



# **P000128, Bio-based Adhesives: Chemistry, Performance and Applications, 4.5 Hp**

## **Syllabus**

Finalized by: Finalized by: FUN, 2024-12-10, 2024-12-10

### **Level within study regulation:**

Third cycle

### **Grading scale:**

Pass / Failed

### **Course language:**

Swedish

### **Entry requirements:**

This is a course for doctoral students that are admitted at SLU or other university, with a background in material science, chemistry, and/or engineering.

### **Objectives:**

#### **Learning outcomes**

After this course, the student will:

1. Understand the existing theories of adhesion.
2. Gain fundamental knowledge about the different types of adhesives and distinguish between fossil-based and bio-based adhesives.
3. Become familiar with the relationship between chemical structure and properties in the development of novel adhesives.

4. Have a basic understanding of bio-adhesive solutions, their advantages and disadvantages, and key requirements/desired properties.
5. Have foundational knowledge of wood industry products, their manufacturing processes, and performance requirements, including paper and cardboard, and wood-based panels
6. Be able to synthesise and evaluate bio-adhesives for use in various wood industry products.
7. Be able to use various analytical techniques and characterise adhesives and evaluate their performance for development and optimisation purposes.
8. Be able to produce a wood panel type using bio-adhesives and conduct basic wood panel tests for development and optimisation, and be familiar with laboratory production and evaluation of particleboard, fibreboard, and plywood.

## **Content:**

### **Modules**

The course is organised into seven modules, divided into theoretical and practical components to provide a comprehensive understanding of bio-based adhesives.

### **Theoretical Modules**

#### Module 1: Introduction

- Overview of the field of bio-based adhesives, with a focus on developments in Sweden and Europe.
- Introduction to current challenges and opportunities in the wood products industry.

#### Module 2: Chemistry (Mandatory)

- Fundamental theories of adhesion and their application to bio-based adhesives.
- Classification of adhesives, including synthetic and bio-based alternatives.
- Exploration of bio-adhesives for various substrates such as wood, paper, and other natural materials.

#### Module 3: Performance (Mandatory)

- Key performance parameters of bio-adhesives, including bond strength, durability, and environmental resistance.
- Factors influencing adhesive performance, such as substrate type, curing conditions, and formulation.

#### Module 4: Applications (Mandatory)

- Industrial applications of bio-based adhesives in wood products and beyond.
- Overview of manufacturing processes, product requirements, and standards.
- Practical approaches to laboratory-scale manufacturing and evaluation of adhesive performance.

### **Practical Modules**

#### Module 5: Synthesis (Mandatory)

- Synthesis of bio-based adhesives using laboratory-scale techniques.
- Understanding the preparation and formulation of adhesives tailored to specific applications.

#### Module 6: Analysis (Mandatory)

- Spectral and thermal analysis of bio-based adhesives (e.g. FTIR spectroscopy, Thermogravimetric analysis (TGA) and Differential Scanning Calorimetry (DSC))
- Techniques for analysing adhesive properties, including viscosity, bond strength, and curing behaviour.
- Characterisation of adhesives to evaluate performance against industrial standards.

#### Module 7: Performance & Application (Mandatory)

- Laboratory manufacturing of wood-based panels using bio adhesives.
- Performance testing of wood panels, including mechanical tests and environmental durability assessments.

### **Modes of assessment:**

The course includes one assignment, which will be completed individually. The assignment involves writing a technical report. Reports can be submitted up to two weeks after the course ends. A pass/fail grading system will be used, and students that do not pass will have an opportunity to revise their work. Detailed instructions for the assignments are provided when the course is announced and the timing of each part is outlined in the course schedule.

- If a student has failed an examination, the examiner has the right to issue supplementary assignments. This applies if it is possible and there are grounds to do so.

- The examiner can provide an adapted assessment to students entitled to study support for students with disabilities following a decision by the university. Examiners may

also issue an adapted examination or provide an alternative way for the students to take the exam.

- If this syllabus is withdrawn, SLU may introduce transitional provisions for examining students admitted based on this syllabus and who have not yet passed the course.
- For the assessment of an independent project (degree project), the examiner may also allow a student to add supplemental information after the deadline for submission. Read more in the Education Planning and Administration Handbook.

### **Organisation:**

Department of Forest Biomaterials and Technology

## **Supplementary information**

### **Other information:**

- The right to participate in teaching and/or supervision only applies for the course instance the student was admitted to and registered on.
- If there are special reasons, students are entitled to participate in components with compulsory attendance when the course is given again. Read more in the Education Planning and Administration Handbook.