Cheng and Song Medium

Cheng and Song Medium: A Key Tool in Plant Tissue Culture

In the world of plant biotechnology, tissue culture is a fundamental technique used for a variety of purposes, from cloning valuable plants to developing disease-resistant varieties. Central to the success of tissue culture is the choice of culture medium, which provides the essential nutrients, hormones, and environmental conditions required for the growth and development of plant cells, tissues, or organs in sterile conditions. One such specialized medium commonly used in plant tissue culture is the **Cheng and Song (CS) Medium**.

In this blog post, we will explore what **Cheng and Song Medium** is, what it is used for, and we will also provide the detailed formulation of this medium on a per-litre basis.

What is Cheng and Song Medium?

The **Cheng and Song Medium** is a specially designed tissue culture medium that is most often used for **woody ornamental plants** and **recalcitrant species**, which are typically harder to propagate using conventional media like the more universal **Murashige and Skoog Medium (MS Medium)**. The Cheng and Song Medium was originally developed for the successful in vitro tissue culture of woody plants like **Paulownia species** (also known as the Empress tree), and it has since been adopted for a range of other plants, particularly those that do not

respond well to traditional plant culture media.

This medium is optimized for improved organogenesis and regeneration from cultured tissues, including the induction of shoots, roots, and sometimes somatic embryos. Because some plants have different nutritional and hormonal requirements, the Cheng and Song Medium contains specific macro- and micronutrients, along with unique ratios of vitamins, amino acids, and plant growth regulators, customized to support these typically difficult-to-culture species.

Applications of Cheng and Song Medium

1. Propagation of Woody Species

Cheng and Song Medium was initially designed to support the tissue culture of woody plants, including species that are notoriously challenging to propagate in vitro. For this reason, it is often used in forestry-related research, where the goal is to multiply trees and other woody ornamentals that may be critical for conservation, afforestation, or commercial purposes.

2. Recalcitrant Species

Some plants—known as recalcitrant species—are difficult to regenerate under standard tissue culture conditions. This includes many tropical species, hardwood trees, and perennial ornamentals. Researchers and biotechnologists rely on the Cheng and Song Medium to successfully induce shoot and root formation in these stubborn species.

3. Germplasm Conservation

Because of its ability to support the growth of recalcitrant species, Cheng and Song Medium is useful in germplasm conservation, where plant genetics need to be preserved ex situ via methods such as tissue culture or cryopreservation. This aids in biodiversity preservation and provides a bank of genetic material that can be reintroduced into the environment when needed.

4. Genetic Transformation

For certain woody species and tough-to-manipulate plants, Cheng and Song Medium provides an ideal environment for the genetic modification process. It is well-suited to support the growth and regeneration of plants following genetic transformation with techniques like **Agrobacterium tumefaciens-mediated transformation**, where the plant cells are genetically altered and then regenerated into whole plants.

5. Plant Development and Research

The medium is also widely used in research studies where the aim is to understand the molecular and developmental processes of woody plants. Its unique formula offers optimal control over specific stages of plant hierarchy—shoot induction, root formation, etc.—at a cellular level, which can be crucial for various developmental biology labs.

Formulation of Cheng and Song

Medium (Per Litre)

Here is the **Cheng and Song Medium formulation** based on the original publication, adjusted for 1 liter of medium.

Macronutrients (per litre):

- **NH_4NO_3 (Ammonium Nitrate)**: 400 mg
- **KNO_3 (Potassium Nitrate)**: 950 mg
- **$CaCl_2 \cdot 2H_2O$ (Calcium Chloride Dihydrate)**: 220 mg
- **$MgSO_4 \cdot 7H_2O$ (Magnesium Sulfate Heptahydrate)**: 180 mg
- **KH_2PO_4 (Potassium Phosphate Monobasic)**: 85 mg

Micronutrients (per litre):

- **$FeSO_4 \cdot 7H_2O$ (Iron Sulfate Heptahydrate)**: 27.8 mg
- **$Na_2EDTA \cdot 2H_2O$ (Ethylenediamine tetraacetic acid disodium salt)**: 37.2 mg
- **$MnSO_4 \cdot H_2O$ (Manganese Sulfate Monohydrate)**: 22.3 mg
- **$ZnSO_4 \cdot 7H_2O$ (Zinc Sulfate Heptahydrate)**: 8.6 mg
- **H_3BO_3 (Boric Acid)**: 6.2 mg
- **KI (Potassium Iodide)**: 0.83 mg
- **$Na_2MoO_4 \cdot 2H_2O$ (Sodium Molybdate)**: 0.25 mg
- **$CuSO_4 \cdot 5H_2O$ (Copper Sulfate Pentahydrate)**: 0.025 mg

- **$CoCl_2 \cdot 6H_2O$ (Cobalt Chloride Hexahydrate)**: 0.025 mg

Vitamins (per litre):

- **Thiamine HCl (Vitamin B_1)**: 1.0 mg
- **Nicotinic Acid (Niacin, Vitamin B_3)**: 0.5 mg
- **Pyridoxine HCl (Vitamin B_6)**: 0.5 mg

Organic Additives (per litre):

- **sucrose (Carbon source)**: 30 g
- **Inositol**: 100 mg
- **Casein Hydrolysate**: 500 mg
- **L-Glutamine**: 80 mg

Plant Growth Regulators (for shoot induction):

- **6-Benzylaminopurine (BAP)**: 1.0 mg/L
- **Indole-3-acetic acid (IAA)**: 0.2 mg/L

pH Adjustment:

- Adjust the final pH of the medium to **5.8** before

autoclaving.

Agar (as a gelling agent, optional):

- If solid medium is required for culture, add **7–8 g** of agar.

Final Note:

After mixing all components and adjusting the pH, the medium should be sterilized by autoclaving at 121°C for 15–20 minutes. After sterilization and cooling to around 50°C, when required, sterile-filtered hormones or other sensitive compounds can be added before the medium is poured into Petri dishes or culture vessels.

Conclusion

The Cheng and Song Medium represents a specialized tool in plant biotechnology that has proven to be highly effective for woody plants, recalcitrant species, and difficult-to-culture plant varieties. Its carefully balanced formulation optimizes nutrient supply and hormonal control, making it indispensable for researchers and biotechnologists focused on plant propagation, conservation, and genetic transformation. If you are working with hard-to-culture plants or exploring new methods for plant regeneration, trying out this reliable medium might just be the breakthrough you need.

Let us know in the comments if you've used the Cheng and Song Medium in your laboratory, and share your experiences and

results with the wider research community! Happy culturing!