



*Internship offer, UMR ECOFOG (French Guiana): MASTER 2*

**Title: Development of natural protection methods, based on extracts of Guyanese species, to improve the durability and fire behavior of fibers used for the manufacture of fiberboards.**

**Supervisors:** Julie BOSSU (CNRS researcher, UMR EcoFoG); Daniela Carolina Florez Parra (CIRAD researcher, UMR EcoFoG); Yannick ESTEVEZ (CNRS research engineer, UMR EcoFoG), Kevin Candelier (CIRAD researcher, UR BLOWOOEB).

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**Context:** This internship is part of a broader research project, the project **PANTHER<sup>2</sup>Guyane** (**PAN**neaux **THE**rmiques issus de la valorisation des **R**essources bois **R**ésiduelles en **G**uyane), funded by the ANR (Agence Nationale de la Recherche). The aim of this project is to study the potential of a production chain for bio-insulators adapted to the extreme hygrothermal conditions of French Guiana, based on the use of local residual wood resources (industrial by-products, land clearing residues, etc.). Technically, the project is based on the hypothesis that the exceptional natural properties of tropical wood fibers can be used to develop high-performance products for sustainable building in tropical areas. By adapting a technique based on fiber felting, the research is directed towards the design and production of semi-rigid non-woven insulating panels, thick and light, with good thermal and mechanical properties, as well as good reaction to fire and biological attacks.

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**Description of the internship:** Within this framework, a key task concerns the development of treatment solutions and the incorporation of natural additives to improve (i) the durability of the panels against biological attacks (termites, fungi) and (ii) the resistance and fire behavior of the fibers used to shape the panels. Recent works carried out in the laboratory have already identified two resources of interest for such application:

- **wacapou** (*Vouacapoua americana*), for the antifungal and anti-termite activities of its extractives (secondary/specialized metabolites contained in the heartwood of these woods);
- tannins (phenolic compounds) contained in **wapa** and **acacia** species, that have shown interesting fire behavior.

It is now crucial to define which extraction, formulation and impregnation methods can be used to transfer the activities of interest of these wood species to treated fibers intended for the manufacture of insulating fiberboards.

**Objectives of the internship:** The objective of the internship is to study the nature and the antifungal, anti-termite and fire-retardant activities of the extractive's fractions from the three wood species mentioned above, and to develop several experimental methods for the extraction and



transfer (impregnation, fixation, etc.) of these molecules of interest into the fibers that will be used for the manufacture of insulation fiberboards. A key issue will be the identification of the target experimental factors (related to extraction, solution formulation and fiber modification processes), which will influence the retention of the molecules (and their conferred activity potential) in the treated fibers, depending on the species to be valorized. Additive solutions (such as the addition of resins or the incorporation of other natural substances) could be considered to improve retention. At the end of the internship, the best technical route will be defined and the final formulation will be selected and used in the rest of the PANTHER<sup>2</sup>Guyane project.

#### **Main techniques and tasks planned:**

- Extraction techniques for natural substances, with the three pre-selected resources;
- Analytical techniques for the characterization of the chemical composition of the studied extractives (IR, HPLC...);
- Formulation of fiber protection treatments from the dry extracts;
- Development of rapid methods for the analysis of the properties of durability and fire behavior of treated fibers;
- Data processing and statistical analysis (Excel, R, etc.);
- Drafting of the final experimental protocol, retained for the continuation of the PANTHER<sup>2</sup>Guyane project;
- Valorization of the results obtained in the form of a scientific publication project.

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**Candidate profile:** Master student in 2<sup>nd</sup> year, with skills in wood science and/or natural substance chemistry, or process chemistry engineer. Knowledge of durability properties and fire behavior of wood would be a plus.

**Duration:** 6 months from February-March 2023.

**Internship locations:** French Guiana (6 months): UMR EcoFoG, Wood Science Lab (Kourou) / Amazonian Natural Substances Lab (Cayenne). Housing option available on the agronomic campus of Kourou.

**Remuneration:** According to current standards

**Possibility of evolution following the internship:** potentially (funding requests in progress), a thesis on the diversity of biocidal activities of Guyanese wood extracts could be proposed to the student, following the internship.

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#### **To apply:**

Send your CV and cover letter to the following email address: [julie.bossu@cnrs.fr](mailto:julie.bossu@cnrs.fr)

Applications are opened until the 15<sup>th</sup> of December 2022.