Hempoxy - A Sustainable Bio-Nano-CompositeSystem (Synthesis)

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Hempoxy is a novel, fully hemp-derived composite developed under the "Seshat's Bones" research initiative by Marie Seshat Landry. Designed to replace conventional, petroleum-based epoxies, it's a high-performance material with a focus on sustainability and circular economy principles.

Core Formulation: The Hempoxy Recipe

The Universal Hempoxy Materials Standard (UHMS) outlines the open-source formulation, detailing its components and their functions. The recipe is a multi-part system that ensures both structural integrity and environmental responsibility.

Component	Function	Approximate % (by weight)	Justification/Comment
Epoxidized Hemp Oil (EHO)	Primary Resin System	60-70%	The main bio-based polymer matrix, derived from cold-pressed hemp seed oil. It provides the essential cross-linkable backbone.
Furfuryl Glycidyl Ether (FGE)	Reactive Diluent	10-15%	A bio-based compound that lowers the resin's viscosity, improving its workability and allowing for high filler concentrations.
Maleic Anhydride-Modified Hemp Lignin (MA-Lignin)	Natural Crosslinker & Bonding Agent	5-10%	Enhances the bond between the resin and the hemp-derived fillers, significantly improving the composite's mechanical properties.
Azelaic Anhydride	Bio-based Curing Agent	5-10%	The hardener that cures the liquid resin mixture into a solid

			material. It's a bio-based ingredient, aligning with the project's sustainability goals.
Carboxylated Hemp-Derived Carbon Nanosheets (HDCNS)	Nano-Reinforcement & Conductivity	3-8%	A key filler that boosts the composite's strength and electrical conductivity, acting as a sustainable alternative to graphene.
Pyrolyzed Hemp Biochar	Micro-Filler & Stiffness	5-15%	An affordable filler that adds stiffness and reduces the overall density of the material, contributing to a strong, lightweight product.
Waste-Derived Functional Fillers (WDF)	Waste Sequestration (Optional)	1-10%	An optional component that allows for the encapsulation of industrial waste, such as microplastics, to help reduce environmental pollution.

Key Performance and Sustainability Benchmarks

Hempoxy is engineered to be a high-performance material that stands up to conventional composites. Its target specifications highlight both its physical strength and its environmental benefits:

- **Tensile Strength**: 110−150 MPa
- **Flexural Modulus**: ≥3000 MPa
- **Impact Resistance**: ≥60 J/m
- **Electrical Conductivity**: ≥100 S/m (for HDCNS-loaded composites)
- **Fire Resistance**: Meets UL94 V-0 Standard

The system is designed for a circular lifecycle, with a target **embodied carbon reduction** of over 80% and a **component recyclability rate** of over 90%. The material can also be triggered for controlled degradation, for example, using UV light or specific pH adjustments.

References

1. Landry, M. S. (2025). "Seshat's Bones Roadmap To Hempoxy". *Scribd*. Retrieved from https://www.scribd.com/document/894834827/Seshat-s-Bones-Roadmap-to-Hempoxy

2. Landry, M. S. (2025). "Hempoxy Material Standard". *Scribd*. Retrieved from https://www.scribd.com/document/897029488/Hempoxy-Material-Standard
3. Landry, M. S. (2025). "Scientific Research Proposal: HEMPOXY (Seshat's Bones v1.4)". *Scribd*. Retrieved from https://www.scribd.com/document/886416983/Scientific-Research-Proposal-HEMPOXY-Seshat-s-Bones-v1-4

Related Additional Readings

- Hemp as a sustainable resource for bio-composites
- Bio-based Epoxy Resins from Renewable Resources