



## UNIT V – TOPIC 1

### Role of Technologies: Principles of Pulsed Electric Field

Pulsed Electric Field (PEF) technology is a non-thermal food processing method that uses short, high-voltage electric pulses to inactivate microorganisms and enzymes while preserving food quality. It is widely used in food preservation, liquid processing, and biotechnology.

#### Key Principles of PEF:

##### 1. Electroporation Mechanism

- PEF applies short bursts (microseconds to milliseconds) of high-voltage electricity (typically 10–80 kV/cm) to a food product placed between two electrodes.
- The electric field disrupts microbial cell membranes by creating pores (electroporation), leading to cell inactivation without significant heat generation.

##### 2. Non-Thermal Processing

- Unlike thermal pasteurization, PEF does not rely on heat, thus preserving nutrients, flavor, and color in foods like juices, milk, and liquid eggs.

##### 3. Energy Efficiency

- PEF consumes less energy compared to conventional thermal processing, making it a sustainable alternative.

##### 4. Selective Inactivation

- PEF primarily affects microorganisms and enzymes while minimally impacting food matrices, ensuring extended shelf life without chemical preservatives.



## 5. Applications in Food & Biotechnology

- **Food Preservation:** Extends shelf life of juices, milk, and sauces.
- **Extraction Enhancement:** Improves yield in juice and oil extraction.
- **Biomedical Uses:** Used in drug delivery and cancer treatment (electrochemotherapy).

### Advantages of PEF:

- ✓ Maintains fresh-like quality of food
- ✓ Reduces energy consumption compared to thermal methods
- ✓ Extends shelf life without chemical additives
- ✓ Suitable for heat-sensitive liquids

### Challenges:

- High initial equipment cost
- Limited effectiveness on solid and high-conductivity foods
- Requires precise control of pulse parameters

### Conclusion

PEF technology is a promising alternative to traditional food processing methods, offering a balance between microbial safety and product quality. Ongoing research aims to optimize its efficiency and expand applications in food and biotechnology.