

Ongoing R&D projects in COST member countries

January 2014



COST FP1303: Performance of bio-based building materials



- LNEC (National Laboratory for Civil Engineering) - http://www.lnec.pt/?set_language=en
- NOVA University of Lisbon, FCT , Dep. Civil Engineering - <http://www.dec.fct.unl.pt/en>
- Polytechnic Institute of Viseu, Dep. Wood Eng. - <http://www.ipv.pt/guide/>
- INIAV (National Institute for Agrarian and Veterinary Research) - <http://www.inrb.pt/>
- Univ. Aveiro, CESAM (Centre for Environmental and Marine Studies) - <http://www.cesam.ua.pt/>
- Univ. Coimbra, Center for Industrial Ecology - <http://www2.dem.uc.pt/CenterIndustrialEcology>
- University of Minho, Dep. Civil Engineering - <http://www.civil.uminho.pt/>
- University of Lisbon, IST (Instituto Superior Técnico), ICIST - https://fenix.tecnico.ulisboa.pt/investigacao/icist/?locale=en_EN



Contacts: Lina Nunes - linanunes@lnec.pt ; Grandão Lopes - glopes@lnec.pt

Title of the project (EU - FP7; 2011-2015) <http://www.biobuildproject.eu/>

High performance, economical and sustainable biocomposite building materials (**BioBuild**)

Objectives - To use biocomposite materials to reduce the embodied energy in building elements (panels for facades and internal partitions, wall claddings and ceiling elements) by at least 50% over current materials with no increase in cost.

*LNEC is responsible for the Work Package 6 - **Evaluation of Biocomposite System Performance**, carrying out the Definitive Testing of Full-Scale Tests*

Fundamental work ongoing or done - identified the normative documents applicable and the system characteristics and target properties; ignitability tests; reaction to fire tests (SBI); sound absorption tests; biodeterioration tests of raw materials and biocomposites.

SHR (The Netherlands) is also a partner and will be giving more details on this project tomorrow



Title of the project (FCT – national research funds ; 2013-2014)
Novel timber conservation method in old buildings (**ConservTimber**)

Objectives – Development of a dual treatment / consolidation strategy for moderately degraded timber elements.

Results

Henriques, DF, Nunes, L, Brito J (2013) Mechanical evaluation of timber conservation processes by bending tests. *Advanced Materials Research* 778: 612-619.

Henriques, DF, Brito J, Duarte, S, Nunes, L (2013) Consolidating preservative-treated wood: combined mechanical performance of boron and polymeric products in wood degraded by *Coniophora puteana*. *Journal of Cultural Heritage*. Online First.





Title of the project (Azores region research funds ; February 2014-2016)

Mechanical and durability characteristics of *Criptomeria japonica* grown in the Azores

Objectives – To characterize the azorean criptomeria strands (2 varieties) in terms of drywood and subterranean termite durability and mechanical characteristic for structural applications. Develop new products of higher value added.





Contact: Paulina Faria - mpr@fct.unl.pt

Topic: Influence of natural fibers and other natural products in lime based rendering and earth based plastering mortars and in elements for wall claddings

Vegetal and animal fibers , cork wastes, wastes from olive oil production and other agricultural wastes



- *Physico-mechanical characterization: dynamic modulus of elasticity, flexural and compressive strength, superficial hardness, adhesion to the wall, durability to salts attack, capillary water absorption, drying, thermal conductivity, microstructure, moisture adsorption*

- *Biological growth evaluation in natural exposure (and in lab condition)*



Projects:

- International: PIRATE - Provide Instructions and Resources for Assessment and Training in Earth Building, <http://pirate.greenbuildingtraining.eu/public/>
- National: Eco-structural wall (QREN nº 2011/021586)

Portugal

Polytechnic Institute of Viseu, Dep. Wood Eng. January 2014



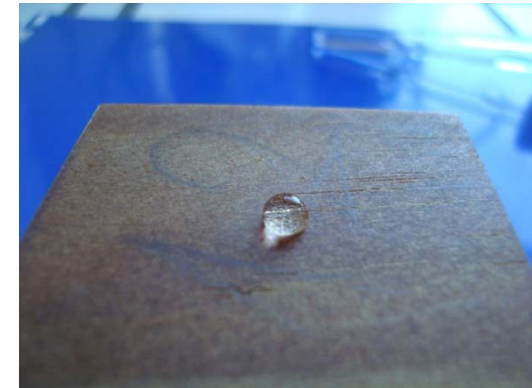
Contact: Bruno Esteves - bruno@demad.estv.ipv.pt



Heat treatment



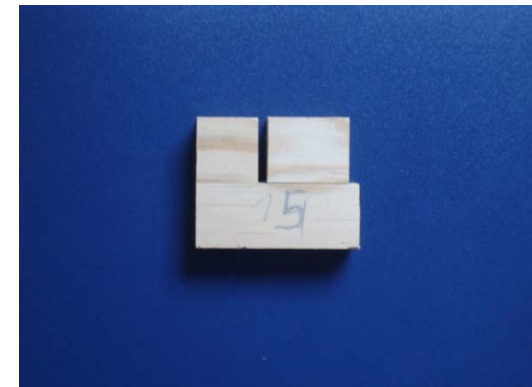
Furfurylation



Other wood
modifications



Chemical
Mechanical
Adhesion
Biodegradation
Gluing and finishing
LCA Studies



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Contacts: M. Carolina Varela - carolina.varela@iniav.pt; Miguel Pestana - miguel.pestana@iniav.pt

Projects/research:

- **Cork oak FAIR 202 provenance trials for cork quality evaluation.** The trials are an international network repeated under harmonized conditions in Portugal, France, Italy, Spain and Tunisia
- **Phenology in relation with cork quality.** The study runs complementary to the observation for the project “*Characterization of Reproductive Development of Quercus suber*” (national project)
- **Promotion of cork products.** Publications: *CORK Mark process* book and other related articles
- ***Development and production of hollow objects with natural materials including cork for innovative process based on rotacional molding.***

Aim - development and production of multifunctional parts by rotational moulding, using cork and other materials of natural origin as structural materials.

Main innovative feature: The use of cork and natural materials to produce hollow parts.

Partners: Robcork , SA (coordinator), Rotomoldagem, IST, INIAV



Main results include:

- Tests to floor tiles of agglomerated cork
- Tests to expansion joint fillers of composition cork
- Determination of dimensions and control of squareness and straightness of edges
- Determination of the effect of stains on resilient floor covering
- Determination of shear force on resilient floor covering
- Determination of dimensional stability and curling after exposure to heat on resilient floor covering
- Determination of flexibility on resilient floor covering
- Determination of seam strength of resilient floor covering
- Determination of compressive creep on thermal insulation cork products for building applications
- Determination of tensile strength perpendicular to faces on thermal insulation cork products for building applications
- Abrasion test to resilient floor covering



Contact: Ana Cláudia Dias – acdias@ua.pt; <http://www.cesam.ua.pt/acdias>

Topic of research: LCA/carbon footprint/water footprint of wood and cork. Carbon accumulation in forest products.

Ongoing project:

"Carbon footprint of cork: from trees to products" (<http://corkcarbon.web.ua.pt/>)

Some publications:

González-García S., Dias A.C., Arroja L. (2013) Life-cycle assessment of typical Portuguese cork oak woodlands. *Science of the Total Environment*. 452-453, 355-364.

Dias A.C., Arroja L. (2012) Environmental impacts of eucalypt and maritime pine wood production in Portugal. *Journal of Cleaner Production*. 37, 368-376.

Dias A.C., Louro M., Arroja L., Capela I. (2009) Comparison of methods for estimating carbon in harvested wood products. *Biomass and Bioenergy*. 33, 2, 213-222.

- Member of the Technical Committee of the Portuguese EPDs system for the building sector - DAPHabitat (<http://www.daphabitat.pt/>)



Contact: Fausto Freire – fausto.freire@dem.uc.pt

Topic of research: LCA/carbon footprint of wood-based panels

Main publications:

Garcia, R., Freire, F. (in press). “Carbon footprint of particleboard: a comparison between ISO/TS 14067, GHG Protocol, PAS 2050 and Climate Declaration”. Journal of Cleaner Production.

<http://dx.doi.org/10.1016/j.jclepro.2013.11.073>

Garcia, R., Freire, F. (2012). “Environmental assessment of wood-based panels: a comparison of life-cycle-based tools”. International Journal of Sustainable Construction, 1(1), 63-71.

Silva, D., Lahr, F., Garcia, R., Freire, F., Ometto, A. (2013). “Life cycle assessment of medium density particleboard (MDP) produced in Brazil”. International Journal of Life Cycle Assessment, 18 (7), 1404-1411.

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Portugal

Univ. Minho, Dep. Civil Engineering January 2014



Contact: Ricardo Mateus – ricardomateus@civil.uminho.pt

Topic of research: LCA/EPDs of bio-based products

- New masonry block for partition walls made of bio-based materials (cork), textile fibers from tire recycling processes and plaster from the flue gas desulfurization process of a power plant.
- Agglomerated cork board for construction.

Projects:

”SipdEco - Eco-efficient masonry block for partition walls”

“Modelling the life cycle of vernacular Portuguese buildings - contributes for the sustainability of buildings”

Main results:

Vasconcelos, G., et al. (2013). Proposal of an innovative solution for partition walls: mechanical, thermal and acoustic validation. Construction and Building Materials, 48, 961-979.

Patent: Masonry building system for partition walls, <http://www.google.com/patents/WO2011114301A2?cl=en>

- Member of the Technical Committee of the Portuguese EPDs system for the building sector - DAPHabitat (<http://www.daphabitat.pt/>)



COST FP1303: Performance of bio-based building materials



Contact: José Dinis Silvestre – jose.silvestre@ist.utl.pt

Topic of research: LCA/EPDs of bio-based products

- Wood plastic composite board for construction
- Agglomerated cork board for construction

Ongoing project:

"MARIE - Mediterranean Building Rethinking for Energy Efficiency Improvement" - Use of local renewable resources in buildings for energy renovation (insulating mortars with cork and ETICS with insulation cork boards) (2011-2014 - www.marie-medstrategic.eu/)

Main publications:

Silvestre, J. D., de Brito, J., Pinheiro, M. D. (2013) From the new European Standards to an environmental, energy and economic assessment of building assemblies from cradle-to-cradle (3E-C2C). Energy and Buildings, 64, 199-208.

Silvestre, J.D. (2012) Life-Cycle Assessment from Cradle to Cradle of Building Assemblies – Application to External Walls. PhD Thesis, IST, Lisbon

- Member of the Technical Committee of the Portuguese EPDs system for the building sector - DAPHabitat (<http://www.daphabitat.pt/>)



LNEC

- Preliminary ignitability test - fig. 1
- SBI test (reaction to fire) - fig. 2
- Thermal conductivity
- Soft and hard body impact test
- Dimensional stability
- Airborne sound insulation
- Sound absorption
- Air permeability, watertightness test
- Salt spray test
- QUV



Fig. 1



Fig. 2



NOVA University of Lisbon, FCT , Dep. Civil Engineering

- Natural Exposure Wallets Station, protected from rain and unprotected from rain, for natural exposure ageing
- Zeus equipment for dynamic modulus of elasticity determination
- Isomet Heat Transfer portable thermal conductivity equipment
- Micromeritics Autopore II equipment for porosity and pore size distribution determination by mercury intrusion
- NMR equipment for moisture transport determination





Polytechnic Institute of Viseu, Dep. Wood Engineering

- HPLC-MS
- GC-MS
- Atomic absorption spectrometer
- QUV
- Water baths
- Humidity controlled chamber
- Equipment for coating performance: chemical and water resistance; flexibility/ impact resistance; abrasion resistance; adhesion ; hardness; gloss

Specialist equipment

January 2014



| INSTITUTE | Properties | | | | | | Environmental | | | | |
|---------------------------------------|--------------------|-----------------------------|---------------------|------------------------------------|--------------------------|-----------------------|------------------------|------------------------|-----------------------|------------------|---|
| | Natural Durability | Moisture / sorption studies | Resistance to mould | Fire resistance / reaction to fire | Insect /termites / pests | Dimensional stability | Life Cycle Assessments | Whole Life evaluations | Product accreditation | Emission testing | Environmental Product Declaration (EPD) |
| LNEC | x | x | x | x | x | x | x | x | x | x | |
| NOVA Univ Lisbon | x | x | | | | x | x | x | | | |
| Polytechnic Institute of Viseu | | x | | | | x | x | x | | x | x |
| Univ Aveiro | | | | | | | x | x | | | x |
| Univ Coimbra | | | | | | | x | x | | | x |
| Univ Minho | | | | | | | x | x | | | x |
| Univ Lisbon, IST | | | | | | | x | x | | | x |

Specialist equipment

January 2014



| | Laboratory tests | | | | | | Field tests | | | | |
|--------------------------------|--------------------|------------------|-------------------------|-----------------------|------------------|-----------------------|-------------------------|-----------------------------|--------------------|--------------------------------|-----------------------|
| INSTITUTE | Natural Durability | Mould resistance | Insect /termite testing | Leaching / weathering | Sorption studies | Dimensional stability | In ground contact tests | Out of ground contact tests | Natural weathering | Surface performance / coatings | Moisture data logging |
| LNEC | x | x | x | x | x | x | x | x | x | x | x |
| NOVA Univ Lisbon | x | x | | x | x | x | | x | x | x | |
| Polytechnic Institute of Viseu | | | | x | x | x | | | | x | |