

# Culture Media for Microbes

N.Gayathri devi

Much of the study of microbiology depends on the ability to grow and maintain microorganisms in the laboratory, and this is possible only if suitable culture media are available. A culture medium is a solid or liquid preparation used to grow, transport, and store microorganisms.

To be effective, the medium must contain all the nutrients, the microorganism requires for growth. A culture media is composed of Beef extract, Peptone, Yeast extract, agar and distilled water. In addition it also contains blood, serum, bovine rumen fluid, plant extracts etc.,

A typical culture media is prepared by mixing beef extract 3g, Peptone 5g, sodium chloride 5g and water 1000 ml. This medium is liquid in nature and called **Nutrient broth**. When agar 15g is added to this, the medium becomes solid and called **Nutrient agar** (A complex media for heterotrophic bacteria growth)

Specialized media are essential in the isolation and identification of microorganisms, the testing of antibiotic sensitivities, water and food analysis, industrial microbiology, and other activities. A medium is used to select and grow specific microorganisms or to help identify a particular species. In such cases the function of the medium also will determine its composition.

## Culture Medium

Culture medium is any solid or liquid material that supports the growth of micro-organisms. The culture medium is composed of beef extract, peptone, yeast extract, agar and distilled water. In addition, it also contains bovine rumen fluid, blood, serum, plant extracts, etc. A typical culture medium is prepared by mixing beef extract, peptone, sodium chloride and water. This medium is liquid in nature and it is called nutrient broth.

Beef extract ....3g

Peptone.....5g

Sodium chloride 5g

Water.....1000ml

When agar (15g) is added to the above components, the medium becomes solid and is called Nutrient broth.

It is a complex medium for the growth of heterotrophic bacteria.

The culture media are classified variously.



## 1. Based on consistency

The culture media are classified into the following three types :

1. Liquid medium or broth
2. Semi solid medium
3. Solid medium

Based on composition,

the culture medium is classified into five types

1. Natural or Empirical medium
2. Living medium
3. Synthetic medium
4. Complex medium
5. Minimal medium

Based on the uses,

The culture medium is classified into the following types:

1. Selective medium
2. Differential medium
3. Enrichment medium
4. Enriched medium
5. Assay medium
6. Transport medium
7. Maintenance medium
8. Enumeration medium
9. Characterisation medium

## Natural or Empirical media

When a natural product is used as such for growing bacteria, the medium is called Natural

medium. Natural media includes natural biological fluids such as plasma and serum and tissue extracts or (plasma) blood, milk, wine, vegetable juices, yeast extract, coagulated egg, meat extract. This media can be used for a wide variety of cell and tissue cultures. This media is used on the basis of experience and observation and hence the name Empirical medium.

Natural media are usually easy to prepare but they have the disadvantage of their unknown composition. Some examples include corn meal agar, potato dextrose agar, V-8 juice agar, and dung agar.

### **Synthetic or Defined Media**

**Synthetic media, on the other hand, contain ingredients of known composition**

**It is prepared by adding inorganic and organic compounds in definite proportions. Hence the chemical composition is well known. Broth is a synthetic Media.**

Some microorganisms, particularly photolithotrophic autotrophs such as cyanobacteria and eucaryotic algae, can be grown on relatively simple media containing CO<sub>2</sub> as a carbon source (often added as sodium carbonate or bicarbonate), nitrate or ammonia as a nitrogen source, sulfate, phosphate.

Such a medium in which all components are known is a defined medium or synthetic medium. Many chemoorganotrophic heterotrophs also can be grown in defined media with glucose as a carbon source and an ammonium salt as a nitrogen source.

### **ROUTINE LABORATORY MEDIA**

These are classified into six types: (1) Basal media, (2) Enriched media, (3) Selective (4) Indicator media, (5) Transport media, and (6) Storage media.

1. BASAL MEDIA. Basal media are those that may be used for growth (culture) of bacteria that do not need enrichment of the media. Examples: Nutrient broth, nutrient agar and peptone water. Bacteria like Staphylococcus and Enterobacteria grow in these media.

#### **2. Enriched media,**

Enriched media contain the nutrients required to support the growth of a wide variety of organisms, including some fastidious ones.

Enriched media are solid media as they are agar-based. Nutritionally rich supplements such as blood, serum yeast extract and vitamins are present. The examples of enriched media are blood agar, chocolate agar, Loeffler's serum, etc. They are commonly used to harvest as many different types of microbes present in the specimen.

#### **Selective media**



This media selects and allows the growth of a particular variety of bacteria from the mixture and other bacteria cannot grow. This media is best used for isolating a specific organism from a mixed natural population.

This media contains certain chemicals that favor the growth of particular microorganisms and suppresses the growth of unwanted type. Bile salts or dyes like basic fuchsin and crystal violet favor the growth of gram-negative bacteria by inhibiting the growth of gram-positive bacteria.

1. Endo agar, 2. eosin methylene blue agar, and 3. MacConkey agar are the three media widely used for the detection of E. coli and related bacteria in water supplies and elsewhere.

MacConkey agar also contains bile salts. Bacteria also may be selected by incubation with nutrients that they specifically can use.

A medium containing only cellulose as a carbon and energy source is quite effective in the isolation of cellulose-digesting bacteria.

The possibilities for selection are endless, and there are dozens of special selective media in use.

Selective medium is a culture medium which allows the growth of a particular variety bacteria. Other bacteria cannot grow.

This medium selects a particular bacterium from a mixture and hence the name. It is suitable for the growth of a specific organism.

This medium is best used for isolating a specific organism from a mixed natural population. Selective medium contains certain chemicals which suppress or kill unwanted type microorganisms.

For example MacConkey's Agar medium contains crystal violet. Crystal violet inhibits Gram positive bacteria. When crystal violet is added to the medium containing both Gram positive and Gram negative bacteria, the Gram positive bacteria are killed and the Gram negative bacteria remain in the culture medium.

Many types of selective media are available. They are MacConkey's agar, Deoxycholate agar, Phenylethanol agar, Columbia CNA agar, etc.

MacConkey's agar medium is a typical selective medium. It is made up of the following components:

Peptone 10g  
Lactose 10g  
Neutral red solution(1%) 10ml  
NaCl 5g  
Bile salt 1.5g  
20g 10g 5g

Agar 13.5g

Crystal violet 0.001g



Distilled water 1000ml

MacConkey's agar is used for the culture and isolation of Gram negative lactose fermenting bacteria.

Columbia CNA agar is used for the isolation of Gram positive cocci. Uses of selective medium:

1. It helps in the growth of a specific micro-organism.

2. It kills the unwanted micro-organisms.

3. It helps in the isolation of a specific variety of micro-organism from a mixture of microorganisms.

4. In clinical and public health laboratories, the selective medium helps to isolate the microbes causing disease. Neisseria gonorrhoea, causing gonorrhoea can be easily isolated by selective medium

Deoxycholate agar is used for the isolation of Gram negative enteric bacillus. Phenylethanol agar is used for the isolation of Gram positive Staphylococci and Streptococci.

#### 4. Indicator media

INDICATOR (DIFFERENTIAL) MEDIA. An indicator is included in the medium. A particular organism causes change in the indicator, e.g. blood, neutral red, tellurite. Examples: Blood agar and MacConkey agar are indicator media.

Differential media are media that distinguish between different groups of bacteria and even permit tentative identification of microorganisms based on their biological characteristics. Eg., A) Blood agar is both a differential medium and an enriched one. It distinguishes between hemolytic and nonhemolytic bacteria. Hemolytic bacteria (e.g., many streptococci and staphylococci isolated from throats) produce clear zones around their colonies because of red blood cell destruction.

B) MacConkey agar is both differential and selective. Since it contains lactose and neutral red dye, lactose-fermenting colonies appear pink to red in color and are easily distinguished from colonies of nonfermenters.

In the differential medium, different types of colonies are produced by different types of organisms. In eosin-methylene blue agar medium, E. coli produces brilliant green colonies; but Aerobacter aerogenes produces pink colonies.

#### 5. Transport media

Any medium that is used for the temporary storage of specimens while they are being transported to the laboratory for examination is termed as a transport medium. This medium



ideally maintains the viability of all organisms in the specimens without altering their concentrations. Transport media typically contain only buffers and salts. Carbon, nitrogen and organic growth factors are totally absent.

#### 6. Assay medium

Assay medium is used to test and analyze the presence of by-products such as vitamins, amino acids, antibiotics, etc., produced by microorganisms. Seed agar, buse agar and agar agar streptomycin agar, etc. are a few antibiotics assay media. Biotin assay medium, folic acid assay medium, niacin assay medium are a few vitamin assay media.

