HEMPOXIES 2026–2027

Controlled Investigation of Hemp-Derived Carbon Nanosheets in Bioepoxy Composites

Experimental study proposal · Version 1.1 · 12 November 2026
Principal proposer: Marie-Soleil Seshat Landry
Programme horizon: November 2026–December 2027, conditional on partner and funding approvals

> **DOCUMENT STATUS — AI-ASSISTED WORKING RESEARCH PROPOSAL**
> Not peer reviewed. No Hempoxies laboratory results, measured improvements, confirmed laboratory partnership, funding award, safety approval or verified product qualification are asserted. Literature checks are targeted, not a systematic review. The Hempoxies research platform is an umbrella for candidate formulations and experiments—not one proven material.

Decision requested: Invite an independent materials-science principal investigator and host laboratory to scope an affordable, staged comparison, approve all procedures, select one primary endpoint and generate a traceable dataset that includes failures and null results.

Decision not requested: Acceptance of superior strength, better conductivity, carbon negativity, graphene equivalence, or suitability for regulated structures before testing.

1. Executive decision brief

The question. Can characterized carbon nanosheets made from hemp biomass (H-CNS), and controlled oxidized/reduced derivatives, improve a specified bioepoxy formulation compared with unfilled resin and appropriate commercial fillers? If so, for which property, under what processing conditions, and at what economic and environmental cost?

Why it warrants testing. Wang et al. produced partially graphitic, porous hemp-derived interconnected carbon nanosheets for supercapacitor electrodes [S01]. Bartoli et al. measured performance of carbonized hemp-derived *fibre-type* fillers in epoxy [S02]. These support the feasibility of making hemp-derived carbons and incorporating related carbon materials in resin, but neither proves that the target H-CNS material improves a bioepoxy formulation. Further research on hemp-derived carbon-based electrode hybrids [S03] and on graphene nanoplatelets added to hemp-fibre/epoxy laminates [S04] expands the neighboring literature without closing this exact comparison.

Practical outcome. A useful result could be an improvement confined to one property—e.g., electrical conductivity—with no mechanical benefit or with a processing penalty. The trial should be able to conclude “not competitive” without changing its criteria after seeing results.

Decision	Proposed answer	Current status
Researchable?	Yes: measurable and falsifiable material/processing comparisons	Proposal, not execution
Resin selected?	One bioepoxy grade + specified compatible hardener to be frozen before Stage A	**OPEN**
Primary endpoint selected?	Either tensile modulus *or* plane-strain fracture toughness, after feasibility pilot	**OPEN**
Material identity established?	H-CNS and derivatives require independent batch characterization	**OPEN**
Budget, PI, laboratory, approvals?	Obtain written partners and itemized quotes	**OPEN**
Environmental superiority?	Cannot be determined from biomass origin alone	**NOT ESTABLISHED**

Minimum viable study (MVS). First choose a matrix and characterize materials; compare C0–C5 in a blocked pilot; then run a smaller confirmatory experiment on finalists, including independent batches. Biochar (C6) is a distinct-morphology side arm. Carbon fibre (C7) requires a different test design. A vitrimer matrix is a second project branch, not a silently pooled treatment.

2. Knowledge boundary and material identity

2.1 What the sources establish—and what they do not

1. **Established adjacent result:** Partially graphitic, porous, interconnected carbon nanosheets have been produced from hemp bast fibre and tested as electrodes, not as the specified bioepoxy reinforcement [S01]. The published article reports particular properties of its own material batch; those values must not be assigned to material later procured for this study.
2. **Established adjacent result:** Waste hemp-derived carbon fibres have been studied as fillers in epoxy; morphology, loading and resin chemistry differ from the proposed nanosheet experiment [S02].
3. **Adjacent epoxy research:** General graphene/GO-epoxy work indicates that dispersion, functionalization, resin chemistry, and agglomeration can influence outcomes [S05, S06]. These are mechanistic leads, not effect-size predictions for H-CNS.
4. **Direct novelty unresolved:** A targeted search undertaken for this revision did not establish a matching published, preregistered head-to-head H-CNS/oxidized-H-CNS/reduced-H-CNS comparison in one bioepoxy. This is **not** evidence that no such work exists. A prior-art review spanning patents, theses, articles, preprints, supplier data and alternate terminology must precede any novelty claim.

2.2 Nomenclature control

H-CNS: An operational label for hemp-derived, sheet-like carbon material. Record precursor, synthesis/activation provenance, dimensions, porosity, graphitic ordering, ash content and contamination. It is not automatically graphene.

ox-H-CNS / red-ox-H-CNS: Controlled oxidized H-CNS and reduced oxidized H-CNS. Use these descriptive terms until analytical evidence warrants a recognized graphene oxide or reduced graphene oxide designation. The relevant terminology boundary is material structure, not merely the addition or removal of oxygen [S09, S10].

GO / rGO: Commercial reference grades with independently documented provenance, stated composition, morphology, and procurement lot. These are controls, not presumed equivalent substances.

Hempoxies: The research platform hosting different candidate resin systems, fillers, composites and test processes. No particular Hempoxies formulation is treated as a validated material by this document.

3. Research objective, falsifiers and endpoints

3.1 Objectives

- **O1 — Characterization:** Establish defensible material identities, batch variability, and supplier/process provenance for H-CNS, ox-H-CNS and red-ox-H-CNS.
- **O2 — Mechanical comparison:** Estimate the effect of selected fillers against unfilled bioepoxy and appropriate commercial materials in one frozen matrix/cure system.
- **O3 — Functional comparison:** Evaluate electrical response and thermal/processability trade-offs without conflating these outcomes with mechanical success.

- **O4 — Feasibility:** Establish whether performance is reproducible, scalable enough for a specified use case, and plausibly competitive on cost and inventory-based environmental indicators.

3.2 Hypotheses and potential falsification

ID	Testable proposition	What would challenge it?
H0	No practically meaningful improvement from baseline C0 on the **prespecified primary** mechanical measure	Effect exceeds predeclared practical threshold with reliable batch-aware uncertainty
H1	At least one H-CNS variant improves that measure	All candidates miss threshold or gains fail replication
H2	A reduced oxidized H-CNS variant yields higher electrical conductivity than its oxidized precursor at matched loading	No detectable difference; commercial rGO outperforms it; processing changes obscure attribution
H3	Controlled oxidation may improve dispersion or polymer–filler interaction	Microscopy, chemical and property measurements show no improvement or adverse change
H4	Higher loading can worsen viscosity, voiding, agglomeration or final properties	No deterioration over tested range, or effect not reproducible
H5	A hemp-derived candidate may meet a commercial comparison within a **predeclared** equivalence/ noninferiority margin	Properly powered analysis excludes acceptable equivalence or cannot resolve it

Primary endpoint: The PI must select **one**, before confirmatory manufacture: tensile modulus using specimen-appropriate testing, **or** fracture toughness using a method whose geometric/validity requirements can actually be met [S11, S12]. The choice must be based on intended application, sample feasibility and pilot variance—not observed confirmatory success.

Secondary endpoints: tensile strength/strain, flexural response, electrical conductivity, thermal transitions, viscosity, void fraction, moisture retention, other measured qualities as approved. An electrical endpoint may be separately preregistered as confirmatory, with a multiplicity plan.

Thresholds, statistical power and comparison set: Pending pilot and laboratory sign-off. Do not substitute a convenient generic percentage for a defensible minimum practically relevant effect.

4. Experimental materials and comparison architecture

4.1 Material groups

Code	Material	Comparison role	Design warning
C0	Neat bioepoxy	Baseline negative control	Same resin/hardener/cure as filled groups

Code	Material	Comparison role	Design warning
C1	Untreated H-CNS	Primary hemp-derived nanosheet target	Characterization and lot provenance required
C2	Oxidized H-CNS	Surface-chemistry variant	Avoid calling GO without structural support
C3	Reduced oxidized H-CNS	Conductivity-oriented variant	Avoid calling rGO without structural support
C4	Commercial characterized GO	Oxidized graphenic reference	Match nominal mass loading; record morphology differences
C5	Commercial characterized rGO	Reduced graphenic reference	Match nominal loading; record active carbon fraction
C6	Hemp biochar	**Separate morphology** and possible cost comparator	Not a nanosheet-matched head-to-head control
C7	Hemp-derived carbon fibre	**Separate reinforcement arm**	Use fibre geometry, architecture and volume fraction

Candidate filler levels: 0.05, 0.10, 0.25, 0.50 and 1.00 wt% of total *uncured mixture or cured composite*—one denominator must be specified and used consistently. These are screening options from the original draft, **not** proven optima. Confirm actual cured composition using mass balance and measured losses where possible. The PI may down-select levels after a blinded rheology/feasibility pilot, documenting why.

4.2 Resin selection gate

Freeze one commercially available bioepoxy grade, compatible curing agent, exact lot and processing instructions. Capture supplier evidence for bio-based content; consider laboratory measurement of bio-based carbon if central to claims [S14]. Bio-based carbon fraction, renewable mass fraction, recyclability and climate impact are **not interchangeable** metrics.

Record resin chemistry, stoichiometric mix basis, moisture limits, viscosity window, pot life, processing temperature, cure schedule and independently checked cure conversion. Do not adjust curing conditions between comparison groups without prospectively defined criteria and an appropriate sensitivity arm. A possible hempseed-oil vitrimer route belongs in **Phase V**, with distinct formulation and endpoints; it is not a biological or mechanical equivalent of the baseline epoxy.

4.3 Phased study instead of a premature full factorial

Stage A — Feasibility and screening: Confirm material identities; choose one matrix and dispersion method; check compatibility, workable viscosity, usable samples, cure consistency and pilot variance. Screen a restricted set of loadings in C0–C5. Keep C6/C7 optional and separate.

Stage B — Confirmation: Freeze the primary endpoint, minimum useful effect, finalist materials/levels, comparison pairs, number of independent formulation batches, coupon allocation, exclusions, randomization and analysis plan. Compare against C0 and relevant commercial reference material.

Stage C — Extension and replication: Only if Stage B justifies it, add durability, scaled production, independent-laboratory confirmation and cost/LCA analyses. A second matrix or vitrimer is a new study stratum, not a pooled observation.

5. Methods programme and stop/go gates

WP	Task / deliverable	Required evidence to advance
WP0	Literature, terminology and prior-art search	Logged sources, exclusions, contradictory studies and novelty limitations
WP1	Source/synthesize and characterize H-CNS batches	Provenance; Raman, XRD, XPS, microscopy, porosity, impurities and batch variability
WP2	Approved oxidation/reduction investigation	Host-signed SOPs, chemical safety approval, yields and pre/post analytical evidence
WP3	Resin selection and dispersion/ manufacture	Frozen matrix, mixing record, rheology, cure, porosity, consistent specimen quality
WP4	Mechanical testing	Appropriate standard, calibration, valid geometry, raw curves and batch-level effects
WP5	Electrical and thermal tests	Measurement geometry, detection limits, instrument artifacts, DSC/ DMA/TGA records
WP6	Durability / optional repairability	Defined exposures, conditioning, retention and repeated-cycle metrics where relevant
WP7	Safety, cost and life-cycle inventory	Transparent system boundary, bill of materials, process inputs, waste and uncertainty
WP8	Analysis, replication and decision	Prespecified inferential plan, raw-data audit, repeat production batches, result publication

WP1—material release criteria. Record every batch’s raw spectral files and settings; give dimensions as distributions, not single favorable images. Check residual activation agents, ash and moisture, since apparent performance may reflect contamination or unmeasured material differences. Batch-identity failures trigger quarantine and repeat characterization, not interpretive rewriting.

WP2—chemical transformation. Oxidation and reduction must be performed by an authorized laboratory under separate reviewed SOPs. This proposal deliberately **does not prescribe a synthesis recipe**; no unapproved reagent combination, thermal program, chemical disposal practice, or nanoscale handling is authorized by publication. Compare processed/control samples using both structure and surface chemistry. Count processing losses and waste streams.

WP3—manufacture. Define dispersing method, energy input, batch size, material residence time, ambient temperature/humidity, degassing, curing and deviations. Preserve a negative control experiencing equivalent mixing conditions. A high-energy treatment may alter filler structure or resin cure; inspect the post-processing material, not just the feedstock.

WP4—mechanics. Select specimen-appropriate tensile standard (e.g., ISO 527 family or a suitable ASTM plastics method); use a valid fracture method only when its assumptions and geometry hold [S11, S12]. Report entire stress–strain or load–displacement files, coupon dimensions, fracture surfaces, failure modes and invalid tests. Composite fibre-laminate methods are reserved for the fibre arm.

WP5—function. Measure bulk/surface resistivity only with validated geometry and reliable contacts; correct for instrument floor and edge leakage. Track temperature, humidity and curing state. Use the relevant DSC/DMA methods and instrument records [S13]. Do not combine surface and bulk conductivities into one indicator.

WP6—durability. Predefine humidity/temperature exposure, ageing duration and retention metrics, with matched unaged controls. Repairability and vitrimer reprocessing are evaluated only in matrices actually designed and confirmed to exhibit those mechanisms. “Self-healing” needs a specified damage and recovery metric, not visual closure alone.

WP7—sustainability. Build a cradle-to-gate process inventory first, then a comparative LCA where available; follow recognized goal/scope, inventory, impact and interpretation practice [S15, S16]. Identify functional unit and performance-equivalent comparator before concluding that hemp is greener. Track biomass cultivation, energy, acids/bases, solvents, drying, carbonization, activation, yields, equipment time, transport and waste treatment where relevant. Sequestered biogenic carbon is not automatically permanent or net-negative.

WP8—decision. Check independent-batch reproducibility; analyze uncertainty and adverse outcomes; decide against meaningful thresholds and user-selected application. Independent lab replication is a goal conditional on budget, not a claim of completed validation.

6. Statistical design and data integrity

Experimental unit. A formulation batch is not the same thing as a mechanical coupon. Three coupons from one cast do not constitute three independent material production replicates. Record biomass precursor lot, H-CNS production batch, chemistry-treatment batch, resin mix batch and coupon ID as distinct levels.

Sampling. “At least three independently prepared production batches” is a provisional planning aspiration retained from v1.0, not a powered requirement. Use pilot dispersion and test variance to set batch/coupon counts; calculate detectable effect, precision, budget and stopping criteria before confirmatory testing.

Randomization and blinding. Randomize casting and measurement order within practical blocks; assign blind sample codes to testers where feasible. Block by day, operator, precursor and resin lot. Record unavoidable confounders, including moisture and instrument drift.

Primary estimand. For the frozen primary endpoint, estimate the batch-aware difference (or ratio if justified) between each selected treatment and C0, plus the agreed commercial comparator. Report an effect estimate and confidence interval; use hierarchical/mixed-effects methods where data support nested structure. Prespecify handling of invalid specimens and multiplicity; retain missing data and rejection log.

Do not post-select a winner solely because one loading produces the largest raw mean. A claim of equivalence requires a separately defined noninferiority/equivalence margin and adequately powered comparison, not a nonsignificant difference.

Data provenance. Store raw machine files read-only, with SHA-256 checksums and instrument settings. Separate experimental values from supplier specifications, literature benchmarks, simulations and analyst forecasts. A blank value is `null`, not zero; below-detection values require a specific status and limit.

7. Safety, governance and realistic capacity

Host laboratory accountabilities. A named PI must sign off chemical process hazards, nanoparticle containment, respiratory exposure controls, relevant training, emergency planning, fire/thermal risks, waste treatment and local rules. A public proposal is not an SOP. Request an institution-specific hazard assessment before purchasing or processing dangerous reagents.

Personnel. Proposer: research question, coordination, disclosure, partner communications. Host PI: equipment, SOPs, personnel, training and design authorization. Analytical lead: randomization, preregistration, statistical audit. LCA/economic collaborator: inventory and cost basis. Independent replication partner: separate batch and blinded re-evaluation. All partner roles are **unfilled** unless separately contracted.

Agreements. Before sample transfer, sign written terms for material ownership, background/foreground IP, publication rights, raw-data access, authorship based on contributions, confidential information, safety liability and patent review. A public Zenodo proposal does not itself prove patent novelty or independent scientific endorsement [S19, S20].

Research integrity. Publish results, failures, uncertainty and deviations, subject to legitimate safety/IP constraints. Label future materials qualification narrowly; these experiments would not certify ballistic, aerospace, bridge, vehicle-structure or defence suitability.

8. Conditional programme schedule, 2026–2027

Window	Provisional milestone	Dependency / hold trigger
Nov–Dec 2026	Protocol scoping, source corrections, PI outreach, pilot quotation	Named lab and funding absent
Jan–Feb 2027	Source lots; WP1 material identity; resin selection gate	Material access, instrument availability
Mar–Apr 2027	WP2 surface-chemistry pilot if EHS approved	Approved treatment-specific SOPs
May–Jun 2027	WP3 manufacturability and variance pilot; freeze Stage B	Stable cure and workable specimen quality
Jul–Aug 2027	WP4/5 confirmatory testing	Prespecified endpoint and adequate batches
Sep–Oct 2027	WP6 durability and WP7 inventory if feasible	Replicated Stage B benefit
Nov 2027	Replication, audit, analysis and life-cycle scoping	New partner/funding, complete raw data

Window	Provisional milestone	Dependency / hold trigger
Dec 2027	Bounded technical report, shared data and next-stage decision	Confirmed results and review

Schedule interpretation: These are milestones, not delivery commitments. If a PI, funding, approved SOP or material batch is unavailable, stop at that gate and issue a revised project plan. Do not compress sample independence or skip EHS review to satisfy a date.

9. Decision gates and procurement budget

Gate	Pass condition	Hold / fail condition
G0 — Literature	Scoped search, original source identities and known competing research documented	Missing prior-art check; claimed novelty not supported
G1 — Material	Characterized, comparable batches with acceptable contaminants	Batch drift or ambiguous identity
G2 — Process	Workable resin processing, reproducible cure and accepted coupons	Uncontrolled voids, severe agglomeration or process instability
G3 — Effect	Primary endpoint exceeds agreed practical criterion with uncertainty	Null/adverse effect; unstable inference
G4 — Replication	Independent formulation batch and ideally external replication	Effect disappears or cannot be reproduced
G5 — Cost/LCA	Comparable cost model and performance-normalized inventory	Missing or incompatible functional unit and inventory
G6 — Scale	Qualified candidate use case and separately funded project	No application-appropriate evidence or owner

Budget status: no validated total. Obtain separate CAD quotes for personnel; hemp precursor and documented GO/rGO reference lots; resins/hardeners; analytical access (Raman, XPS, XRD, microscopy, BET); chemical synthesis/waste services; machining/moulds; mechanical/electrical/thermal tests; batch replication; LCA; storage and publication. Include tax, shipping, access charges, contingency and in-kind contributions. Do not make a partner pitch that implies a signed budget exists.

Practical partner request: First quote the MVS only. Quote optional WP6/7/C7/vitrimer arms as priced extensions, not invisible obligations.

10. Evidence workflow: WTF → 5W+1H → Observation X

The source proposal's "WTF Unified v3.1" organizes inquiry into observation, questions, hypotheses, evidence/experiment, analysis, conclusion and reiteration. Retain it as a **proposer-developed organizational framework**, not an externally validated statistical/scientific standard. Claims about "161 candidate methods" are deferred to a separately archived versioned method list; the number is not used to imply 161 applied techniques.

Observation X: Hemp-derived, partially graphitic/porous carbon nanosheets are plausible candidates for resin fillers. Their surface chemistry could modify dispersion, bonding, rheology and final properties. No direction or magnitude of effect in the selected bioepoxy is assumed.

Stage	Required output	Literature check and correction route
1. Observe	Material provenance and bounded observation	Original H-CNS synthesis and alternative nomenclature
2. Ask	Measurable question, endpoint, scope	Direct/adjacent studies and contrary reports
3. Hypothesize	H0/H1, mechanisms and falsifiers	Disconfirming mechanisms, dispersion failure
4. Experiment	Host-approved SOP, controls and raw-data log	Methods, standards, safety and confounders
5. Analyze	Batch-aware effects and uncertainty	Appropriate models and failure conditions
6. Conclude	Bounded claim and limitation statement	Null findings, contradictory literature, correction checks
7. Reiterate	Revision and replication decision	New studies, revised hypotheses and archived changes

Search disclosure. The targeted verification supporting v1.1 inspected selected publisher, PubMed, Zenodo, ISO and standards landing pages on 12 November 2026. It was not a reproducible systematic search of all research databases or patents. Before declaring comprehensive coverage, the project must archive exact database/provider, search string, date, filters, retrieved records, deduplication, screened/excluded reasons, full-text access, retractions and contradictory literature. PRISMA 2020 / PRISMA-S offer useful reporting guidance when a formal systematic review is actually undertaken [S17, S18].

11. Laboratory record system: blank templates

Record status is always one of: `NOT MEASURED`, `PENDING`, `MEASURED`, `BELOW DETECTION LIMIT`, `NOT APPLICABLE`, `INVALID`, or `REJECTED`. These tables are **form specifications, not observed results**.

Form	Mandatory entries	Status
D-01 — Provenance	permanent sample/batch/coupon IDs; hemp origin; supplier certificate; preparation; custody; operator; storage	NOT MEASURED
D-02 — Carbon structure	Raman ID/IG & acquisition; XRD; XPS C/O; SEM/TEM distributions; BET with degassing; ash/moisture; conductivity method	NOT MEASURED
D-03 — Chemistry	feedstock batch; authorized SOP ID; reagent lots; process changes; yield; residuals; before/after characterization; waste	NOT MEASURED
D-04 — Bioepoxy	resin & hardener grade; mass balance; filler wt% denominator; mixing energy; rheology; degassing; cure; porosity	NOT MEASURED
D-05 — Mechanics	standard/revision; conditioning; calibrated machine; coupon geometry; raw curves; KIC/GIC validity; failure images	NOT MEASURED
D-06 — Functional	resistivity geometry; DSC/DMA/TGA files; temperature and moisture; ageing; cycle/recovery metrics	NOT MEASURED
D-07 — Statistics	primary outcome; effect threshold; batch and coupon counts; analysis version; uncertainty; exclusions; decision/dissent	NOT MEASURED
D-08 — Literature	stage; query/provider/date; records; screened/excluded; DOI; contradictory results; retraction check	PENDING
D-09 — EHS/LCA/cost	host approval; reagent/mass/energy ledger; emissions/waste; cost and quotation provenance; functional unit	PENDING

Machine-readable minimal schema:

```
 programme_id, work_package, material_code, precursor_lot,
material_batch_id, treatment_batch_id, formulation_batch_id,
specimen_id, measurement_id, measured_value, unit,
measurement_uncertainty, detection_limit, record_status,
source_type, source_url_or_sop, instrument_id, calibration_date,
operator, timestamp_iso8601, raw_file_path, raw_file_sha256,
protocol_revision, deviation_id, rejection_reason
```

`source_type` takes `EXPERIMENT`, `SUPPLIER`, `LITERATURE`, or `MODEL`. Never store a model result as if it came from an instrument. Suggested immutable record hierarchy: programme / work package / material batch / treatment batch / formulation batch / specimen / measurement. **Example ID format only:** `H27-WP4-C2-L010-B03-S07`.

12. Evidence and citation audit of v1.0

Scope: The following ledger reports claims where the revised document's wording materially depends on external evidence or a research-status distinction. `V` = source/metadata supports the limited claim as stated; `S` = adjacent support, not the broader implication; `U` = unresolved; `N` = proposal/status, not empirical finding. A verified bibliographic reference is not verification of a proposed composite effect.

ID	Source draft issue or claim	Audit	Editorial action
C001	R1 title "Graphene-like carbon nanosheets from hemp biomass..."	**V bibliographic correction**	Restore published title *Interconnected Carbon Nanosheets Derived from Hemp for Ultrafast Supercapacitors with High Energy* [S01]
C002	R1 used as anchor for composite feasibility	**S**	Keep only as hemp-nanosheet production and electrode precedent; no epoxy performance conclusion
C003	R2 "Bartoli et al. (2022)" details pending	**V bibliographic correction**	Restore title, journal and DOI, clarify carbonized fibre morphology [S02]
C004	Any claim that nobody has tested hemp nanosheets in composites	**U**	Make no absence/first-ever assertion; require full novelty and patent search
C005	Oxidation automatically produces GO	**U if asserted**	Use ox-H-CNS until graphene-family identity validated [S09, S10]
C006	All 8 work packages executable during 2027	**N / conditional**	Introduce staged minimum viable study and stop/go dependencies
C007	Three batches adequate for power	**U**	Retain only as planning aspiration; require pilot variance and power justification
C008	"Complete laboratory research proposal" despite absent SOPs, budget and PI	**S; overbroad title**	Call it a full **study concept / execution-gated proposal**, not an approved protocol

ID	Source draft issue or claim	Audit	Editorial action
C009	Hemp feedstock yields superior LCA outcomes	**U**	Require performance-normalized inventory and no carbon-negative promise [S15, S16]
C010	Landry 2025/2026 Zenodo records	**V existence; N as performance evidence**	Cite as earlier proposals/ frameworks, never independent validation [S19, S20]
C011	Graphene/epoxy may benefit from dispersion and surface control	**S**	Retain as mechanism to test; no transferrable effect-size promised [S05, S06]
C012	WTF Unified “161 methods”	**U for external applicability**	Treat as unpublished/ author-supplied framework detail; require supporting registry before audit claim

Central counterargument: Porosity, heterogeneity and surface oxygen can make carbon nanosheets more difficult to disperse, less effective at load transfer, less conductive, or costlier to process than standardized commercial fillers. The strongest negative result would be characterized lots repeatedly failing the agreed practical threshold under acceptable, matched cure/process conditions. That outcome would be scientifically useful and should be published.

13. References and source-access status

Entries `[S##]` are scoped support, not a completed systematic bibliography. “Metadata/abstract inspected” is different from reading full text. URLs are supplied for independent follow-up and version checks.

1. **[S01]** Wang, H., Xu, Z., Kohandehghan, A., et al. (2013). *Interconnected Carbon Nanosheets Derived from Hemp for Ultrafast Supercapacitors with High Energy.* ACS Nano 7(6), 5131–5141. https://doi.org/10.1021/nn400731g — **Publisher abstract and PubMed metadata inspected**; electrode precedent.
2. **[S02]** Bartoli, M., Duraccio, D., Faga, M. G., et al. (2022). *Mechanical, electrical, thermal and tribological behavior of epoxy resin composites reinforced with waste hemp-derived carbon fibers.* Journal of Materials Science 57, 14861–14876. https://doi.org/10.1007/s10853-022-07550-9 — **Open-access article abstract inspected**; carbonized-fibre/epoxy precedent.
3. **[S03]** *Synthesis of highly porous hybrid nanocomposite of hemp derived carbon nanosheet/carbon nanotube/manganese cobalt oxide for asymmetric supercapacitor* (2024). Materials Chemistry and Physics 313, 128677. https://doi.org/10.1016/j.matchemphys.2023.128677 — **Publisher abstract inspected**; electrode hybrid, not target bioepoxy.
4. **[S04]** *Investigation of Mechanical and Impact Properties of Hemp Fiber Reinforced Epoxy-Based Nanocomposites* (2025). Polymer Composites. https://doi.org/10.1002/pc.30135 — **Publisher abstract inspected**; graphene nanoplatelets + hemp-fibre epoxy, not hemp-derived nanosheet filler.

5. **[S05]** *Molecular Mechanism of Physical and Mechanical Improvement in Graphene/Graphene Oxide-Epoxy Composite Materials* (2024). ChemPhysChem. https://doi.org/10.1002/cphc.202400497 — **PubMed/PMC abstract inspected**; molecular modeling, not H-CNS experiment.
6. **[S06]** *Graphene-enhanced epoxy composites: A comprehensive review of dispersion mechanisms, processing strategies, property optimization, characterization and sustainable innovations* (2025). Progress in Aerospace Sciences 158, 101142. https://doi.org/10.1016/j.paerosci.2025.101142 — **Publisher abstract/preview inspected**, full text not comprehensively audited.
7. **[S07]** Marcano, D. C., Kosynkin, D. V., Berlin, J. M., et al. (2010). *Improved Synthesis of Graphene Oxide.* ACS Nano 4(8), 4806–4814. https://doi.org/10.1021/nn1006368 — **PubMed metadata/ abstract inspected**; graphite-based GO chemistry precedent, not a transferable hemp SOP.
8. **[S08]** Pei, S. and Cheng, H.-M. (2012). *The Reduction of Graphene Oxide.* Carbon 50(9), 3210–3228. https://doi.org/10.1016/j.carbon.2011.11.010 — **Publisher abstract inspected**; general reduction context.
9. **[S09]** ISO/TS 80004-13:2024. *Nanotechnologies—Vocabulary—Part 13: Graphene and other two-dimensional materials.* https://www.iso.org/standard/82855.html — **ISO official description inspected**; terminology, not certification of these batches.
10. **[S10]** IUPAC Gold Book. *Graphene* definition. https://doi.org/10.1351/goldbook.08172 — **IUPAC entry inspected**.
11. **[S11]** ASTM D5045-14(2022), *Plane-Strain Fracture Toughness and Strain Energy Release Rate of Plastic Materials.* https://doi.org/10.1520/D5045-14R22 — **Standard designation and scope confirmed from official listing; licensed method text not evaluated**.
12. **[S12]** ISO 527-1:2019. *Plastics—Determination of tensile properties—General principles.* https://www.iso.org/standard/527-1 — **ISO official description inspected**.
13. **[S13]** ISO 11357-1:2023. *Plastics—Differential scanning calorimetry—General principles.* https://www.iso.org/standard/83904.html — **ISO official description inspected**.
14. **[S14]** ASTM D6866-24a, *Determining the Biobased Content of Solid, Liquid and Gaseous Samples Using Radiocarbon Analysis.* https://doi.org/10.1520/D6866-24A — **Official listing inspected**; bio-based carbon test, not an LCA outcome.
15. **[S15]** ISO 14040:2006. *Environmental management—Life cycle assessment—Principles and framework.* https://www.iso.org/standard/37456.html — **ISO official abstract inspected**.
16. **[S16]** ISO 14044:2006. *Environmental management—Life cycle assessment—Requirements and guidelines.* https://www.iso.org/standard/38498.html — **ISO official abstract inspected**.
17. **[S17]** Page, M. J., et al. (2021). *The PRISMA 2020 statement.* BMJ 372:n71. https://doi.org/10.1136/bmj.n71 — **Publisher/PubMed metadata inspected**; reporting guidance.
18. **[S18]** Rethlefsen, M. L., et al. (2021). *PRISMA-S: an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews.* Systematic Reviews 10:39. https://doi.org/10.1186/s13643-020-01542-z — **Publisher/PubMed metadata inspected**.
19. **[S19]** Landry, Marie Seshat (2025). *A Comparative Analysis of Hemp-Derived Carbon Nanosheets and Graphite-Derived Graphene as Reinforcing Agents in Synthetic and Bio-Epoxy Composites.* Zenodo **Proposal**. https://doi.org/10.5281/zenodo.17201998 — **Record inspected**; pre-experimental author work.
20. **[S20]** Landry Industries Materials Science Division (2026). *Hemp-Derived Graphene Oxide (HGO) & Hemp-Derived Reduced Graphene Oxide (HrGO) Research Framework.* Zenodo. https://doi.org/10.5281/zenodo.21437852 — **Record inspected**; published framework/SOP document, not independently executed or verified synthesis.

Unresolved citation/version note: The source v1.0 additionally lists ASTM D638, D790, D3039/D3039M, ISO 6721 and ISO 11357 generally. These remain candidate laboratory methods. No current-edition applicability decision has been made for all specimens; the PI must select licensed/current revisions and validate fit.

14. Version history, editorial disposition and next action

Item	v1.0 issue	v1.1 repair
Scope	Calls itself complete while critical execution gates remain open	Explicit protocol, lab, funding and safety hold points
Terminology	H-CNS/GO boundary could blur	Operational material identity and separate HGO labels
Evidence	R1 title wrong; R2 unfinished	Corrected bibliographic identifiers and added adjacent studies
Novelty	Direct comparison is proposed but precedent is incompletely mapped	Narrow research gap; no first-ever claim
Design	Large screen and eight WPs without resource plan	Phased MVS, separate carbon-fibre and vitrimer arms
Statistics	Three-batch aspiration has no power analysis	Pilot-based batch/coupon allocation and prespecified outcome
Sustainability	Bio-based material could be misread as inherently greener	No LCA claim without measured inventory and comparator
Communication	Repeated “Gate: Gate” and boilerplate	Concise acceptance criteria, record system and evidence ledger
Research status	Proposal caveat mostly correct but easy to overlook	Visible cover disclosure; not peer reviewed/not lab tested

Release decision — READY AS A LABELED, AI-ASSISTED WORKING PROPOSAL; NOT READY AS AN APPROVED LABORATORY PROTOCOL OR VERIFIED MATERIALS CLAIM. Targeted bibliographic and source-scope checks were performed as recorded, but no systematic prior-art search, laboratory method validation, independent peer review, full citation-by-citation text audit or environmental calculation was performed. All performance results await experimental measurement.

Next decision: obtain (1) a host PI, (2) one available resin/hardener pair, (3) traceable H-CNS material lots, (4) a quote for Stage A, and (5) the host laboratory’s safety/method review. Only then freeze a confirmatory study.