Plants as Platform for the Biosynthesis of Melanin

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ABSTRACT

Researchers at the University of California, Davis have developed a scalable, plant-based method using somatic embryogenesis to produce high yields of water-soluble melanin externally from walnut tissues.

FULL DESCRIPTION

This technology presents methods and systems that utilize somatic embryogenesis of plants, particularly walnut (Juglans spp.), to produce water-soluble melanin. By culturing plant somatic embryos in nutrient-rich media containing polyphenol oxidase substrates, the method enables enzymatic synthesis and external accumulation of melanin, simplifying extraction and purification. Genetic modification of embryo lines to overexpress polyphenol oxidase enzymes further enhances melanin production. The process allows continuous propagation of embryogenic tissues and can be optimized through controlled environmental conditions, such as oxidative stress, achieving melanin yields up to 200 g/L.

APPLICATIONS

- Natural pigment production for cosmetics, textiles, and food industries.
- Biocompatible polymers for biomedical and pharmaceutical applications.
- Environmentally friendly alternatives for electronic and photoprotective materials.
- Research tools in plant biochemistry and enzymology.
- Sustainable production platforms for specialty chemical manufacturing.

FEATURES/BENEFITS

- Utilizes a plant-based system to avoid microbial and animal melanin sources.
- Produces melanin externally to simplify purification and downstream processing.
- Increases yield with genetically modified embryos.
- Enables scalable and reproducible production through somatic embryogenesis culture techniques.
- Allows control of reaction conditions and enhanced output via oxidative stress.
- Applies well-defined culture media (e.g., Driver-Kuniyuki-Walnut medium) for optimized growth.
- Delivers an environmentally sustainable and ethically favorable production approach.
- Reduces production costs and ethical concerns associated with animal or microbial melanin.
- Provides a controlled, reproducible plant system for water-soluble melanin synthesis.
- Simplifies purification challenges by producing melanin externally rather than within tissue.
- Maximizes enzymatic oxidation and melanin polymerization in plant-based systems.
- Overcomes scalability limitations in traditional melanin-producing plant tissue propagation.

PATENT STATUS

Patent Pending

INVENTORS

- Abbattista, Ramona
- Dandekar, Abhaya M.
- Zaini, Paulo

OTHER INFORMATION

KEYWORDS

catechol oxidase, enzymatic melanin production, genetically modified embryos, juglans spp., oxidative stress, plant-derived melanin, polyphenol oxidase, somatic embryogenesis, walnut tissue culture, water-soluble melanin

CATEGORIZED AS

- **Agriculture & Animal Science**
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  - Plant Traits
  - Plant Varieties
  - Processing and Packaging
  - Transgenics
- **Biotechnology**
  - Food
  - Genomics
  - Industrial/ Energy
  - Other

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