DAIKA Wood – Upcycling Wood Waste Streams into New Products

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1. SUMMARY DAIKA Wood

DAIKA Wood has developed a new material which is 100% natural. The material is composed from natural materials (no plastics or petroleum-based materials) and wood waste in a low energy no-waste streams process. While utilizing existing industrial mass-manufacturing processes such as extrusion and compression molding, the resulting products retain the unique properties of wood such as warmth, sense and acoustics and can be further processed as natural timber. The material can be extruded, moulded or printed giving shape to many solutions that can replace naturally grown wood and plastic with a sustainable bio-based and affordable material to manufacture products such as wall panels, furniture, construction materials, automotive parts, packaging, etc. DAIKA Wood has enhanced and customisable properties: water absorption, fire retardancy, decay and pest and rot resistance against fungi and bacteria without compromising the material's 100% natural composition. The material is fully recyclable.

DAIKA Wood is solving two main challenges:

a. Utilization of the billions of tons of waste wood (agriculture, municipal and industrial) that are not currently being used in the spirit of a true circular economy.
b. Creating a new raw material for mass manufacturing of sustainable process (much lower temperatures and pressure while compared to injection molding and no waste process) products.

2. CHALLENGES

2.1. Wood Waste

Text Manufacturers of wood products such as sawmills, furniture, construction pieces, industrial supports, etc., produce approximately 250 Mt in the EU alone each year. This waste difficult/not possible (e.g., treated and contaminated wood) to recycle, generating a large volume of wood waste that must be disposed of with the least possible environmental impact. High logistic costs to effectively handle the wood waste and separate it from plastic waste, impacting the profitability of recycling companies and public authorities and the shared resources involved in the process. The organic waste is turned into GHG instead of being used as a raw material for manufacturing industries. In addition, municipalities spend a substantial share of their budget on disposing and treating biomass waste streams. On average, 21% of municipal solid waste consists of what is known as «Green waste» – trimmings of trees, shrubs, and garden wastes – produced within the city frequently and in high volumes.
It is estimated that up to 30% of this resource is not or badly recovered, much being used as biomass with few upcycling applications. Hence, environmental impact generated by the industry results in significant challenges to handle the transition towards an economy with net-zero greenhouse gas (GHG) emissions by 2050.

2.2. Wood-Like Materials

Many industries, i.e. furniture and construction industry use raw materials that are based on wood-like materials, such as MDF/OSB boards. These contain hazardous binders such as formaldehyde. At the same time, increasing regulations and consumer trends are moving industry towards natural wood products, which has raised prices of natural timber in recent years. This market trend and regulatory development towards products being 100% sustainable has left industry without a clear solution that is both cost-effective in mass manufacturing processes and allows unique high-end designs. This is where DAIKA Wood with its 100% natural material comes in.

3. MATERIAL PROPERTIES

The unique chemistry of our EU patented innovation acts in a synergetic effect while creating unique covalent and ionic bonds that results in physical properties of high mechanical strength and wood properties (acoustic, thermal, and preventing water absorption as well as fire retardancy). The chemistry does not involve **any** thermoplastics nor epoxys or hazardous binders (i.e., formaldehyde). The process requires significantly less energy than compared to WPCs and plastics (saving 15KW*h/month, into >€1,700 per product line).

The invention (***PCT (WO) 2019/135245***) concerns methods and formulations comprising wood chips/wood powder and plant-extracted, natural binders (cellulose nanocrystals – CNCs- and hemicellulose) for constructing wood products. DAIKA Wood can be shaped through cold injection moulding and extrusion, overcoming the limitations currently existing in other methods requiring high temperatures and pressures or wood-based processes which utilise hazardous materials. Since then, we have further optimised our innovation, creating a real synergetic chemistry with all-natural materials to form the unique chemical bonds while enabling the manufacturing process based on extrusion and compression moulding. Our process is low temperature, pressure, and energy (reducing CO2 emissions), contributing directly to different climate actions and regulatory frames as the green deal objectives or COP26 (end and reverse deforestation by 2030). Plus, our products promote recyclability and a circular economy.

4. PROCESSING AND MANUFACTURING

DAIKA Wood's innovative material composition constitutes a unique sustainable material (directly from nature, 100% biodegradable and recyclable), scalable, customisable (can be extruded, injected in a mould, coloured and texturized), cost-effective, and that does not require any elevated heating and pressures. It allows mass manufacturing of various wood products ranging from wall panels and furniture to consumer products and electronics, or for coating a surface (wood composite).

DAIKA Wood can make compression moulding/extrusion wood products from fibres, water and recycled wood that looks and feels like natural wood and are of superior quality and effectiveness. Can replace plastic based materials (i.e., consumer products) due to their properties, promoting wood recycling and avoiding the use of new plastic products.

The manufacturing process overcomes the limitations of natural wood and avoids the use of plastics or hazardous binders. Providing a green manufacturing process biodegradable to wood objects that may be a standalone manufacturing process or may be integrated into existing operations in the industry. Their natural compositions can also be used as materials to replace conventional wood-like objects while using only raw materials composed of wood and plant components. With the growing demand for green materials, this invention eliminates the chemical safety issues currently encountered with current industries such as construction, and furniture.

5. OUTLOOK

DAIKA Wood intends to exploit its innovation by producing original DAIKA Wood products that fulfil various ecolabelling and Environmental Technology Verification (ETV and others such as EPD and LCA) standards and all other required certificates (mechanical, fire retardancy and water absorption). DAIKA Wood will focus on molding products that form our current expertise and on productivity, cutting costs, ensuring lasting quality and building reputation together with design parterships such as Steelcase. Market entry will be via the furniture industry and design suppliers (architectures and designers).