COIL COLLABORATIVE LEARNING ACTIVITY

From Coastal Problem to Circular Solution

A Sustainable Sargassum Treatment and Valorization Project

Universidad Autónoma de Querétaro (UAQ) • Perimeter College, Georgia State University

Intercultural, interdisciplinary teams | Chemistry & Biosystems

PROPOSAL

The Project Challenge

Massive sargassum arrivals affect coastal ecosystems, tourism, fisheries, public health, and local economies in Mexico and the United States. While sargassum may be a potential resource, safe use is limited by contaminants such as heavy metals and by the environmental impacts of collection, transport, storage, and processing.

In intercultural and interdisciplinary teams, students design a conceptual treatment and valorization proposal — grounded in scientific literature, chemistry principles, biosystems considerations, and the local realities of Mexico and the United States. No lab work required.

DRIVING QUESTION

How can we transform collected sargassum into a safer, potentially valuable material through a scientifically justified, environmentally responsible, and context-sensitive treatment process?

Each team's proposal must be evidence-based, not experimental.

TEAM STRUCTURE

Team Composition

1

UAQ Master's Student

Biosystems — scientific facilitator

5–6

CHEM 1151 Students

Perimeter College / Georgia State University

The UAQ Master's student guides the team in locating reliable literature, connecting the proposal to biosystems and sustainability principles, and evaluating feasibility — not as the sole person responsible for the project.

SUGGESTED ROLES

Team coordinator
Organizes meetings, deadlines, communication

Sargassum-context analyst
Explains the environmental, social, economic problem

Biosystems & sustainability analyst
Evaluates inputs, waste, scale, risks, logistics

Literature & evidence lead
Locates and organizes reliable sources

Chemistry process designer(s)
Develops the chemical pathway / reaction sequence

Product / application designer
Defines the final material and its intended use

PRESENTATION LEAD

Integrates slides, visual design, and oral presentation.

Every student contributes an identifiable part of the shared document and presentation.

PROPOSAL REQUIREMENTS

Five Required Project Components

01

Collection & Initial Handling

Where and how sargassum is collected, transported, stored, dried; local constraints in Mexico vs. U.S.

02

Pre-Treatment & Characterization

Washing, sorting, drying, grinding; identifying contaminants, especially heavy metals.

03

Treatment / Decontamination

Justify an approach to reduce, separate, or manage heavy metals; explain the chemical principle.

04

Chemical Process Pathway

Visual reaction scheme or separation cascade showing inputs, outputs, and waste streams.

05

Valorization & Feasibility

Select a realistic end use; weigh benefits, risks, and sustainability across both countries.

COMPONENT 01–02

Collection & Pre-Treatment

1 Collection & Initial Handling

- Where and how could sargassum be collected?
- What precautions are needed during transport, storage, and drying?
- What local constraints differ between Mexico and the United States?

2 Pre-Treatment & Characterization

- Washing, sorting, drying, grinding, or other conditioning steps
- Identify relevant contaminants, especially heavy metals

WHY IT MATTERS

Contaminant management is essential before selecting an end use — the treatment stage determines what the final material can safely become.

Teams should treat handling and pre-treatment decisions as the foundation the rest of the proposal builds on — collection method and drying conditions directly affect which contaminants persist and which treatment options remain viable downstream.

COMPONENT 03–04

Treatment Strategy & Chemical Pathway

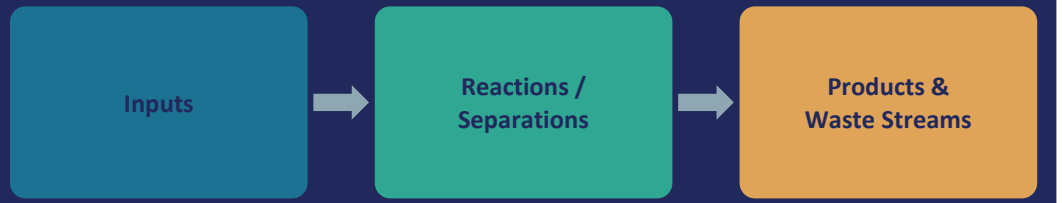
Treatment / Decontamination Strategy

Select and justify at least one approach for reducing, separating, immobilizing, or managing heavy metals — and explain the underlying chemical principle.

- Water washing
- Acid / alkaline washing
- Adsorption / biosorption
- Precipitation
- Ion exchange
- Thermal treatment

CHEMICAL PROCESS PATHWAY

CHEM 1151 students prepare a visual chemical route, reaction scheme, separation sequence, or process cascade for at least one key part of the treatment.



May include species, reactions, pH adjustments, adsorption mechanisms, thermal transformations, or purification steps — clearly indicating inputs, outputs, useful products, and waste streams.

COMPONENT 05

Valorization: Choosing an End Use

Select one realistic use for the treated material, and explain why it is safer and more feasible than the alternatives.

Biochar / Adsorbent

Pyrolysis-derived material for water or soil applications.

Compost / Soil Amendment

Only where safety conditions for heavy metals are met.

Construction Composite

Fiber or filler component in building materials.

Biopolymer-Related Material

Alginate or cellulose-derived polymer feedstock.

Energy-Related Precursor

Biomass feedstock for fuel or energy recovery.

Other Evidence-Based Product

Any additional use the team can justify with literature.

COMPONENT 05 (CONT.)

Feasibility, Risk & Sustainability

1. Compare potential benefits and limitations in Mexico and the United States

2. Address environmental risks, worker safety, waste management, cost or resource constraints, and product safety

3. Identify at least one limitation of the proposal

4. Identify one recommendation for future laboratory validation

PROJECT TIMELINE

Three-Week Sequence

WEEK 2

Problem Definition & Evidence Search

1

Understand the sargassum problem and define the design challenge.

WEEK 3

Process Design & Chemical Pathway

2

Transform the problem analysis into an evidence-based proposal.

WEEK 4

Presentation & Peer Exchange

3

Communicate and defend a feasible interdisciplinary solution.

Week 5 closes the project with an individual reflection and the COIL satisfaction survey.

WEEK 2

Problem Definition & Evidence Search

OBJECTIVE: Understand the sargassum problem and define the design challenge.

DURING THE SYNCHRONOUS SESSION

- Review the project challenge and assigned roles
- Discuss what teams know about sargassum in Mexico, the Caribbean, Florida, or other coastal areas
- Select a specific geographical context, or compare one Mexican and one U.S. context
- UAQ Master's student guides locating scientific literature and evaluating source reliability

ASYNCHRONOUS TEAM WORK

- Prepare a one-page Problem and Evidence Brief
- Identify at least 3 impacts of sargassum accumulation (environmental, social, health, economic)
- Identify relevant stakeholders (communities, governments, hotels, fisheries, researchers, industry)
- Locate at least 4 reliable sources, including 2 peer-reviewed or technical/institutional sources
- Select one potential final product or material to explore

DELIVERABLES

- One-page Problem and Evidence Brief
- Initial reference list
- Preliminary team process map with at least 3 proposed stages

INSTRUCTOR FEEDBACK FOCUS

Problem clarity, suitability of sources, scientific scope, and feasibility of the selected product idea.

WEEK 3

Process Design & Chemical Pathway

OBJECTIVE: Transform the problem analysis into an evidence-based treatment and valorization proposal.

DURING THE SYNCHRONOUS SESSION

- Teams share their preliminary treatment concept
- Instructors and peers give formative feedback on feasibility, safety, chemistry, and sustainability
- Teams identify missing information and revise their proposed pathway

ASYNCHRONOUS TEAM WORK

- Develop a detailed process flow diagram from collection to final product
- Design the chemical process pathway or treatment cascade for one critical stage
- Explain the scientific basis of the selected heavy-metal management strategy
- Compare at least 2 treatment alternatives and justify the team's selection
- Identify inputs, outputs, waste streams, energy needs, and safety precautions
- Draft the written proposal and prepare the digital presentation

DELIVERABLES

- Draft process flow diagram
- One chemical pathway, reaction scheme, separation sequence, or process cascade
- Draft proposal, approximately 2–3 pages

INSTRUCTOR FEEDBACK FOCUS

Chemical accuracy, clarity of treatment steps, connection between decontamination and final use, and realistic limitations.

WEEK 4

Presentation & Peer Exchange

OBJECTIVE: Communicate and defend a feasible interdisciplinary solution.

DURING THE SYNCHRONOUS SESSION

- Each team presents its proposal in 8–10 minutes
- Every team member participates orally, through narration, or a clearly identified contribution
- Each presentation is followed by 3–5 minutes of questions and peer feedback
- Students review at least 2 other team proposals, noting one strength and one question for each

ASYNCHRONOUS TEAM WORK

- Finalize the written proposal and presentation materials ahead of the session
- Prepare to defend design choices under peer and instructor questioning

DELIVERABLES

- Two- to three-page written proposal
- Process flow diagram
- Chemical pathway / reaction scheme / process cascade
- 8–10 minute presentation uploaded to Padlet, LMS, or shared class space
- Peer-feedback form for other teams

INSTRUCTOR FEEDBACK FOCUS

Overall coherence of the proposal, quality of the defense, and depth of peer engagement.

FINAL DELIVERABLE

Presentation Structure & Grading Rubric

SUGGESTED PRESENTATION STRUCTURE

1. Title, team members, and selected context
2. The sargassum problem: environmental and socio-economic impacts
3. Why contaminant / heavy-metal management matters
4. Proposed collection and pre-treatment steps
5. Treatment / decontamination process
6. Chemical pathway, reaction scheme, or separation cascade
7. Proposed product or material and intended use
8. Risks, limitations, and safety considerations
9. Comparison of relevance for Mexico and the United States
10. Conclusion and next steps for laboratory validation

GRADING RUBRIC

Problem analysis & use of reliable evidence	20%
Chemistry and process-pathway accuracy	25%
Feasibility of treatment and valorization proposal	20%
Sustainability, safety, and risk analysis	15%
Intercultural and interdisciplinary collaboration	10%
Clarity, visual communication, and quality of presentation	10%

WEEK 5 — CLOSURE

Individual Reflection & COIL Survey

Students complete an individual reflection and the COIL satisfaction survey, addressing:

- What they learned about sargassum
- Chemistry–biosystems connections
- Intercultural teamwork
- Digital collaboration
- Challenges of proposing a sustainable solution

This closing component aligns with the syllabus reflection and pre/post-survey activities.