of Lactic Acid, Production of Citric Acid
14	Biogas Production, Waste-water and effluent treatment

Suggested References

- ▶ Waites M. J., Morgan, N. L., Rockey, J. S., Higon, G. (2001). **Industrial microbiology, An Introduction.** Blackwell Sci., Great Britain.
- ▶ Okafor, N. (2007). **Modern Industrial Microbiology and Biotechnology.** Science Publishers, Enfield, NH, USA.

Definition of Industrial Microbiology

- ▶ **Industrial microbiology** is defined as the use of microorganisms such as bacteria, fungi and algae for the manufacturing and services.
- ▶ **Industrial microbiology** is also defined as the study of the large-scale and profit-motivated production of microorganisms or their products for direct use, or as inputs in the manufacture of other goods.
- ▶ **Industrial microbiology** is primarily associated with the commercial exploitation of microorganisms and involves processes and products that are of major economic, environmental and social importance throughout the World.
- ▶ **Industrial microbiology** is a branch of biotechnology that applies microbial sciences to create industrial products in mass quantities and includes the traditional and nucleic acid aspects.

Aspects of Industrial Microbiology

- ▶ There are two key aspects of industrial microbiology.
- ▶ **The first** relating to production of valuable microbial products via fermentation processes. These include traditional fermented foods and beverages, such as bread, beer, cheese and wine, which have been produced for thousands of years. In addition, over the last hundred years or so, microorganisms have been further employed in the production of numerous chemical feedstocks, energy sources, enzymes, food ingredients and pharmaceuticals.
- ▶ **The second aspect** is the role of microorganisms in providing services, particularly for waste treatment and pollution control, which utilizes their abilities to degrade virtually all natural and man-made products.

Industrial Microbiology

- ▶ The scope of **industrial microbiology** is to use microorganisms to serve an industrial purpose.
- ▶ In other words, **industrial microbiology** is the branch of microbiology that uses microorganisms to produce industrial products in large quantities.

What is Bioprocess/Biotransformation/Bioconversion?

- ▶ Biochemical conversions which are catalyzed by microorganisms or enzymes are called as biotransformations or bioconversions.
- ▶ The industrial productions which are performed with the use of biological agents are generally referred to as «bioprocess».
- ▶ Biocatalysts in bioprocesses: microbial cell/enzyme-free/immobilized.
- ▶ Biocatalysts are definitely necessary for bioprocesses.

In bioprocesses, the following conditions should be provided:

1. Obtaining a suitable industrial microorganism strain (by selection or mutation)-Strain screening and selection
2. Cultivation of microbial strain
3. Selection of appropriate substrate and substrate formulation
4. Biosynthesis under suitable conditions
5. Product purification/separation from the growth medium

The Main Stages of Bioprocessing

