White’s Medium

White’s Medium: A Key Medium in Plant Tissue Culture

Tissue culture is a widely used technique in plant biology and biotechnology, allowing the growth and propagation of plants in controlled, sterile environments. One of the cornerstone solutions that support plant growth in vitro is the plant tissue culture medium. Today, we’ll explore one classic tissue culture medium that has been critical in the development of plant cell culture systems: **White’s Medium**.

What is White’s Medium?

White’s Medium, developed by Philip R. White in 1943, is one of the earliest and most significant formulations used for the culture of various plant tissues. White’s medium provided the foundation for other, more advanced plant tissue culture media, such as Murashige and Skoog (MS) medium.

White originally formulated this medium to support the continuous growth of *Nicotiana tabacum* (tobacco) roots in vitro. It is specially designed to sustain long-term cell division and differentiation, and though it has been largely supplanted for routine use by more advanced media like MS, White’s Medium is still relevant in various specialized applications.

Uses of White’s Medium

White’s Medium is best known for its utility in the cultivation of plant roots, callus culture, and organ culture. While it is not as nutrient-dense as some modern media, its

simplicity makes it ideal for experiments where low-nutrient conditions are beneficial or preferred, for example:

1. **Root Growth**: Initially developed for culturing tobacco roots, White’s medium is still used for root studies in various plant species.

2. **Organ Cultures**: It is sometimes used in studies focused on specific organs like the roots or shoots, where less nutrient concentration is appropriate to avoid rapid growth that would complicate the research.

3. **Callus Induction**: In certain cases, White’s Medium can be used for inducing callus growth when supplemented with plant growth hormones.

4. **Low-Nutrient Studies**: Its limited salts and nutrient content provide a low-nutrient environment necessary for certain experimental setups, where the growth needs to be steady but not overly robust.

5. **Variation Studies**: White’s medium is helpful in experiments focusing on the minimum nutritional requirements of different plant tissues because it exposes their inherent preferences and limitations. This makes it useful in research where studying nutrient uptake or plant deficiencies is a priority.

Formulation of White’s Medium (Per Liter)

White’s Medium contains essential macro- and micronutrients that are vital for plant tissue survival and limited growth. Below is the classic White’s Medium formulation:

Macro Elements:

- **KNO_3 (Potassium nitrate)**: 80 mg/L
- **$MgSO_4 \cdot 7H_2O$ (Magnesium sulfate)**: 370 mg/L
- **KH_2PO_4 (Potassium dihydrogen phosphate)**: 30 mg/L
- **$Ca(NO_3)_2 \cdot 4H_2O$ (Calcium nitrate)**: 240 mg/L

Micro Elements:

- **$MnSO_4 \cdot 4H_2O$ (Manganese sulfate)**: 0.3 mg/L
- **H_3BO_3 (Boric acid)**: 0.5 mg/L
- **KI (Potassium iodide)**: 0.75 mg/L
- **$ZnSO_4 \cdot 7H_2O$ (Zinc sulfate)**: 0.1 mg/L

Iron Source:

- **$Na_2EDTA \cdot 2H_2O$ (Disodium EDTA)**: 5.6 mg/L
- **$FeSO_4 \cdot 7H_2O$ (Ferrous sulfate)**: 5.6 mg/L

Sucrose (Carbon Source):

- **Sucrose**: 20 g/L

Vitamins:

- **Thiamine HCl (Vitamin B_1)**: 0.1 mg/L

Other Additives:

In some protocols, **agar** (at a concentration of ~7-10 g/L) is used for solidification when preparing the medium in a solid form.

Preparation and Storage

After mixing the specified amounts of chemicals into distilled water, the pH of the medium is generally adjusted to around **5.6-5.8**. The solution is then sterilized by autoclaving at high pressure and temperature (typically 121°C for 20 minutes).

Conclusion

White’s Medium remains a classic tissue culture medium with historical significance, and it continues to be used in certain specialized plant tissue culture applications today. Although not as nutrient-dense as later media such as Murashige and Skoog (MS) medium, it has played an invaluable role in the progression of plant tissue culture studies.

Whether you’re working on root-specific cultures or nutrient-sensitive studies, White’s Medium offers a less-complicated, well-directed formulation that can help produce steady and meaningful growth results in your experiments – all while honoring the roots of modern plant tissue culture

methodologies.

References

1. White, P.R. (1934). The Cultivation of Animal and Plant Cells.
2. White, P.R. (1943). A handbook of tissue culture methods: their application and interpretation.

Are you considering using White’s Medium for your studies? We’d love to hear your thoughts and experiences with it in the comments!