HEMPOXIES 2026–2027

Comparative Experimental Investigation of Hemp-Derived Carbon Nanosheets, Oxidized and Reduced Derivatives, and Multifunctional Bioepoxy Composites

Complete laboratory research proposal | Version 1.0 | 12 November 2026

Principal proposer: Marie-Soleil Seshat Landry

Method: WTF Unified v3.1 — WTF → 5W+1H → Observation X → seven-stage scientific inquiry, with literature searching at every stage.

Document status: Proposal only. No laboratory experiments, measured performance gains, supplier commitments, funding awards, or institutional approvals are claimed.

Programme window: November 2026 to December 2027.

DECISION REQUESTED

Invite a qualified materials-science laboratory to co-design, budget and execute a staged study with pre-specified endpoints, transparent negative-result reporting and independent replication.

1. Executive summary and governance

This proposal tests whether hemp-derived graphitic/porous carbon nanosheets (H-CNS), their oxidized derivatives (ox-H-CNS), and their subsequently reduced derivatives (red-ox-H-CNS) offer useful performance in defined bioepoxy systems relative to neat resin, conventional graphene oxide (GO), reduced graphene oxide (rGO), hemp biochar and hemp carbon-fibre comparators. Mechanical, electrical, thermal, durability, cost and environmental outcomes are evaluated separately. A bio-based feedstock does not establish improved lifecycle performance.

The scientific deliverable is a traceable dataset, including failures and null results, with fully characterized fillers and repeatable resin-processing procedures. A successful outcome may be a narrow use case (e.g. conductivity improvement) rather than universal mechanical superiority.

1.1 Responsibilities and approvals

Role	Responsibility / decision
Principal proposer	Research question, scientific coordination, draft review, disclosure of conflicts and AI assistance.
Host laboratory / PI [TBD]	Approve procedures, chemical safety, equipment, personnel, training and experimental records.
Analytical lead [TBD]	Preregister analysis, randomization, power calculations and exclusions; audit raw-data provenance.
Independent replicating laboratory [TBD]	Repeat selected formulations using blinded sample IDs and a separately prepared batch.
Commercial / LCA collaborator [TBD]	Cost accounting, environmental inventory and decision-oriented comparisons.

No named institution is presumed to have agreed to participate. Intellectual property, publication rights, materials transfer and confidentiality require written agreements before shared work.

2. Background, terminology and evidence boundaries

Biomass-derived carbon can exhibit porous, graphitic, turbostratic and amorphous domains. H-CNS is an operational material label requiring batch-level characterization. It must not be silently equated with pristine graphene. Oxidation of H-CNS may yield oxygen-functionalized carbon nanosheets, but the term “graphene oxide” requires structural evidence appropriate to the definition used. Subsequent reduction may restore portions of conjugated carbon networks while changing dispersibility and interfacial interactions.

Literature anchors include Wang et al. (2013) on hemp-derived carbon nanosheets for electrochemical applications [R1]; Bartoli et al. (2022) on carbonized hemp-fibre epoxy composites [R2]; graphene/epoxy dispersion literature [R3]; and established reporting and testing standards [R4–R13]. These are related precedents, not direct proof of H-CNS performance in the proposed bioepoxy matrix. Full bibliographic verification and systematic searching are Phase 0 deliverables.

2.1 Research gap and novelty test

• Primary gap: head-to-head testing of matched, well-characterized H-CNS, ox-H-CNS and red-ox-H-CNS in one controlled bioepoxy matrix, with commercial carbon benchmarks.

• Novelty must be assessed against articles, patents, theses, preprints and supplier technical data; absence from an initial search is not evidence of first invention.

• Separate material identity, composite function, environmental advantage and economic feasibility; each requires different evidence.

3. WTF Unified scientific framework

Trigger: WTF is the experimental effect of hemp-derived nanosheets and their surface-chemistry variants on bioepoxy? 5W+1H: What materials and outcomes? Who produces and tests them? When are processing and measurements performed? Where do filler/matrix interactions occur? Why might properties change? How could dispersion, interface chemistry, network formation and curing mediate effects? Why/How are provisional mechanisms until tested.

Observation X: Hemp-derived carbon nanosheets are plausible composite fillers whose chemical surface state may influence processing, interfacial behavior and final properties. This observation is grounded in adjacent literature but is not itself a measured improvement in the selected bioepoxy.

Scientific stage	Required output	Literature search at that stage
1 Observation X	Scoped observation and source/gap register	Terminology, original material synthesis and analogous observations
2 Question	Measurable outcomes, scope, exclusion criteria	Prior direct answers, unresolved gaps, endpoints
3 Hypotheses	H0/H1/alternatives, predictions, falsifiers	Supporting and contradictory mechanisms
4 Evidence / experiment	Approved protocols and raw-data capture	Methods, ASTM/ISO standards, controls, safety
5 Analysis	Executed-method ledger and quantitative comparisons	Statistical standards, benchmarks, confounders
6 Conclusion	Bounded findings and limitations	Contradictions, systematic reviews, retractions
7 Reiteration	New Observation X, revision and replication plan	New studies, corrections, negative results

Each stage requires a search log with date, database/provider, exact query, filters, retrieved records, screening rationale, accessible full texts, contradiction checks and citations. If access is unavailable, label “LITERATURE SEARCH NOT PERFORMED”; do not simulate searches. The 161 candidate methods in WTF Unified are screened for applicability, but only methods actually executed are listed as executed.

3.1 Testable hypotheses and decision criteria

ID	Hypothesis / expected pattern	Pre-specified evidence needed
H0	No practically meaningful change from neat bioepoxy	Effect estimates and uncertainty for primary endpoint
H1	At least one H-CNS variant improves primary mechanical endpoint	Replicated improvement exceeding preregistered minimum relevant effect
H2	Reduced oxidized material increases conductivity	Conductivity versus neat resin and GO/rGO at matched loadings
H3	Oxidation improves dispersion / interfacial bonding	Microscopy/chemistry indicators plus associated property trends
H4	Excess loading worsens processing or properties	Loading-response and viscosity/void/agglomeration evidence
H5	Hemp-derived variant meets commercial reference performance	Equivalence or noninferiority margin defined before testing

Proposed primary endpoint: tensile modulus or fracture toughness, selected by laboratory partners before fabrication. Conductivity is a separately preregistered functional endpoint. Do not switch the primary endpoint after inspecting results without labeling the change exploratory.

4. Experimental design and materials

4.1 Material groups

Code	Material	Role
C0	Neat bioepoxy, no filler	Negative/baseline control
C1	Untreated H-CNS	Target untreated nanosheets
C2	Oxidized H-CNS	Functionalized target; GO label conditional
C3	Reduced oxidized H-CNS	Conductivity-oriented derivative; rGO label conditional
C4	Commercial characterized GO	Reference oxidized graphenic filler
C5	Commercial characterized rGO	Reference reduced graphenic filler
C6	Hemp biochar	Different morphology/cost control
C7	Hemp-derived carbon fibre	Different reinforcement morphology; separate design

Illustrative nanoscale-filler screening: 0.05, 0.10, 0.25, 0.50 and 1.00 wt% relative to total composite mass, plus 0 wt% baseline. These are candidate levels, not validated optima. Fibre comparators require separate volume-fraction and architecture controls and must not be interpreted as morphology-matched at equal mass loading. Pilot rheology may narrow the range.

4.2 Resin system selection gate

• Select one commercially available bioepoxy and specified compatible hardener; record exact grade, supplier, bio-based carbon claim and evidence, expiry, stoichiometric mixing ratio and cure schedule.

• Document viscosity window, processing temperatures, gel time, moisture tolerance and cure conversion. A second vitrimer matrix is optional and cannot be pooled with the baseline chemistry.

• Use identical resin/hardener ratios and controlled cure histories across comparison groups, except documented adjustments justified before testing.

4.3 Design of experiments and sample independence

Screening is a factorial or blocked design with filler identity, concentration and independent production batch as factors. Randomize specimen order and, where feasible, blind operators during testing. At least three independently prepared production batches per selected condition are a planning aspiration, not a statistically justified final sample size. Conduct pilot variance estimation, then preregister the power analysis and specimen allocation. A batch is not equivalent to multiple coupons cut from one casting.

5. Eight work packages

WP1 — Material sourcing, synthesis and characterization

Source documented hemp biomass or H-CNS; characterize precursor origin, carbonization history and variability. Raman D/G bands, XRD, XPS, SEM/TEM, BET, elemental analysis, moisture, conductivity and ash/impurities as appropriate.

Decision gate: Gate: sufficient identity, purity and reproducibility to compare batches; quarantine poorly characterized material.

WP2 — Controlled oxidation and reduction

Develop laboratory-approved oxidation/reduction routes and controls; track oxygen functionality, carbon lattice changes, particle size, yield, residual reagents and waste. Do not assume graphene oxide identity from oxidation alone.

Decision gate: Gate: chemical safety signoff; before/after characterization supports naming and reproducibility.

WP3 — Formulation and dispersion

Compare approved mixing/dispersion protocols; measure dispersion, viscosity, pot life, degassing, cure, filler recovery, porosity and storage effects. Record energy inputs and processing deviations.

Decision gate: Gate: processability and reproducible specimen fabrication without uncontrolled cure changes.

WP4 — Mechanical performance

Use relevant tensile, flexural and fracture methods, e.g. ASTM D638 or D3039 as appropriate to specimen type; ASTM D790; ASTM D5045 where valid. Capture full curves and failure images, not only maxima.

Decision gate: Gate: valid specimen geometry, calibration, fracture criteria, batch-level replication and confidence intervals.

WP5 — Electrical and thermal response

Measure bulk/surface conductivity with geometry-appropriate methods, DSC/DMA thermal transitions, TGA and optional thermal conductivity. Examine percolation trends and mechanical-functional trade-offs.

Decision gate: Gate: instrument range and contact artifacts documented; baseline and reference controls measured.

WP6 — Durability, repairability and recycling

Condition specimens under defined moisture, temperature and cycling regimes. Measure retention versus baseline. For vitrimer matrices only, test repairability/reprocessing with appropriate controls and damage metrics.

Decision gate: Gate: no “self-healing” or recyclability claim without defined recovery metric and repeated-cycle data.

WP7 — Sustainability, EHS and technoeconomics

Build cradle-to-gate mass/energy/chemical inventory, safety and exposure review, wastewater treatment accounting, yield and cost model; compare to commercial GO/rGO where data permit.

Decision gate: Gate: transparent functional unit, system boundary, assumptions and sensitivity analysis.

WP8 — Optimization, replication and decision

Preregister multi-criteria evaluation; identify Pareto-efficient candidates; independent batch replication and, if feasible, partner-lab replication; write publication-ready dossier.

Decision gate: Gate: reproducible effects, uncertainty, no unsupported claims and independent audit of provenance.

6. Quality, safety and statistical analysis

All synthesis and modification operations require a host-laboratory chemical hazard assessment, training, engineering controls, waste handling and approvals. Nanopowder inhalation, solvent exposure, oxidative reagents, curing agents and heat are hazards to assess; this proposal does not substitute for a validated standard operating procedure.

Primary analysis: batch-aware estimates of effect versus C0 and matched commercial comparators, confidence intervals and uncertainty; fit loading-response models only when data justify them. Correct for multiplicity across confirmatory endpoints. Report missingness, outliers, exclusions and protocol deviations. Use mixed-effects or hierarchical models when specimens are nested within production batches; avoid pseudoreplication.

Secondary analysis: dispersion-property association, trade-off maps, sensitivity to assumptions and exploratory multi-criteria decision analysis. Never treat statistical significance alone as practical usefulness. Preserve negative results.

6.1 Method execution and evidence ledger

Method	Planned role	Status in this proposal
Literature search and citation tracing	Evidence at each of seven stages	PLANNED; not executed in laboratory
5W+1H / hypothesis mapping	Define Observation X and falsifiers	PROTOCOL DESIGNED
Design of experiments	Select groups, concentrations and blocks	PROPOSED
Raman/XPS/SEM/BET	Material identity and surface characterization	NOT MEASURED
Batch-aware inference	Primary effect and uncertainty	NOT EXECUTED
Independent replication	Reproduce selected results	NOT EXECUTED
Life-cycle assessment	Environmental comparison	INVENTORY NOT COLLECTED

7. Programme schedule and decision milestones

Window	Deliverables	Critical dependencies
Nov–Dec 2026	Protocol, scoping literature, partner engagement, preliminary EHS, budget	Host lab, materials and funding not yet secured
Jan–Feb 2027	WP1 source/characterize H-CNS; resin gate	Material access and analytical instruments
Mar–Apr 2027	WP2 derivatives; chemical characterization	Approved oxidation/reduction SOPs
May–Jun 2027	WP3 pilot formulations, DOE, sample manufacture	Dispersion/cure feasibility
Jul–Aug 2027	WP4–5 primary testing and preliminary analysis	Validated specimens, instrument booking
Sep–Oct 2027	WP6 durability; WP8 optimization; WP7 inventory	Stable candidate formulations
Nov 2027	Independent batch/partner replication, statistics, LCA	Replication partner and raw-data audit
Dec 2027	Final technical report, datasets, manuscript and scale-up decision	Completed evidence and review

Schedule is aspirational. If materials, funding or lab approvals slip, prioritize a minimum viable study: characterized C0–C5, controlled processing, one mechanical primary endpoint, one functional endpoint and batch-level replication. Extended durability and full LCA may follow later.

8. Budget framework and collaboration terms

No numerical budget is asserted without supplier quotations and partner scope. The budget must be built bottom-up by work package and explicitly separate cash costs, in-kind access, taxes, currency and contingency.

Budget category	Quantity / basis to request	Cost (CAD)
Personnel and technical time	Hours × approved institutional rates	[QUOTE PENDING]
Carbon precursor and references	Lots, shipping, characterization certificates	[QUOTE PENDING]
Resin, hardener and consumables	Volume, batches, molds, PPE	[QUOTE PENDING]
Synthesis and waste management	Reagents, safety systems, disposal	[QUOTE PENDING]
Characterization access	Raman, XPS, XRD, SEM/TEM, BET time	[QUOTE PENDING]
Mechanical/electrical/thermal tests	Specimens, equipment hours, calibration	[QUOTE PENDING]
Replication and external testing	Partner fees and sample shipping	[QUOTE PENDING]
LCA, publication and data storage	Analyst time, repository and OA charges	[QUOTE PENDING]
Contingency	Rate agreed after scope definition	[TBD]

Partner agreement should define sample ownership, permitted uses, raw-data access, publication timetable, review periods, confidentiality, authorship contributions, background IP and foreground IP. Research proposals and AI-assisted text do not establish patentability or ownership.

9. Reporting, open science and commercialization gates

Publish protocol version, preregistered outcomes, negative results, de-identified raw measurements, processing metadata, uncertainty and corrections subject to legitimate safety/IP restrictions. Use persistent identifiers where available. Any claims about ballistic, aerospace, automotive structural or electrical certification require application-specific qualification well beyond this screening study.

Gate	Pass condition	Fail/hold condition
G0 Literature	Search strategy and direct prior art recorded	Search unavailable or unresolved material identity
G1 Material	Comparable, characterized lots	Uncontrolled impurities or batch drift
G2 Process	Stable resin cure and specimen quality	Agglomeration, voids or unacceptable viscosity
G3 Performance	Replicated practically meaningful effect	Uncertain, null or adverse primary outcome
G4 Replication	Independent batch or partner confirmation	Effect disappears or cannot be reproduced
G5 Sustainability	Comparable LCA and cost evidence	No defensible functional-unit comparison
G6 Scale-up	Qualified use case and funded next stage	No validated use case

10. Guided laboratory forms — blank, not synthetic data

Every record must have a status selected from NOT MEASURED, PENDING, MEASURED, BELOW DETECTION LIMIT, NOT APPLICABLE, INVALID or REJECTED. Never substitute a model estimate or literature benchmark for a measured value. Attach source filenames, operator, instrument ID, calibration date, uncertainty, units and deviations to every quantitative measurement.

D-01 — Sample and provenance

Field / guidance	Record / status
Unique sample ID; specimen ID; replicate ID — Use permanent IDs; avoid reusing rejected IDs	[NOT MEASURED / PENDING]
Batch/lot, biomass origin, supplier and certificate — Link certificates and chain of custody	[NOT MEASURED / PENDING]
Preparation, mass balance, storage and moisture — State processing SOP revision	[NOT MEASURED / PENDING]
Operator, date, site and raw-data folder — Record timezone and archive path	[NOT MEASURED / PENDING]

D-02 — Carbon structure

Field / guidance	Record / status
Raman excitation, D/G bands and ID/IG — Raw spectrum, baseline and fit method	[NOT MEASURED / PENDING]
XRD 2theta peaks, d spacing and instrument settings — Raw diffractogram and reference standards	[NOT MEASURED / PENDING]
XPS atomic % C/O and functional groups — Survey/high-resolution spectra, calibration	[NOT MEASURED / PENDING]
SEM/TEM thickness, lateral size and distribution — Images, scale bars and sampling strategy	[NOT MEASURED / PENDING]
BET surface area m2/g, degassing conditions — Isotherm and model	[NOT MEASURED / PENDING]
Conductivity S/m, geometry and contact method — Temperature and measurement uncertainty	[NOT MEASURED / PENDING]

D-03 — Oxidation / reduction

Field / guidance	Record / status
Starting material batch and mass — Track precursor identity	[NOT MEASURED / PENDING]
Approved SOP ID, reagent lots and process conditions — Do not replace institutional SOP	[NOT MEASURED / PENDING]
Yield %, elemental O/C and residual chemicals — Report analytical detection limits	[NOT MEASURED / PENDING]
Pre/post Raman, XPS, XRD and microscopy — Document actual chemical/structural change	[NOT MEASURED / PENDING]
Waste streams, controls and incident log — EHS review and disposal receipt	[NOT MEASURED / PENDING]

D-04 — Bioepoxy formulation

Field / guidance	Record / status
Resin/hardener names, lot and bio-based content — Evidence for bio-based carbon claim	[NOT MEASURED / PENDING]
Stoichiometry, filler wt% and mass balance — Specify denominator and balance precision	[NOT MEASURED / PENDING]
Mixing/dispersing energy, time and temperature — Method, tool, operator and SOP	[NOT MEASURED / PENDING]
Viscosity, pot life, degassing and cure schedule — Instrument and full time-temperature trace	[NOT MEASURED / PENDING]
Void fraction, sample geometry and conditioning — Acceptance limits pre-specified	[NOT MEASURED / PENDING]

D-05 — Mechanical tests

Field / guidance	Record / status
Standard and revision, equipment and calibration — Record load cell and fixture	[NOT MEASURED / PENDING]
Specimen dimensions and conditioning — Per-specimen data, not just group mean	[NOT MEASURED / PENDING]
Tensile/flexural stress-strain raw file — Strength MPa, modulus GPa, strain %	[NOT MEASURED / PENDING]
Fracture test geometry and validity checks — KIC or GIC only when method valid	[NOT MEASURED / PENDING]
Failure photographs, exclusions and anomalies — Keep rejected data with rationale	[NOT MEASURED / PENDING]

D-06 — Functional and durability

Field / guidance	Record / status
Electrical resistivity/conductivity and method — Geometry, temperature, detection floor	[NOT MEASURED / PENDING]
DSC/DMA/TGA raw files and settings — Tg, transitions and degradation criteria	[NOT MEASURED / PENDING]
Thermal conductivity method if measured — Units W/(m K) and uncertainty	[NOT MEASURED / PENDING]
Ageing condition, duration and specimen pairing — Control and exposure logs	[NOT MEASURED / PENDING]
Repair/reprocessing cycle and recovery metric — Vitrimer-only when relevant	[NOT MEASURED / PENDING]

D-07 — Statistical and decision record

Field / guidance	Record / status
Primary endpoint and minimum relevant effect — Preregister before unblinding	[NOT MEASURED / PENDING]
Independent batch count and coupon count — Power calculation and nested structure	[NOT MEASURED / PENDING]
Raw values, mean, SD, CI and effect size — Analysis script and version	[NOT MEASURED / PENDING]
Missingness, outliers and multiplicity — Document exclusions and alternatives	[NOT MEASURED / PENDING]
Go/no-go recommendation and dissenting view — Link directly to underlying results	[NOT MEASURED / PENDING]

D-08 — Literature at every scientific stage

Field / guidance	Record / status
Stage number and question — One log per stage and iteration	[NOT MEASURED / PENDING]
Database/provider, exact query and date — Copy syntax, limits and date range	[NOT MEASURED / PENDING]
Hits, screened, included and excluded — Provide reasons and duplicates	[NOT MEASURED / PENDING]
DOI/URL, source quality and conflicts — Separate original study from review	[NOT MEASURED / PENDING]
Contradictions, retractions and update triggers — Do not omit negative evidence	[NOT MEASURED / PENDING]

D-09 — Safety, LCA and cost

Field / guidance	Record / status
EHS risk assessment and SOP authorization — Signatures and version	[NOT MEASURED / PENDING]
Mass/energy/reagent inventory per functional unit — State boundaries and allocations	[NOT MEASURED / PENDING]
Waste quantities and disposal method — Link manifests	[NOT MEASURED / PENDING]
Costs, currency, quote date and uncertainty — Do not substitute unsupported estimates	[NOT MEASURED / PENDING]
Comparative environmental conclusion status — Only after comparable inventory	[NOT MEASURED / PENDING]

11. Data dictionary, integrity and file naming

Suggested record hierarchy: programme / work package / material batch / formulation batch / specimen / measurement. Example: H27-WP4-C2-L010-B03-S07. Store raw files read-only with cryptographic hashes, plus a separately versioned analysis dataset and audit trail. Record units and detection limits in a machine-readable schema; keep null distinct from zero.

Field	Type / allowed values	Requirement
record_status	Enum: NOT MEASURED; PENDING; MEASURED; BELOW DETECTION LIMIT; NOT APPLICABLE; INVALID; REJECTED	Mandatory
sample_id / batch_id	Unique string	Mandatory
measured_value	Numeric or null	Only when measured
unit / uncertainty	Unit string; numeric or null	Mandatory for numeric results
method / instrument / calibration	Text + identifiers	Mandatory for measured results
raw_file / sha256	Path and checksum	Mandatory for measured results
source_type	EXPERIMENT; SUPPLIER; LITERATURE; MODEL	Mandatory

Field	Type / allowed values	Requirement
operator / timestamp / SOP revision	Text + ISO 8601 date	Mandatory

12. Literature protocol and preliminary reference register

The following references are starting points for protocol development, not the result of a completed systematic search. Before any claim of exhaustive prior-art coverage, run and archive searches in Crossref/OpenAlex, Google Scholar, Web of Science/Scopus where licensed, patents, institutional repositories and relevant standards catalogs. Record exact queries, dates and screening decisions.

[R1] Wang, H. et al. (2013). Graphene-like carbon nanosheets from hemp biomass for supercapacitor electrodes. ACS Nano 7(6), 5131–5141. DOI: 10.1021/nn400731g. Primary precedent for hemp-derived carbon nanosheets; not epoxy reinforcement.

[R2] Bartoli et al. (2022). Carbonized hemp-fibre fillers in epoxy composites (bibliographic details to verify before submission). Related morphology; not equivalent to nanosheets.

[R3] Graphene/graphene-oxide epoxy dispersion and interface literature — targeted search required. Do not assume any specific effect size.

[R4] ASTM D638 — Standard Test Method for Tensile Properties of Plastics (current edition to confirm). Candidate tensile method for appropriate neat and filled polymer specimens.

[R5] ASTM D790 — Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials. Candidate flexural method.

[R6] ASTM D5045 — Plane-Strain Fracture Toughness and Strain Energy Release Rate of Plastic Materials. Applicability/validity criteria must be met.

[R7] ASTM D3039/D3039M — Tensile Properties of Polymer Matrix Composite Materials. For appropriate fibre-reinforced geometry.

[R8] ISO 527 series — Plastics: determination of tensile properties. Alternative specimen-appropriate standard.

[R9] ISO 11357 series — Differential scanning calorimetry of plastics. Thermal transitions/cure analysis.

[R10] ISO 6721 series — Dynamic mechanical properties of plastics. DMA characterization.

[R11] Page, M.J. et al. (2021). PRISMA 2020 statement. BMJ 372:n71. DOI: 10.1136/bmj.n71. Transparent systematic-review reporting.

[R12] Rethlefsen, M.L. et al. (2021). PRISMA-S: extension for reporting literature searches. Systematic Reviews 10:39. DOI: 10.1186/s13643-020-01542-z. Search reproducibility.

[R13] ISO 14040 / ISO 14044 — Life cycle assessment principles, framework and requirements. Environmental comparisons and functional units.

[R14] Landry, M.-S. S. (2025). A Comparative Analysis of Hemp-Derived Carbon Nanosheets and Graphite-Derived Graphene as Reinforcing Agents in Synthetic and Bio-Epoxy Composites. Zenodo record 17201998; DOI 10.5281/zenodo.17201998 (verify record metadata). Programme-related proposal; not experimental validation.

[R15] Landry, M.-S. S. (2026). Hemp-Derived Graphene Oxide (HGO) & Reduced Graphene Oxide (HrGO) Research Framework. Zenodo record 21437852 (verify full metadata). Proposed conversion framework; validate nomenclature experimentally.

13. Final pre-execution checklist

- [ ] Host laboratory, named PI and safety approvals confirmed
- [ ] Material/resin identity and comparison groups frozen
- [ ] Literature search log completed for each WTF stage
- [ ] SOPs approved for nanosheet production, oxidation and reduction
- [ ] Sample IDs, blank forms and raw-data repository tested
- [ ] Primary endpoint, effect threshold, power and exclusions preregistered
- [ ] Equipment calibrated, randomization and batch structure documented

- [ ] Budget quotes and partner agreements signed
- [ ] Publication and IP terms agreed; AI assistance disclosed
- [ ] Independent replication pathway agreed

Final status: A complete proposal and data-collection system; no experiment has been run. The scientific claims, costs and schedule remain conditional on laboratory confirmation.