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Workshop
Bio glue cooking

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1. Introduction

Glueing is a big part in many industries including woodworking. In production adhesives based on formaldehyde and other resins are frequently used. That results in VOC emissions - volatile organic compounds. Even though It is hard to change the process in production, for home restorations and small wood projects the bio glue can reduce VOC emissions. This workshop teaches students how to make simple bio-based glue using natural ingredients. Participants explore how eco-friendly adhesives reduce harmful chemicals and lower carbon emissions in the woodworking industry. By cooking and testing homemade glue, they learn practical ways to replace synthetic products and support sustainable, low-impact production methods.

1.1 Learning Objectives

- Understand what bio-based glue is and how it differs from synthetic adhesives.
- Learn about the environmental impact of traditional glues in woodworking.
- Discover how natural ingredients can create effective, safer glue alternatives.
- Test the homemade glue on wood samples to observe performance.
- Discuss how using bio glue can help reduce harmful emissions and support decarbonization in the woodworking industry.

1.2 Required Knowledge

No chemistry or technical skills needed

2. Workshop Structure

Table 1 Example of a workshop structure

Phase	Duration	Activities	Purpose	Materials
Opening	5-10 min	Welcome, introductions, icebreakers	Set tone and expectations	Name tags, agenda
Context Setting	15-30 min	Share objectives and relevance	Align participant expectations	Printed objectives
Main Content	60-70% of time	Core sessions with interactive elements	Deliver key learning	Presentation materials, worksheets
Wrap-up	5-10 min	Summary, reflection, next steps	Consolidate learning	Action plan templates

2.1 Workshop Agenda

Table 2 Example workshop agenda

Time	Activity	Format	Duration	Materials	Facilitator Notes
9:00-9:05	Welcome & Introductions	Group discussion	5 min	Name tags	Create welcoming atmosphere
9:05-9:25	Agenda Review	Presentation	20 min	Printed agenda, slides	Usage of glues in woodworking and the amount of CO2 produced. Key concept of bio glue.
9:25-10:00	Core Content	Interactive presentation	45 min	Slides, handouts	Cook the bio glue and apply it immediately to glue samples togethe
10:00-10:15	Wrap-up & Next Steps	Group discussion	15 min	Action templates	Applications of the bio glue, its advantages and disadvantages

2.2 Required Equipment

Table 3 Example of Required Equipment

Category	Item	Quantity	Purpose	Alternative Options
Technology	Projector/screen	1 set	Presentations	Large monitor, flip charts
Materials	Wood samples	3-5 pieces per participant - group	Group activities	Cardboard, chipboard
Supplies	Gelatine	1 portion	Group activities	-
Supplies	Water	3 portions	Group activities	-
Supplies	Heating equipment	1 per group	Group activities	Induction plates
Supplies	Markers/pens	1 per participant	Writing activities	Digital tools, tablets
Documentation	Handouts	1 set per person	Reference materials	Digital distribution

2.3 Evaluation Framework

Table 4 Example for Workshop Evaluation

Evaluation Type	Timing	Method	Key Metrics	Follow-up Actions
Immediate	End of workshop	Feedback forms	Satisfaction, objective achievement	Immediate improvements
Short-term	1-2 weeks later	Email survey	Knowledge retention, initial application	Provide additional resources
Long-term	3-6 months later	Interview/survey	Behavior change, performance impact	Plan follow-up sessions

3. Detailed Explanation

Welcome & Introductions

The lecturer asks the participants about their knowledge of the reasons for decarbonization, introduces them to the problem of CO2 emissions and the part that takes automotive industry in it.

Slide 1 – The Earth is getting hotter

Today we're going to talk about something that affects the whole planet — carbon dioxide, or CO2. This is a gas that comes from things like cars, factories, and even buildings. When there's too much CO2 in the air, the Earth gets warmer. That's called climate change.

Slide 2 – What is CO2

Now let's talk about something very important — CO_2, or carbon dioxide.

You can't see it, you can't smell it, but it's all around us. It's a gas that gets into the air when we burn things like coal, gas, or oil — for example, when we drive cars or turn on lights in buildings that use fossil fuels.

And guess what? When there's too much CO_2 in the air, it traps heat from the sun — kind of like when you wear a winter coat on a sunny day. The heat stays inside, and the Earth gets warmer and warmer. That's what we call climate change.

And since we all live on this planet — we all care about what happens to it, right?

Questions:

Can you think of something in your house that might use energy and make CO_2? Maybe a light? A heater? A car?

Slide 3 – Buildings and CO2

Buildings might not seem like a big problem, but they actually use a lot of energy. We need electricity for lights, computers, TVs, refrigerators, and more. We also use energy to heat and cool buildings, so they stay comfortable. That energy often comes from burning fuel, which produces CO2. Even building a house or a school creates CO2 because of all the machines and materials involved. Think about all the houses, schools, stores, and offices in your neighborhood. Now imagine how much energy they all use every day! That's why making buildings smarter and more energy-efficient is an important step in helping our planet.

Questions:

What things in your classroom do you think use the most energy?"

Slide 4 – What is Decarbonization?

Let's talk about a big word: decarbonization. That simply means making less carbon dioxide. It's about changing the way we do things, so we create less CO2.

For buildings, it can mean using clean energy like solar power instead of electricity made from coal. It can also mean using better designs or materials that don't waste energy. When we use less fuel or make cleaner choices, we help the planet. That's what decarbonization is all about! Think of it like turning down the heat on a stove before something burns. The sooner we start, the better.

Questions:

Can you think of something you use that could be more eco-friendly?

Slide 5 – Why decarbonization matters?

Why is decarbonization important? Because it helps us protect the Earth. When we lower CO2 emissions, we reduce global warming, make the air cleaner, and keep nature healthier. It also helps people save money on energy bills and live more comfortably. Decarbonization is not just about big companies or governments. It's something we all can be part of. Even small changes can make a big difference when many people do them together. So, every action counts.

Questions:

If you could make one small change at home or at school to help reduce CO2, what would it be?

Agenda Review

Slide 6 - What Is Glue In Woodworking

Glue in woodworking is the adhesive that holds everything together, quite literally. It allows us to bond pieces of wood and wood-based products like plywood, particleboard, or MDF. Beyond furniture, glue is essential in flooring, cabinetry, veneers, and decorative finishes. Its role is to create strong joints without visible fasteners, ensuring both durability and aesthetics. Different types of glue are chosen depending on exposure

to moisture, load-bearing needs, or indoor versus outdoor use. In many ways, glue is the hidden backbone of wooden constructions, giving stability where mechanical joints alone may fail.

Questions:

Can you think of a woodworking project where glue might be more effective than nails or screws?

Slide 7 - Common Types of Glues

In woodworking, several synthetic glues dominate. **Urea-formaldehyde** is widely used in furniture and plywood because it's strong and affordable, but it has issues with formaldehyde emissions. **Phenol-formaldehyde** adhesives are darker and highly durable, making them suitable for outdoor and structural uses, such as laminated beams. **Polyurethane** glue is versatile, water-resistant, and bonds different materials, not just wood, which is why it's popular in repair work and high-performance applications. Each has its strengths, but also drawbacks tied to cost, health, or environmental impact.

Questions:

Which type of glue do you think is most common in the furniture you use at home?

Slide 8 - What is The Environmental impact

Traditional synthetic glues bring significant environmental concerns. Formaldehyde-based adhesives can release emissions into indoor air, posing long-term health risks. During production, these glues generate CO_2 and other greenhouse gases, contributing to climate change. Additionally, many adhesives emit volatile organic compounds (VOCs), which worsen indoor air quality. At the end of life, products bonded with synthetic glue are difficult to recycle, as the glue complicates separation of wood fibers. This makes sustainable disposal or reuse much harder. In short, while these adhesives support strong and reliable wood products, their hidden environmental footprint is substantial.

Questions:

Have you ever noticed the smell of "new furniture"? That odor often comes from VOCs—do you find it pleasant or concerning?

Slide 9 - What Is BIO-Glue?

Bio-glues represent an innovative alternative to conventional adhesives. They are produced wholly or partly from renewable raw materials such as soy protein, gelatin, starch, or tannins. The idea is to reduce dependence on fossil-based chemicals while keeping similar bonding properties. Bio-glues are not entirely new; some natural adhesives have been used historically, but modern versions aim for improved durability, lower emissions, and industrial-scale application. They open the door to more sustainable woodworking practices by using agricultural or natural by-products instead of petroleum-based chemicals.

Questions:

Which of these natural materials—soy, gelatine, starch, or tannin—surprises you the most as a potential glue ingredient?

Slide 10 - Advantages of bio-glues

Bio-glues bring multiple environmental and health-related benefits. They reduce the use of fossil resources, which lowers the overall carbon footprint. Many formulations are free from formaldehyde, or contain much lower amounts, which means better indoor air quality for homes and workplaces. Their reduced emission of VOCs also makes them safer for both workers and end-users. By improving air quality and minimizing hazardous substances, bio-glues directly contribute to healthier living environments. While they still need further optimization, these advantages already highlight their potential to replace traditional adhesives in specific applications.

Questions:

Do you think consumers would be willing to pay more for furniture if they knew it was made with healthier, bio-based glue?

Slide 11 - Limitations And Challenges

Despite their promise, bio-glues face several challenges. In many cases, they do not yet match the strength, water resistance, or long-term durability of synthetic adhesives. Production costs can also be higher, making them less attractive for large-scale industrial use. Scaling up requires new infrastructure and investment, which can be a barrier for manufacturers. Moreover, some bio-based production routes require energy-intensive processing or additional chemical modifiers, which can offset part of the environmental benefits. These limitations mean that, for now, bio-glues are often used in niche or experimental applications rather than mainstream mass production.

Questions:

What do you think is the biggest barrier to adopting bio-glues—performance, cost, or industry habits?

Slide 12 - Where Bio-Glue Can Be Used

Even with limitations, bio-glues already have promising areas of application. In woodworking projects such as furniture assembly, interior decorative panels, or small-scale craftwork, they can perform well. They are also suitable for repairs, where extreme durability may not be as critical. By choosing bio-glue in these contexts, makers and consumers can contribute to sustainability without sacrificing practicality. Over time, improvements in formulations may expand their role into larger construction or structural uses. For now, their best fit is in projects where health, sustainability, and moderate performance requirements align.

Questions:

Can you imagine a DIY or repair project in your own life where you'd consider trying bio-glue instead of traditional glue?

Core Content

Using the materials and supplies participants cook bio glue samples and use them until they run cold. The glue can be used to just connect samples, but also to construct some product (small house for example).

The casein glue recipe:

1. Pour about 100 mL milk into a 400 mL beaker. Add 15 mL of white vinegar (5% acetic acid).
2. Place the mixture on heat, stirring gently. Observe the mixture carefully and stop when mixture begins to boil and curds are seen floating. It is vital to avoid overheating the mixture, since the protein will eliminate the adhesive quality and the glue won't work. I over-heated my mixture the first time, and this happened to me. If the temperature exceeds 40 °C, the protein is be destroyed in the acidified milk solution.
3. Filter the mixture, using a folded piece of paper towel, into a glass container. The curds remain in the paper towel, while the liquid filtered through into the container. Discard the liquid filtrate, as the whey has limited adhesive qualities.
4. Scrape the curds from the paper towel into a small cup, and slowly add 1 tsp baking soda to the cup and stir with a wooden tool. Slowly add drops of water, stirring periodically, until the consistency of white glue is obtained.

Wrap-up & Next Steps

The lecturer tells about the applications of bio glue (or asks the participants for it)