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**FACULTY OF ENGINEERING &  
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**Course: B. Tech Biotechnology**  
**Sub Code: BBT-515**

**Semester: 5th**  
**Sub Name: Plant Biotechnology**

# LECTURE 4

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Element	Function
Nitrogen (N)	Component of proteins, nucleic acids and some coenzymes Element required in greatest amount
Potassium (K)	Regulates osmotic potential, principal inorganic cation
Calcium (Ca)	Cell wall synthesis, membrane function, cell signalling
Magnesium (Mg)	Enzyme cofactor, component of chlorophyll
Phosphorus (P)	Component of nucleic acids, energy transfer, component of intermediates in respiration and photosynthesis
Sulphur (S)	Component of some amino acids (methionine, cysteine) and some cofactors
Chlorine (Cl)	Required for photosynthesis
Iron (Fe)	Electron transfer as a component of cytochromes
Manganese (Mn)	Enzyme cofactor
Cobalt (Co)	Component of some vitamins
Copper (Cu)	Enzyme cofactor, electron-transfer reactions
Zinc (Zn)	Enzyme cofactor, chlorophyll biosynthesis
Molybdenum (Mo)	Enzyme cofactor, component of nitrate reductase

# COMPOSITION OF COMMONLY USED NUTRIENT MEDIA

## Murashige & Skoog Medium (MS)

## APM1005/APM5005

### Use

Murashige & Skoog Medium (MS) is used for micropropagation, organ culture, callus culture and cell suspension culture..

### Summary

Murashige & Skoog Medium (MS) is established by Murashige & Skoog (1962) for in vitro callus culture of *Nicotiana tabacum* (family- Solanaceae).

### Principle

Murashige & Skoog Medium (MS) provides all essential Macroelements, Microelements, & Vitamins for the growth of plant cell, tissue and organ culture in vitro. Medium with high concentration of salts is used for cultivating plant cell, tissue and organ culture.

### Macroelements :

In this medium nitrogen is supplied as ammonium and nitrate ions. This mixture of cation and anion balances the pH of the medium. Also plays a important role in plant growth. Potassium dihydrogen phosphate serves as a source of phosphate in medium.

### Microelements:

Boron, Managanese, molybdenum, copper, iron and zinc plays a vital catalytic role in plant metabolism. Boron plays a key role in carbohydrate metabolism in plant cells.

### Vitamins:

Thiamine, pyridoxin and nicotinic acid content had been increased in the medium which have a stimulatory effect.

### Amino acid:

The medium contains increased concentration of glycine.

### Formula

#### Ingredients in mg per liter

#### Macroelements

Potassium nitrate	1900.00
Ammonium sulphate	1650.00

Calcium chloride anhydrous	332.16
Magnesium sulphate	180.69
Potassium phosphate monobasic	170.00
<b>Microelements</b>	
Manganese sulphate.H <sub>2</sub> O	16.90
Boric Acid	6.20
Potassium iodide	0.83
Molybdic acid (sodium salt).2H <sub>2</sub> O	0.25
Zinc sulphate.7H <sub>2</sub> O	8.60
Copper sulphate.5H <sub>2</sub> O	0.03
Cobalt chloride.6H <sub>2</sub> O	0.03
Ferrous sulphate.7H <sub>2</sub> O	27.80
Na <sub>2</sub> EDTA	37.30
<b>Vitamins</b>	
Myo-Inositol	100.00
Thiamine HCL	0.10
Pyridoxine HCL	0.50
Nicotinic acid (Free acid)	0.50
<b>Amino Acid</b>	
Glycine (Free base)	2.00
<b>Carbohydrate</b>	
Sucrose	30000.00
<b>Buffering Agent</b>	
MES (Free acid)	500.00
Plant Growth Regulators	
6-Benzyl amino purine(BAP)	5.00
Gelling Agent	
Agar	8000.00
<b>Storage</b>	
Store at 2-8°C and prepared medium at 2-8°C.	
<b>Shelf Life</b>	
Use before expiry date as mentioned on the label.	
Reference:	
Murashige T. and Skoog F., 1962. Physio. Plant., 15, 473-497	

## BM Medium

### USE

BM Media is used for seed culture and micropropagation of orchids.

### Summary

Van waes, (1986) has developed BM medium for in vitro cultivation of Protocorms from orchid seeds.

### Principle

BM medium provides all essential Macroelements, Microelements, Vitamins, Amino acid & Plant growth regulators for the growth of Orchid in vitro. This medium is especially suitable for terrestrial orchids.

### Macroelements :

Potassium dihydrogen phosphate serves as a source of phosphate. This medium lacks in inorganic nitrogen.

### Microelements:

Zinc and boron content in the medium is increased to provide proper nourishment to developing protocorms.

### Vitamins:

Thiamine content had been increased (0.5mg/l) in the medium. It is a most important element in carbohydrate metabolism and some amino acids biosynthesis. Biotin and folic acid along with other vitamins facilitates in vitro development of Protocorm.

### Amino acid:

Glycine and glutamine serve as reduced nitrogen source.

### Carbohydrate:

Sucrose serves as a carbon source.

### Organic supplements:

Casein hydrolysate used as a supplement, which is a source of free amino acid.

## APM1002/APM5002

### Plant growth regulators:

6-Benzyl amino purine(BAP) induces shoot proliferation.

### Formula

#### Ingredients in Grams/Litre

#### Macroelements

Potassium nitrate	2830.00
Ammonium sulphate	463.00
Calcium chloride anhydrous	125.33
Magnesium sulphate	90.37
Potassium phosphate monobasic	400.00

#### Microelements

Manganese sulphate.H <sub>2</sub> O	3.33
Boric Acid	1.60
Potassium iodide	0.80
Zinc sulphate.7H <sub>2</sub> O	1.50
Ferrous sulphate.7H <sub>2</sub> O	27.80
Na <sub>2</sub> .EDTA	37.26

#### Vitamins

Thiamine HCL	1.00
Pyridoxine HCL	0.50
Nicotinic acid (Free acid)	0.50

#### Amino acid

Glycine (free base)	2.00
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#### Storage

Store at 2-8°C and prepared medium at 2-8°C.

#### Shelf Life

Use before expiry date as mentioned on the label.

#### Reference:

Chu C.C., *et. al.*, 1975. Scientia Sinic., 18, 659-668.

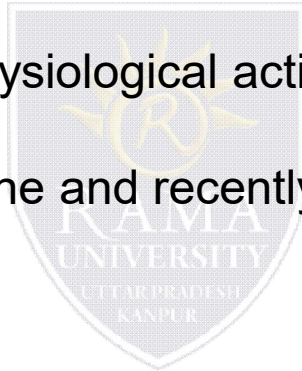
### **Selection of a Suitable Medium:**

In order to select a suitable medium for a particular plant culture system, it is customary to start with a known medium (e.g. MS medium, B5 medium) and then develop a new medium with the desired characteristics. Among the constituents of a medium, growth regulators (auxins, cytokinins) are highly variable depending on the culture system.

In practice, 3-5 different concentrations of growth regulators in different combinations are used and the best among them are selected. For the selection of appropriate concentrations of minerals and organic constituents in the medium, similar approach referred above, can be employed.

# PLANT HORMONES

- Naturally occurring organic compounds other than nutrients produced by plants that control or regulate germination, growth, metabolism, or other physiological activities.
- Also called phytohormone and recently called growth bioregulators.
- Relatively low molecular weight.



# QUIZ

