Seshat's Bones

A Novel Organic Composite Material Engineered from Hemp-Derived Carbon Allotropes and Hemp Oil for High-Performance Sustainable Applications

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May 30, 2025

Abstract

This study introduces **Seshat's Bones**, an innovative composite material derived from hemp oil and hemp carbon allotropes, engineered to provide a sustainable, biodegradable, and mechanically robust alternative to conventional synthetic composites. The material leverages the unique molecular structures of carbon allotropes obtained from hemp biomass combined with the natural binding properties of hemp oil. This research aims to systematically evaluate the mechanical, thermal, and electrical properties of Seshat's Bones, to validate its potential across industrial, military, and environmental applications.

Introduction

Seshat's Bones represents a pioneering step in the organic materials revolution, merging natural hemp constituents into a high-performance composite. Traditional composites rely heavily on petrochemical-derived resins and carbon fibers, resulting in significant environmental impact and limited biodegradability. By contrast, Seshat's Bones aims to harness the regenerative potential of hemp as a carbon source and binder, aligning with sustainable development goals and circular economy principles.

Hypothesis

We hypothesize that:

> *Seshat's Bones, composed of hemp-derived carbon allotropes and hemp oil, exhibits mechanical strength, thermal stability, and electrical conductivity comparable to or exceeding those of conventional synthetic composites, while maintaining biodegradability and lower environmental impact.*

Materials

- **Hemp Carbon Allotropes**: Biochar, graphene-like nano-structures, and amorphous carbon derived via controlled pyrolysis and chemical vapor deposition of hemp biomass.

- **Hemp Oil**: Cold-pressed, organic hemp seed oil purified for use as a natural binding matrix.
- **Additives**: Optional natural catalysts or crosslinkers (to be tested).
- **Fabrication Equipment**: Hydraulic press, curing oven, pyrolysis reactor.
- **Testing Instruments**: Universal testing machine (UTM), thermal analyzer (TGA/DSC), electrical conductivity meter.

Methodology

Material Preparation

1. **Carbon Allotrope Synthesis**: Hemp biomass is pyrolyzed under inert atmosphere at temperatures between 700–1000°C to produce biochar with controlled porosity and nano-structural characteristics. Further processing includes exfoliation and chemical vapor deposition to generate graphene-like sheets.
2. **Oil Purification**: Hemp oil is filtered and purified to remove impurities and optimize viscosity.

Composite Fabrication

1. Mix hemp carbon allotropes with hemp oil in varying weight ratios (e.g., 50:50, 60:40, 70:30) to identify optimal formulation.
2. Homogenize mixture using mechanical stirring and sonication.
3. Place mixture into molds and cure under controlled heat and pressure cycles (e.g., 120°C for 4 hours at 10 MPa).

Testing Protocols

- **Mechanical Testing**: Tensile strength, compressive strength, and flexural modulus measured using a universal testing machine (ASTM D638, D695, D790).
- **Thermal Analysis**: Thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) to assess thermal stability and glass transition temperature.
- **Electrical Conductivity**: Four-point probe method to evaluate electrical conductivity of cured samples.
- **Biodegradability Assessment**: Soil burial and enzymatic degradation tests to measure material breakdown over time.

Expected Results

We anticipate that Seshat's Bones will demonstrate:

- High tensile and compressive strength comparable to mid-range synthetic composites.
- Thermal stability up to 300°C with distinct glass transition behavior.
- Moderate electrical conductivity suitable for applications in sensors and lightweight electronics.
- Significant biodegradability under natural soil conditions within 6 to 12 months.

Discussion

The use of hemp carbon allotropes combined with hemp oil offers a unique synergy between organic chemistry and materials engineering. If successful, Seshat's Bones could disrupt multiple industries by providing a scalable, eco-friendly alternative to carbon fiber composites and petroleum-based polymers. The material's natural origins reduce carbon footprint and toxic waste, supporting global sustainable development goals.

Challenges may include optimizing processing conditions for consistency, ensuring long-term durability in harsh environments, and scaling production while maintaining purity of raw materials.

Conclusion

Seshat's Bones embodies a transformative material innovation that aligns scientific rigor with sustainable principles. Validating the hypothesis through rigorous experimentation will establish the material as a leading candidate for next-generation organic composites, enabling a shift toward regenerative industrial practices.

References

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