Factors affecting growth of Micro-organism in food

Dr. Sudha Tiwari,
Asst. Professor,
GGPGC, Banda, UP

Factors affecting microbes in foods

- Extrinsic factors
- Intrinsic factors

Factors affecting growth of Micro-organism in food

- In most cases, micro-organism utilizes our food supply as a source of nutrient for their growth.
- This result in deterioration(decay)of food also poses risks of disease to the human being on consumption of such contaminated food.
- However, the growth of microorganisms in food may be affected by several factors like physical, chemical and biological.
- These factors can broadly divide into two categories i.e. intrinsic factors and extrinsic factors

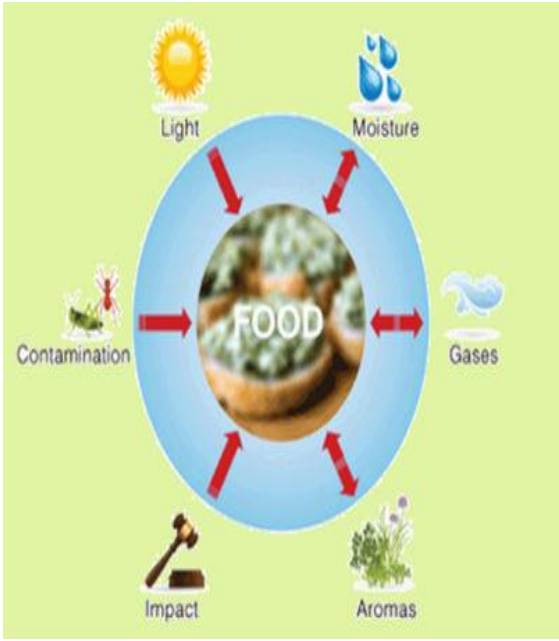
Factors affecting growth of Micro-organism in food

- **Factors related to the food itself are known as "intrinsic factors," which include nutrient content, water activity, pH value, and the presence of antimicrobial substances**

- **Factors related to the environment in which the food is stored, the "extrinsic factors," including the temperature of storage, and the composition of gases and relative humidity in the atmosphere surrounding the food;**

Factors affecting growth of Micro-organism in food

- **Intrinsic Factors**
  1. pH Value
  2. Moisture content or water activity(aw)
  3. Nutrients Contained
  4. Anti-microbial Constituents
  5. Biological Structure
- Extrinsic Factors
  1. Temperature of storage
  2. Relative humidity
  3. Presence and concentration of gases
  4. Presence and activity of micro-organism

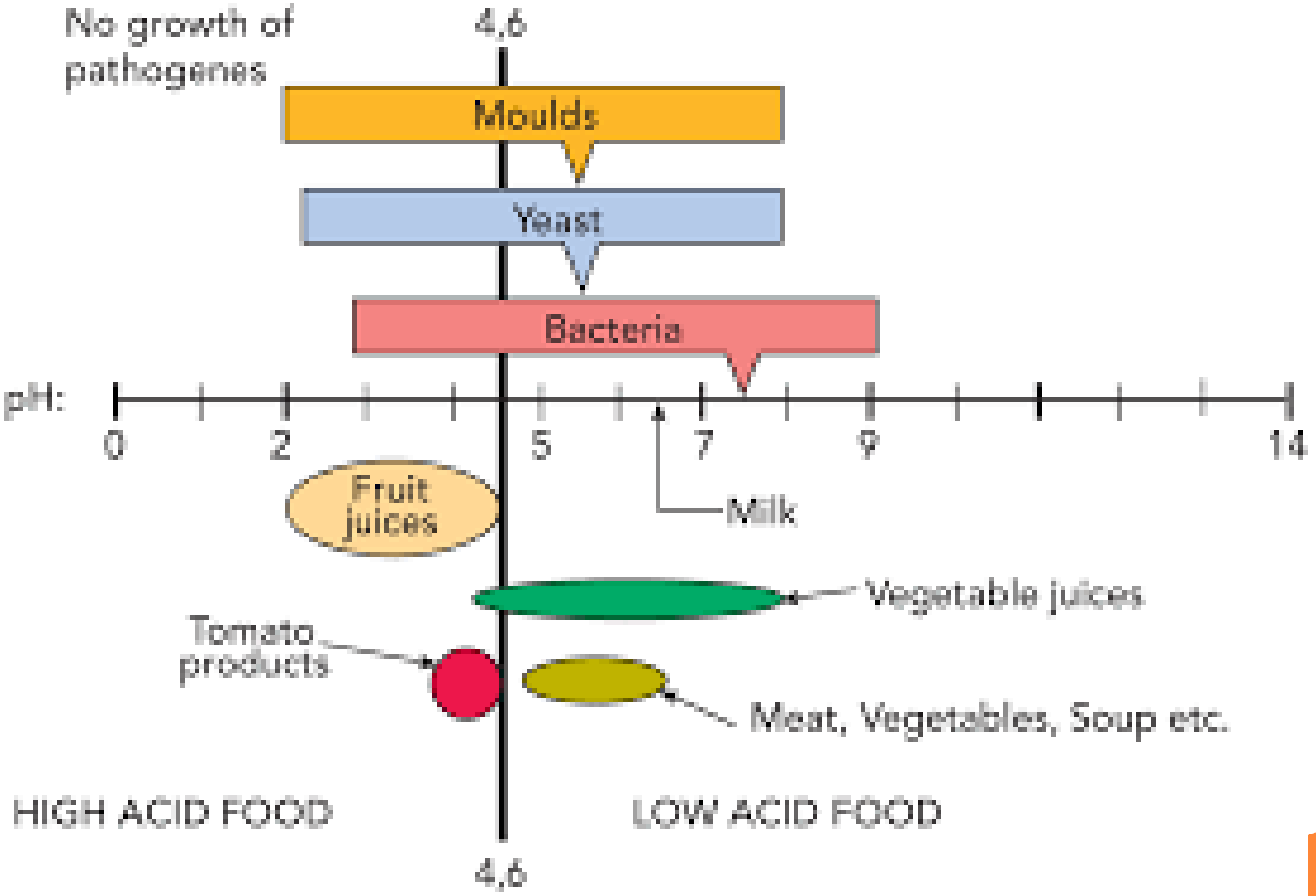


Intrinsic Factors-

- Intrinsic parameters are natural or inherent properties of food.
- These parameters greatly affect the number and types of microorganism that will colonize the food and food product.
- Intrinsic parameters affect only microorganisms, not to the food itself. These include:
  - Nutrients
  - pH
  - Water activity
  - Antimicrobial constituents
  - Antimicrobial structures

1. pH Value

- Every organism has a minimal, maximal and optimal pH for growth
- Some organism can grow better at low pH or acidic pH, some can grow in alkaline pH and while other grow at somewhat neutral pH.
- pH influence both the growth rate and types of organism that will predominant the food.
- In general yeast and mould are more acid tolerant than bacteria.

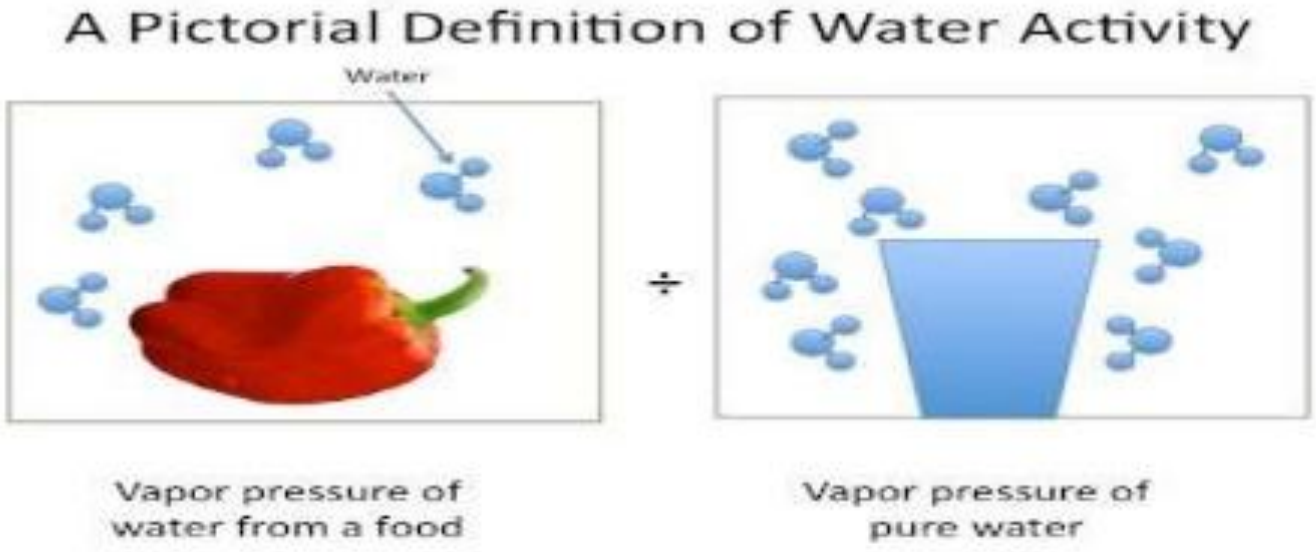

No growth of pathogenes
4,6
Moulds
Yeast
Bacteria
pH:
0
2
5
7
9
14
Fruit juices
Milk
Vegetable juices
Tomato products
Meat, Vegetables, Soup etc.
HIGH ACID FOOD
LOW ACID FOOD
4,6

2.Moisture content or water activity

- Micro-organism has an absolute demand for water, however, the exact amount of water needed for growth of microorganisms varies.
- This parameter helps us to understand the movement of water from the environment to the cytoplasm or from cytoplasm to the environment.
- Water activity is the ratio of the vapour pressure of water present in food substrate(solution) to the vapour pressure of pure water at the same temperature.

What is Water activity?

- Water activity is a thermodynamic property which is defined as the ratio of vapor pressure of water in a food system and vapor pressure of pure water at the same temperature.



Water activity	Contaminant
aw = 0.91...0.95	Many bacteria
aw = 0.88	Many yeasts
aw = 0.80	Many mildews
aw = 0.75	Halophile bacteria
aw = 0.70	Osmiophile yeasts
aw = 0.65	Xerophile mildew

3.Nutrients Contained

- Nutrient content of the food are important in determining which microorganism is most likely to grow.
- The carbohydrate(simple sugar) is most commonly utilized as an energy source.
- Protein-rich food like meat, egg, fish etc. are always spoiled by protolytic organism because they can utilize protein as a source of energy if sugar is not available.
- In fact, protein-rich food promotes more growth of bacteria then yeast and mould.
- Mould can grow in the higher concentration of sugar, yeast in fairly high concentration but most bacteria grow best in the low concentration of sugar.

4.Anti-microbial Constituents

- Some foods possess naturally occurring substances which influence the activity of invading microorganisms, for example:-
- In Plant;

  Clove:- Eugenol

  Garlic:-Allicin

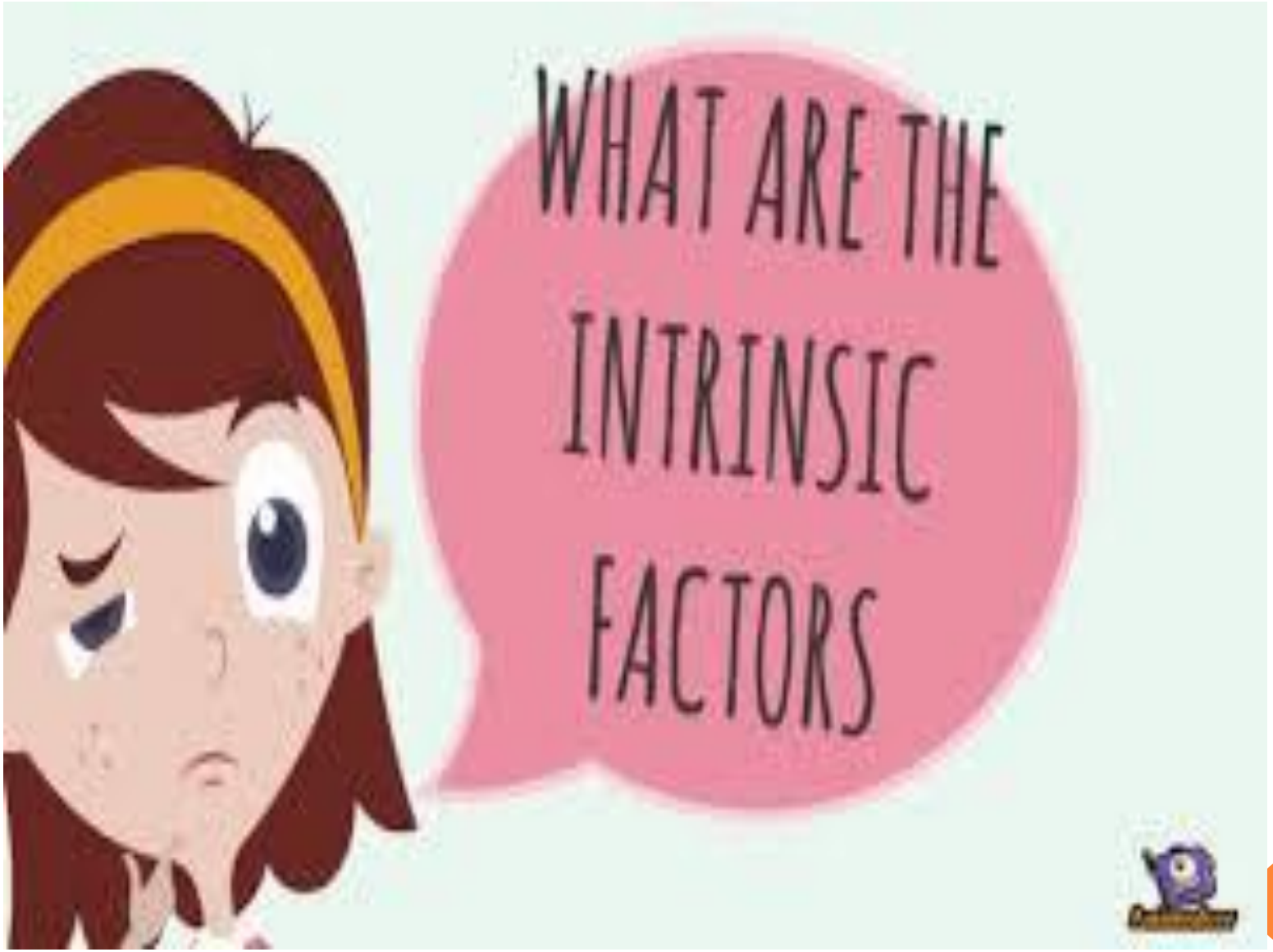
  Mustard oil:-Allyl isothiocyanate
- In Animal –

  Cows milk:-Lactoferrin, conglutinin, lactoperoxidase system.

  Egg:-Lysozyme,0vatransferrin(inhibit Salmonella enteritidis)

5. Biological Structure

- The natural covering of some foods provides excellent protection against the energy of microorganism and spoilage of food by such microorganisms.
- Natural covering of food like, Testa of seed Shell of egg/nuts peel of fruits/vegetable
- Hide of animal may limit the entry of microorganisms


WHAT ARE THE
INTRINSIC
FACTORS

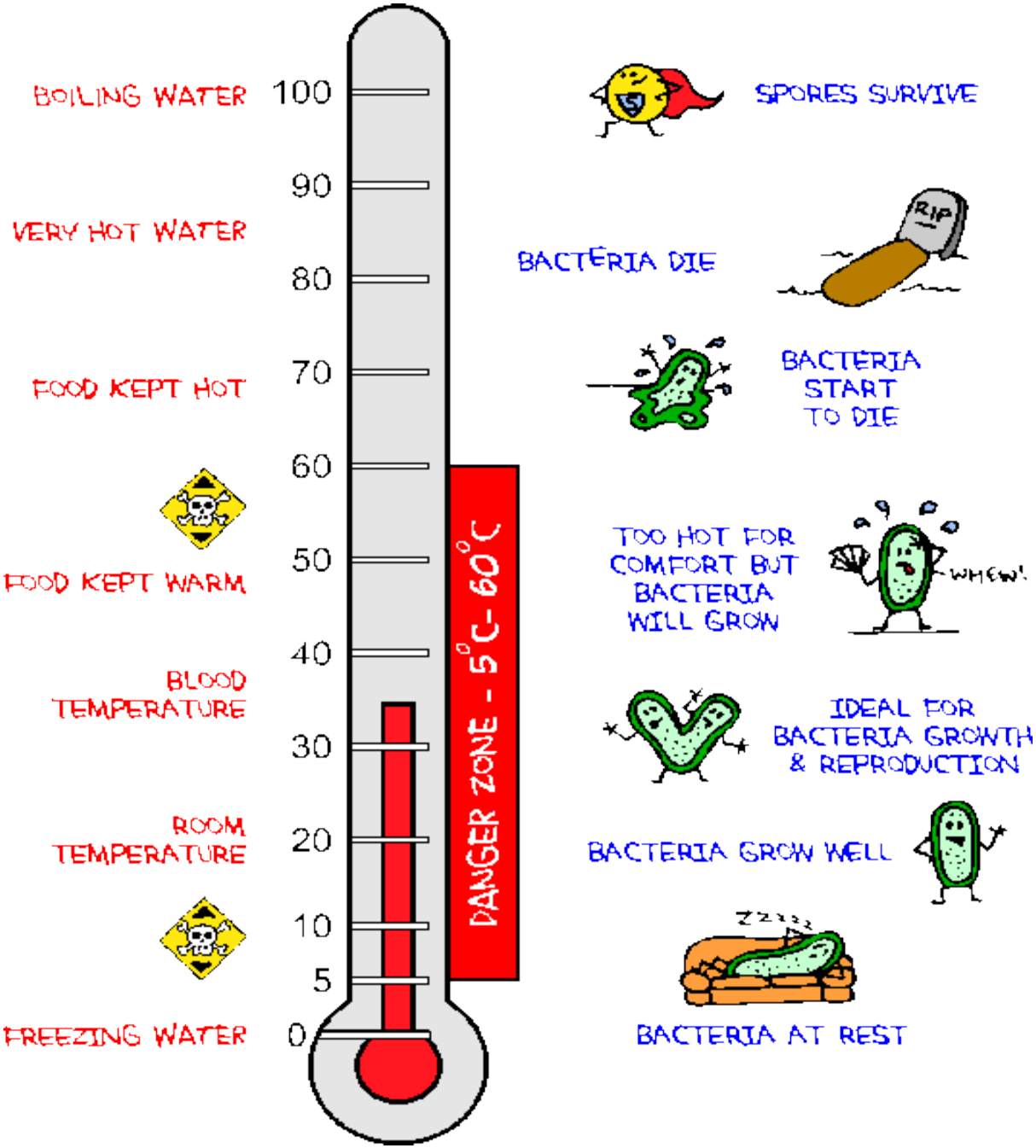
Extrinsic Factors

- Extrinsic parameters are environmental factors, in which food and food products are kept.
- Extrinsic parameters substrate independent and affect both micro-organism as well as food.
- Unlike intrinsic parameters, extrinsic parameters can be maintained and regulated well. These include:-
  - Temperature –
  - Relative humidity –
  - Gaseous atmosphere
  - Presence and activity of micro-organism

1. Temperature of Storage

Microorganisms are divided to groups according their demands on optimal temperature for division and metabolisms;-

- Psychrophilic bacteria (12-15 °C)
- Psychrotrophic bacteria (25-30 °C)
- Mezophilic bacteria (30-40 °C)
- Thermophilic bacteria (50-70 °C)


BOILING WATER
100
90
VERY HOT WATER
80
70
FOOD KEPT HOT
60
50
FOOD KEPT WARM
40
BLOOD TEMPERATURE
30
ROOM TEMPERATURE
20
10
5
FREEZING WATER
0
DANGER ZONE - 5°C - 60°C
SPORES SURVIVE
BACTERIA DIE
RIP
BACTERIA START TO DIE
TOO HOT FOR COMFORT BUT BACTERIA WILL GROW
WHEW!
IDEAL FOR BACTERIA GROWTH & REPRODUCTION
BACTERIA GROW WELL
BACTERIA AT REST

2. Humidity

- Humidity is the concentration of water vapour in the atmosphere.
- Relative humidity and water activity are interrelated i.e. when food with low water activity are stored in the environment of high humidity, water will transfer from gas phase (air) to the food
- Thus increased water activity of the food leading to spoilage by viable micro-organisms

3. Gaseous Atmosphere

- Presence of different gases and its varying concentration may significantly affect the colonizing micro-organisms on the food.
- Oxygen is one of the most important gases which affects both food products as well as micro-organisms

4. Presence and activity of micro-organism

- Inhibition or destruction of one population of micro-organism by the presence of other population of mos present in the same habitat is the microbial interference
- Some Micro-organisms produced substances or metabolites (like secondary metabolites), that are either lethal or inhibitory to other micro-organisms.

Assignment

- Enlist intrinsic and extrinsic factors affecting food spoilage.
- Describe how intrinsic factors are responsible for the food spoilage and microbial growth.
- Enumerate micro-organism on the basis of temperature needed for their growth.

Thank You