Al-Mustaqbal University

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جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

كلية العلوم

قسم التقنيات الاحيائية الطبية

Lec. 1

INDUSTRIAL MICROBIOLOGY

by

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Introduction

Integration of biochemical principles with industrial processes.

Aim: Sustainable and efficient production.

Key products: Foods, pharmaceuticals, biofuels, enzymes.

Importance

- Reduces pollution and uses renewable resources.
- Improves industrial efficiency.
- Supports the green economy.

Key Industrial Applications

- Pharmaceuticals – Antibiotics ,vaccines, therapeutic proteins.
- Food Industry – Fermentation (yogurt ,cheese, beer.(
- Bioenergy – Ethanol, biodiesel.
- Textiles & Leather – Enzymatic treatments.
- Waste Management – Bioremediation and recycling.

Microorganisms in Industrial Processes

•Easy to handle, cultivate, and manipulate.

•Source of enzymes, organic acids ,hormones.

•Improved via mutation and selection.

Microbial Composition

- %90of dry weight: C, O, N, H, S, P, K, Zn, Mg, Ni.
- Essential roles:
  - K: Enzyme activation
  - Mg: Cofactor
  - S: Amino acids
  - Fe: Electron transport
  - Ca^{2+}: Heat resistance
  - Zn^{2+}: Catalytic sites

Vitamins and Cofactors

Biotin – Carboxylation: Leuconostoc mesenteroides.

Folic Acid – Acyl transfer: Lactobacillus casei.

Thiamine (B1) – Aldehyde transfer: Onchomonas mellamensis.

Pantothenic Acid – Precursor of CoA: Paramecium.

Historical Development

- Ancient Era – Fermentation (bread ,wine, vinegar).
- 1800s – Pasteur (fermentation) ,Buchner (enzymes).
- – 1950–1900 Large-scale fermentation ,penicillin.
- – 2000–1950 Genetic engineering ,enzyme tech.
- –2000Present – Synthetic biology ,CRISPR, biorefineries.

Modern Impact

•Advances in bioreactors and process control.

•Shift to engineered strains.

•Expansion to detergents, food ,textiles.