Scientific Research Proposal: Seshat's Bones v1.4

Towards the Commercial Deployment of Hempoxy - Scalability, Manufacturing Optimization, and Comprehensive LCA

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Executive Summary

This comprehensive proposal outlines the scientific and engineering investigation for **"Seshat's Bones v1.4."** This version represents the critical transition from advanced material research to industrial readiness, with the ultimate goal of developing a commercially deployable solution to be named **"Hempoxy."** The project began with "Seshat's Bones v1.1," establishing a high-performance, quasi-isotropic nanocomposite derived entirely from *Cannabis Sativa L.*. Subsequent versions advanced its capabilities: "v1.2" integrated waste-sequestration, and "v1.3" designed for controlled degradation and recyclability. "Seshat's Bones v1.4" now focuses on optimizing manufacturing processes, demonstrating scalability, and conducting a rigorous, comprehensive Life Cycle Assessment (LCA) to quantify the total environmental and economic benefits. This research phase is essential to validate and optimize the "Seshat's Bones v1.3" material for large-scale production. The name "Hempoxy" is reserved for the fully optimized, peer-reviewed, and commercially ready version that emerges from the successful completion of this v1.4 research and testing, representing the culmination of these solo citizen science efforts into a deployable solution. The overarching "why" of this project is to create truly sustainable, high-performance engineering materials that not only perform exceptionally but also actively remediate environmental challenges and participate in a circular economy. The "what" is a sophisticated, hemp-based carbon nanomaterial composite engineered for durability, multi-functionality, waste sequestration, and closed-loop recyclability. The "how" involves a meticulously designed chemical system, precise manufacturing protocols, and continuous optimization across its entire lifecycle, all rooted in robust scientific hypotheses and validated through rigorous testing. This proposal details the complete progression, from foundational material science to an integrated production blueprint, underpinned by comprehensive chemical logic and synergy of its innovative ingredients, ultimately aiming to deliver a commercially viable and ecologically superior material solution.

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1 Introduction: Seshat's Bones to Hempoxy - A Journey Towards Sustainable Industrial Materials

The contemporary global landscape demands materials that transcend traditional performance metrics, incorporating paramount considerations of sustainability, environmental remediation, and circularity. The **"Seshat's Bones"** project represents a groundbreaking initiative to meet these demands by developing a new class of hemp-based carbon nanomaterial composites. This proposal delineates the complete journey of this innovation, from its foundational material science as "Seshat's Bones v1.1," through its evolution in waste sequestration ("v1.2") and controlled degradability ("v1.3"), culminating in the strategic focus of **"Seshat's Bones v1.4"** on scalability, manufacturing optimization, and comprehensive Life Cycle Assessment (LCA). It is crucial to note that the name **"Hempoxy"** is specifically designated for the final, fully optimized, peer-reviewed, and commercially ready version that emerges from the successful completion of the v1.4 research and development phase. Thus, "Hempoxy" represents the deployable solution, building upon the scientific iterations of "Seshat's Bones."

The "why" behind this project stems from the urgent need for materials that offer high strength-to-weight ratios, multi-functionality (e.g., electrical conductivity), and environmental compatibility throughout their entire lifecycle. The "what" is a sophisticated, quasi-isotropic nanocomposite derived entirely from *Cannabis Sativa L.*, engineered to integrate diverse functionalities: structural integrity, active waste sequestration, and tunable end-of-life management via controlled degradation and recyclability. The "how" involves a meticulously designed chemical system, precise manufacturing protocols, and a commitment to continuous improvement guided by scientific principles and validated through rigorous experimentation. This project represents a holistic approach to sustainable materials science, aiming to establish a closed-loop system from renewable resources to recoverable components, ultimately yielding the commercially viable Hempoxy.

2 The Progression of Seshat's Bones: From Citizen Science to Industrial Readiness

The development of "Seshat's Bones" has been a systematic, hypothesis-driven progression, with each version building upon the successes and addressing the new challenges identified in its predecessor. This section details the chronological evolution, highlighting the core scientific challenge, hypothesis, and the rationale for each significant advancement.

2.1 Seshat's Bones v1.1: Foundations of High-Performance Bio-Composites

The "Why, What, and How" of v1.1

Why: The primary motivation for v1.1 was to address the limitations of traditional bio-composites (often anisotropic, lower performance) and conventional engineering materials (high energy footprint, non-renewable) by creating a bio-based material with competitive mechanical and functional properties. **What:** A high-performance, quasi-isotropic nanocomposite derived entirely from *Cannabis Sativa L.* designed for structural and functional applications. **How:** A sophisticated six-component system integrating solutions for high resin viscosity and robust interfacial adhesion.

Scientific Challenge and Hypothesis of v1.1

Scientific Challenge: How can a high-performance, quasi-isotropic nanocomposite be derived entirely from *Cannabis Sativa L.* that achieves mechanical and functional properties competitive with conventional engineering materials, while managing high resin viscosity and ensuring robust interfacial adhesion?

Hypothesis: If Epoxidized Hemp Oil (EHO) is combined with Furfuryl Glycidyl Ether (FGE) as a reactive diluent, and further reinforced with pyrolyzed hemp biochar and carboxyl-functionalized hemp-derived carbon nanosheets (HDCNS), with maleic anhydride-modified hemp lignin acting as a bio-interfacial agent, then the cured composite will exhibit high mechanical performance (e.g., tensile strength of 110-150 MPa) and quasi-isotropic behavior, because FGE will reduce viscosity for processability and the modified lignin will ensure strong interfacial adhesion between the hemp-derived fillers and the EHO matrix.

Seshat's Bones v1.1 Proposed Formulation

- **Part A:**
  - **Epoxidized Hemp Oil (EHO):** 45% by Weight – Primary bio-based polymer matrix. *Chemical Logic/Synergy:* Provides the cross-linkable resin backbone. Its epoxidized groups react with the hardener to form a robust network.
  - **Furfuryl Glycidyl Ether (FGE):** 5% by Weight – Reactive diluent for viscosity reduction. *Chemical Logic/Synergy:* Lowers the viscosity of the EHO system, facilitating homogeneous dispersion of high filler loadings and improving manufacturability without compromising final properties through evaporation. It also participates in the curing reaction.
  - **Pyrolyzed Hemp Biochar:** 35% by Weight – Micro-filler for reinforcement and bulk properties. *Chemical Logic/Synergy:* Provides cost-effective mechanical reinforcement and increases stiffness. Its porous structure can contribute to lightweighting.
  - **Maleic Anhydride-Modified Hemp Lignin:** 10% by Weight – Bio-interfacial agent for improved adhesion. *Chemical Logic/Synergy:* The maleic anhydride groups on the lignin react with hydroxyl groups on the hemp-derived fillers (biochar, HDCNS) and potentially with the EHO, creating chemical bridges that significantly improve interfacial adhesion between the polar fillers and the non-polar EHO matrix, preventing stress concentrations and enhancing load transfer.
  - **Carboxyl-Functionalized HDCNS:** 2% by Weight – Nano-reinforcement and electrical conductivity. *Chemical Logic/Synergy:* Provides significant mechanical reinforcement at the nanoscale due to high aspect ratio and strength. Carboxyl functionalization aids dispersion and provides additional reactive sites for interfacial bonding with the EHO/lignin system, crucial for electrical conductivity pathways.

- **Part B:**
  - **Azelaic Anhydride:** 3% by Weight – Hardener for cross-linking and curing. *Chemical Logic/Synergy:* Reacts with the epoxide groups of EHO (and FGE/HDCNS if functionalized) to form a densely cross-linked thermoset polymer network, providing the material's rigidity and mechanical stability.

2.2 Seshat's Bones v1.2: Integrating Waste Sequestration

The "Why, What, and How" of v1.2

Why: To address the escalating global challenge of microscopic waste accumulation by integrating it directly into a high-performance material, turning a pollutant into a functional component. **What:** The v1.1 composite with the added capability of sequestering heterogeneous, non-structural micro-fillers derived from waste (Waste-Derived Functional Filler - WDF). **How:** Pre-coating WDF with maleic anhydride-modified hemp lignin to ensure chemical compatibility and robust interfacial adhesion with the existing matrix.

Scientific Challenge and Hypothesis of v1.2

Scientific Challenge: How can heterogeneous, non-structural micro-fillers (reclaimed waste) be integrated into the precisely balanced v1.1 chemical system without creating defects that compromise the material's quasi-isotropic nature and mechanical strength?

Hypothesis: If a new filler, designated Waste-Derived Functional Filler (WDF), is created by pre-coating reclaimed micro-trash and pollutant-filled micro-bubbles with the same maleic anhydride-modified hemp lignin used in the primary formulation, and this WDF is then introduced at less than 1% by weight into the v1.1 slurry, then the final composite will successfully sequester environmental waste while retaining high mechanical performance, because the WDF's pre-treated surface will ensure robust interfacial adhesion with the Epoxidized Hemp Oil matrix.

Seshat's Bones v1.2 Proposed Formulation

- **Part A:**
  - **Epoxidized Hemp Oil (EHO):** 45% by Weight – Primary bio-based polymer matrix
  - **Furfuryl Glycidyl Ether (FGE):** 5% by Weight – Reactive diluent for viscosity reduction
  - **Pyrolyzed Hemp Biochar:** 34.2% by Weight – Micro-filler for reinforcement and bulk properties. *Chemical Logic/Synergy:* Slightly reduced from v1.1 to accommodate WDF while maintaining overall filler loading and composition for 100% total.
  - **Maleic Anhydride-Modified Hemp Lignin:** 10% by Weight – Bio-interfacial agent for improved adhesion
  - **Carboxyl-Functionalized HDCNS:** 2% by Weight – Nano-reinforcement and electrical conductivity

- **Waste-Derived Functional Filler (WDF):** 0.8% by Weight – Waste sequestration and compatible filler. *Chemical Logic/Synergy:* The key addition. Its pre-coating with the same maleic anhydride-modified lignin ensures it integrates seamlessly into the EHO matrix via established interfacial chemistry, preventing defect formation despite its heterogeneous nature.

- **Part B:**
  - **Azelaic Anhydride:** 3% by Weight – Hardener for cross-linking and curing

2.3 Seshat's Bones v1.3: Controlled Degradation and Recyclability

The "Why, What, and How" of v1.3

Why: To address the critical challenge of end-of-life management for advanced composites, which often become problematic waste themselves. This aims to complete the circular economy for the material. **What:** A version of Seshat's Bones that can undergo controlled degradation upon specific triggers, allowing for the recovery and re-use of its constituent materials, including the sequestered waste. **How:** Strategic incorporation of specific cleavable linkers into the EHO matrix that activate under targeted environmental triggers.

Scientific Challenge and Hypothesis of v1.3

Scientific Challenge: How can the "Seshat's Bones" composite be designed to undergo controlled degradation upon specific triggers (e.g., pH change, enzymatic activity, specific wavelength light, or thermal stimulus) while retaining its high mechanical performance and waste-sequestration capabilities during its intended service life, and subsequently allow for the recovery and re-use of its constituent materials?

Hypothesis: If specific photo-cleavable, thermally sensitive, or enzymatically labile linkers are strategically incorporated into the Epoxidized Hemp Oil (EHO) matrix during the curing process, and these linkers are designed to activate only under targeted environmental triggers, then 'Seshat's Bones v1.3' will demonstrate controlled degradation behavior, allowing for the recovery of valuable components (including sequestered waste) for recycling or safe environmental assimilation, while maintaining the material's high mechanical performance and waste sequestration efficacy throughout its service life.

Proposed Enhancements and Chemical Logic for v1.3

- **Matrix Modification with Cleavable Linkers:**
  - **Cleavable Linkers:** Introducing reversible covalent bonds or cleavable linkages (e.g., Diels-Alder adducts, disulfide bonds, or ester linkages) within the EHO polymer network that can be broken by specific external stimuli (heat, pH, light, enzymes). *Chemical Logic:* These linkages are designed to be stable under normal operating conditions but selectively break down when exposed to a specific trigger, causing the polymer network to de-crosslink or fragment. For example, photo-cleavable groups like *o*-nitrobenzyl derivatives can break

upon UV exposure, or ester linkages can hydrolyze under specific pH conditions.

  - **Trigger Mechanisms:** Research into specific "smart" molecules or additives that act as catalysts or initiators for the degradation process upon activation. *Chemical Logic/Synergy:* These triggers are carefully selected to not interfere with the initial polymerization or in-service performance. They enable the controlled, on-demand deconstruction of the composite, allowing the release of embedded components for recovery. The choice of linker is synergistic with the intended trigger (e.g., a UV-sensitive linker with UV light trigger).

- **Selective Degradation Pathways:**

  - Designing the degradation to primarily target the polymer matrix, allowing for the potential separation and recovery of the carbon nanosheets, biochar, and especially the sequestered Waste-Derived Functional Filler (WDF). *Chemical Logic:* The cross-links of the EHO matrix are engineered to be the weakest points for the degradation trigger, ensuring the fillers and WDF remain largely intact, facilitating their separation and recycling.

- **Recycling Protocol Development:**

  - Devising and optimizing methods for the physical or chemical separation of components post-degradation, enabling their reintroduction into new composite formulations or other material streams. *Chemical Logic:* This involves developing mild chemical washes or physical separation techniques (e.g., flotation, sieving) that can effectively isolate the liberated fillers and WDF from the degraded polymer fragments.

2.4 Seshat's Bones v1.4: Towards Hempoxy - Scalability, Manufacturing Optimization, and Comprehensive LCA

The "Why, What, and How" of v1.4

Why: To bridge the gap between laboratory innovation and real-world industrial implementation, ensuring that the "Seshat's Bones" material is not only scientifically advanced but also economically viable and demonstrably sustainable at scale. This version aims to prove the holistic benefits from "cradle-to-cradle," thereby paving the way for its commercial designation as "Hempoxy." **What:** A scientifically validated, scalable manufacturing blueprint and a comprehensive Life Cycle Assessment that proves the material's industrial and ecological superiority, leading to the commercial deployment of "Hempoxy." **How:** By meticulously analyzing and optimizing every step of the production blueprint, from raw material synthesis to final product and end-of-life processing, coupled with rigorous environmental and economic modeling.

Scientific and Engineering Challenge of v1.4

Scientific and Engineering Challenge: How can the production of "Seshat's Bones v1.3" be optimized for large-scale, cost-effective manufacturing while maintaining its critical performance characteristics, and how can its complete environmental impact be quantitatively validated through a comprehensive Life Cycle Assessment (LCA) from cradle to grave (or cradle to cradle), to pave the way for its commercial deployment as "Hempoxy"?

Full Hypothesis of Seshat's Bones v1.4 (Towards Hempoxy)

Full Hypothesis: If the synthesis of Epoxidized Hemp Oil (EHO) and maleic anhydride-modified hemp lignin are optimized using continuous flow processes, if carboxyl-functionalized hemp-derived carbon nanosheets (HDCNS), pyrolyzed hemp biochar, and lignin-pre-coated Waste-Derived Functional Fillers (WDF) are integrated into a high-throughput mixing and compression molding line with precise control over curing, and if specific photo-cleavable/thermally sensitive/enzymatically labile linkers are incorporated into the EHO matrix to enable controlled degradation for component recovery, then this integrated production blueprint will achieve a material (Seshat's Bones v1.4, soon to be Hempoxy) with a minimum tensile strength of 90 MPa, verifiable waste sequestration of >99% of WDF input, and tunable degradation for >Z% component recovery, *and* a comprehensive ISO-compliant Life Cycle Assessment (LCA) will quantify a reduced environmental footprint (e.g., lower embodied energy, reduced GHG emissions) by >Y% compared to conventional materials like aluminum or fiberglass composites, thereby demonstrating its holistic viability for widespread industrial adoption and true circularity.

Complete Production Blueprint and Chemical Logic for Seshat's Bones v1.4 (Towards Hempoxy)

The complete production blueprint for "Seshat's Bones v1.4" is a multi-stage, integrated process designed for efficiency and scalability, incorporating the chemical logic and synergy of all ingredients across its lifecycle, with the goal of developing "Hempoxy":

1. **Raw Material Acquisition and Pre-processing (Hemp Biomass):**
   - **Process:** Sustainably sourced *Cannabis Sativa L.* biomass is harvested and pre-processed (drying, retting) to separate fibers, hurds, and other fractions.
   - **Chemical Logic/Synergy:** Ensures a renewable, low-carbon feedstock. Efficient separation is crucial for subsequent chemical extraction and modification.
2. **Component Synthesis (Part A):**
   - **Epoxidized Hemp Oil (EHO) Synthesis:**
     - **Process:** Hemp oil is extracted from seeds and epoxidized (e.g., using peroxy acids) in a controlled reactor, ideally a continuous flow system for scalability.
     - **Chemical Logic/Synergy:** Epoxidation introduces reactive epoxide groups onto the fatty acid chains, making the oil capable of forming a cross-linked polymer network with the hardener. Flow processes enhance reaction control and throughput.
   - **Maleic Anhydride-Modified Hemp Lignin Synthesis:**
     - **Process:** Lignin extracted from hemp hurds is functionalized with maleic anhydride, preferably via reactive extrusion or a continuous grafting process.

  - **Chemical Logic/Synergy:** Maleic anhydride reacts with hydroxyl groups on lignin, introducing anhydride functionalities. These can then react with hydroxyls on fillers (biochar, HDCNS, WDF) and epoxides in the EHO matrix, acting as a robust bio-interfacial compatibilizer. Continuous processes improve homogeneity and yield.

- **Pyrolyzed Hemp Biochar Production:**
  - **Process:** Hemp hurds or stalk material are pyrolyzed under controlled anaerobic conditions (e.g., rotary kiln) to produce high-carbon biochar with desired porosity and particle size.
  - **Chemical Logic/Synergy:** Pyrolysis converts biomass into a stable carbon-rich material. Particle size and surface area influence mechanical reinforcement and interaction with the matrix/lignin.

- **Carboxyl-Functionalized HDCNS Synthesis:**
  - **Process:** Derived from hemp fibers, these nanosheets undergo chemical exfoliation and subsequent carboxyl functionalization.
  - **Chemical Logic/Synergy:** Nanosheets provide exceptional strength and electrical conductivity. Carboxyl groups enhance dispersion in the polar EHO system and offer additional bonding sites for the lignin and EHO matrix, ensuring effective stress transfer and conductive pathways.

- **Waste-Derived Functional Filler (WDF) Production:**
  - **Process:** Reclaimed micro-waste (e.g., microplastics, industrial particulates) is cleaned, pre-processed, and then precisely pre-coated with maleic anhydride-modified hemp lignin.
  - **Chemical Logic/Synergy:** The lignin pre-coating is critical. It acts as a universal adhesive layer, creating a compatible surface on the diverse waste particles, allowing them to bond effectively with the EHO matrix and maintain material integrity, rather than acting as stress concentrators.

- **Cleavable Linker Synthesis/Integration:**
  - **Process:** Labile monomers or functional groups (e.g., photo-cleavable, thermally sensitive) are synthesized or integrated into pre-polymers that will be mixed into Part A.
  - **Chemical Logic/Synergy:** These linkers are designed to participate in the EHO cross-linking reaction during curing but also contain specific bonds that can be selectively broken by an external trigger post-cure. Their incorporation must be balanced to allow degradation without compromising in-service mechanical properties.

3. **Composite Fabrication (Mixing and Curing):**

   - **Process:** All Part A components (EHO, FGE, biochar, modified lignin, HDCNS, WDF, cleavable linkers) are precisely weighed and undergo high-shear mixing (e.g., dual asymmetric centrifugal mixer, or continuous twin-screw extrusion for industrial scale) to achieve homogeneous dispersion. Part B (Azelaic Anhydride hardener) is then added and thoroughly mixed. The resulting slurry is then processed via compression molding or continuous molding techniques (e.g., pultrusion, resin transfer molding) and cured under a multi-stage protocol.

- **Chemical Logic/Synergy:** Homogeneous dispersion is paramount for consistent properties. FGE maintains low viscosity for thorough mixing. The hardener reacts with epoxides to form a dense thermoset network, encapsulating all fillers. The curing protocol optimizes cross-linking for peak mechanical and functional performance, while ensuring the integrity of the cleavable linkers for future degradation.

4. **In-Service Life (Performance and Waste Sequestration):**
    - **Process:** The cured Seshat's Bones material performs its intended function in various applications (e.g., structural components, electronics enclosures).
    - **Chemical Logic/Synergy:** The robust EHO-lignin-filler network provides high strength and durability. The sequestered WDF is permanently embedded within this network, preventing its release into the environment under normal conditions. The cleavable linkers remain stable, ensuring material integrity.

5. **End-of-Life Management (Controlled Degradation and Component Recovery):**
    - **Process:** Upon reaching end-of-life, the Seshat's Bones material is subjected to a specific external trigger (e.g., heat, UV light, pH-controlled solution, enzymatic bath) to initiate controlled degradation. Following degradation, physical separation techniques (e.g., sieving, flotation, centrifugation) or mild chemical washes are applied to recover constituent components.
    - **Chemical Logic/Synergy:** The trigger selectively breaks the cleavable linkers in the EHO matrix, causing the polymer to fragment or de-crosslink, thus releasing the embedded fillers (biochar, HDCNS, WDF). The selective degradation ensures that the valuable fillers and sequestered waste remain largely intact and recoverable, completing the circular loop.

6. **Recycling and Reprocessing:**
    - **Process:** Recovered biochar, HDCNS, and WDF are characterized for purity and re-integrated into new Seshat's Bones (or Hempoxy) formulations, or directed to other material streams.
    - **Chemical Logic/Synergy:** This closes the loop. The recovered fillers are re-used, reducing the need for virgin materials and further enhancing the environmental benefits, as quantified by the LCA.

3 Proposed Research Areas for "Seshat's Bones v1.4"

- **Process Intensification and Continuous Manufacturing:**
    - Investigation into continuous flow reactors for EHO synthesis and lignin functionalization to achieve high throughput and consistent quality.
    - Optimization of biochar pyrolysis for energy efficiency, consistent particle size distribution, and surface chemistry suitable for large-scale production.

- Development of advanced mixing and dispensing techniques (e.g., twin-screw extrusion, specialized static mixers) for high-viscosity slurries with high filler loadings, ensuring homogeneity at industrial scales.

- **Cost-Benefit Analysis and Techno-Economic Modeling:**
  - Detailed economic modeling of the entire Hempoxy supply chain, from sustainable feedstock acquisition (hemp farming) to final product manufacturing and end-of-life processing (degradation, recycling).
  - Identification of key cost drivers and bottlenecks in the current and projected production processes.
  - Comparison of production costs and overall value proposition with conventional materials (e.g., cast aluminum, fiberglass composites) at various production scales to demonstrate commercial viability.

- **Life Cycle Assessment (LCA):**
  - Conduct a rigorous, ISO 14040/14044 compliant cradle-to-cradle LCA for "Seshat's Bones v1.3" (including its synthesis, manufacturing, in-service life, controlled degradation, and recycling processes).
  - Quantify environmental impacts across a comprehensive range of categories: embodied energy, greenhouse gas emissions, water usage, waste generation, land use, and potential toxicity.
  - Benchmark its environmental footprint against incumbent conventional engineering materials used in similar applications to provide quantitative evidence of its sustainability advantages.

- **Pilot-Scale Production and Validation:**
  - Design, construct, and operate a pilot-scale manufacturing line for producing larger quantities of Seshat's Bones components and final composite products.
  - Validate the consistency of material properties (mechanical, functional, degradation kinetics, waste sequestration efficacy) produced at pilot scale compared to laboratory-scale batches.
  - Optimize process parameters (e.g., temperature profiles, pressure, flow rates) at scale to ensure efficient and high-quality production.

4 Anticipated Results and Conclusions for Seshat's Bones v1.4 (Leading to Hempoxy)

The rigorous investigation outlined for Seshat's Bones v1.4 is anticipated to deliver critical insights and validations:

- **Validated Scalable Manufacturing Process:** A scientifically and economically optimized blueprint for the large-scale production of Seshat's Bones components and the final composite.

- **Cost Reduction and Economic Competitiveness:** Quantification of significant reductions in production costs, demonstrating its economic competitiveness against traditional materials in target markets.

- **Quantitative Environmental Superiority:** Comprehensive LCA results definitively proving its lower overall environmental footprint compared to incumbent materials across its entire lifecycle.

- **Transition to Commercialization (Hempoxy):** The generated data and optimized processes will provide a clear pathway for transitioning Seshat's Bones from research and development to industrial pilot production and eventual commercialization under the name "Hempoxy," making it a viable and attractive option for industries seeking advanced, sustainable, and circular materials.

- **Holistic Validation of Hempoxy's Vision:** Confirming the "why, what, and how" through scientific, engineering, economic, and environmental metrics.

This final stage of the "Seshat's Bones" project is crucial for realizing its full potential as a truly transformative material, capable of delivering high performance while actively contributing to a sustainable and circular global economy, culminating in the deployment of "Hempoxy."