

2nd International Conference on Bio-Based Building Materials (ICBBM 2017)

RILEM Proceedings Pro 119

Clermont-Ferrand, France
21-23 June 2017

Editors:

**Sofiane Amziane
Mohammed Sonebi
Karine Charlet**

ISBN: 978-1-5108-9528-7

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2017) by RILEM Publications
All rights reserved.

Printed with permission by Curran Associates, Inc. (2020)

For permission requests, please contact RILEM Publications
at the address below.

RILEM Publications
4 avenue du Recteur Poincare
75016 Paris
France

Phone: +33 1 42 24 64 46
Fax: +33 9 70 29 51 20

dg@rilem.net

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

INTERNATIONAL CONFERENCE ON BIO-BASED BUILDING MATERIALS

Chp 1. Innovations in bio-based building materials

- Natural reinforcements	
Physical characterisation of hemp shiv: cell wall structure and porosity	23
Fibrous raw materials from an alternative supply chain for building products.....	30
The use of human hairs as a fiber-reinforcement in cement-based mortars.....	36
The compatibility between wool fibers and cementitious mortars	43
Use of natural fibres to enhance tensile strength of concrete	49
- Innovative admixtures	
Effect of guar gum derivatives combined with superplasticizers on properties of Portland cement-pastes	56
Incidence of the water-soluble compounds contained into lavender and sunflower bioaggregates on the hardening process of mineral binders	63
Beneficial reuse of refinery spent caustic solution in alkali-activated infrastructure materials	70
Effect of viscosity modifying agent on the mechanical and transport properties of hemp and rapeseed straw concrete.....	74
Effectiveness of starch ethers as rheology modifying admixture for cement based systems	82
Strength development of mortars using a magnesium silicate hydrate binder system under different curing conditions	87
Bio-based admixture for self-healing cement-based mortar	92
Properties of modified phosphogypsum binder	97
Properties of a new binder based on lime	104
- Material treatments	
Assessing a method of bamboo treatment and its effects on the durability and mechanical performance	113
Conventional and microwave-assisted thermal treatment of dendrocalamus asper bamboo	117
Physical and mechanical properties of rice straw treated with solution of potassium hydroxide from wood ash ..	121
Effect of linseed oil and metakaolin on the mechanical, thermal and transport properties of hemp-lime concrete	125
Hydrophobic sol-gel coatings on bio-based materials – influence of catalyst and solvent concentration	134
Effect of the use of autoclave on bio-construction materials.....	139
- Earth based materials	
Using alginate biopolymer to enhance the mechanical properties of earth-based materials	144
Mechanical enhancement of casted and compacted earth-based materials by sand, flax fiber and woven fabric of flax.....	149
An exploratory study on earthen materials stabilized by alkaline activator	155
Fire behavior of bio-based earth products for sustainable buildings.....	161
Mechanical and thermal performance of cob materials	167
Light earth performances for thermal insulation: application to earth-hemp	174
- Cementitious composites	
Typha bio-based aggregate mixed with natural clay to form composites: the compressive strength, the hygric performance and the fire reaction of composites are studied	182
Using alternative binders for the development of flax fibre reinforced mortars	189
Utilization of wood biomass ash (WBA) in the cement composites	197
Mechanical properties of hemp yarn impregnation in cementitious matrix	203
Compressive stress strain behavior of workable bio-concretes produced using bamboo, rice husk and wood shavings particles.....	212
Experimental investigation of cement mortar reinforced with natural fibers	224

- Other innovative materials

Superabsorbent biopolymers for mitigating autogenous shrinkage in cement-based materials	229
Supersulfated cements based on volcanic raw materials	234
Lime-hemp concrete (LHC) enhancement using magnesium based binders	239
Calcium sulfate: an alternative for environmentally friendly construction.....	247
Projection formed and precast hemp-lime: better by design?	253
Development of a bio-based plasterboard.....	261
The compressive strength of mycelium derived from a mushroom production process	266
Utilization of mine tailings as partial cement replacement	273
Light-weight claydite and sawdust concrete based on supersulphated cement	279
Fresh and rheological properties of 3D printing bio-cement-based materials.....	284
Commercial potential of bioresins and their success in thermosetting composites: an overview	292

Chp 2. Characterisation and modelling of the properties of bio-based building materials

- Mechanical characterization

Evaluation of shear strength parameters of bio-based concretes by means of triaxial compression.....	303
Straw bales for buildings: mechanical behaviour under compression	311
Mechanics of straw bales for building applications	317
Mixed-mode interfacial fracture toughness of wood and adhesives	325
Mechanical properties and durability of mortar with rice husk ash calcined at low temperature	330
Drying shrinkage and strength of GGBS and sawdust incorporated OPC mortar.....	335
Characterization of mechanical properties of hemp-clay composite.....	340
Experimental study of lateral load resistance of unclassified timber walls	349
Investigation on the performance and durability of treated hemp concrete with linseed oil	354
Synthesis and characterization of fly ash hybrid cements with limestone.....	363

- Acoustic properties

Evaluating and understanding the acoustical properties of biobased materials.....	368
Acoustic properties of lime/hemp concrete produced by compression molding	374
Influence of liquid water on thermal and acoustical properties of hemp concretes.....	381

- Hygrothermal behaviour

Experimental assessment of hygrothermal properties of clay – sunflower (<i>Helianthus Annuus</i>) and rape straw (<i>Brassica Napus</i>) bio-composites	387
The effect of cellulose nanocrystal (CNC) on the water permeability of early aged oil well cement	392
Assessment of a precast hemp concrete hygrothermal properties	397
Hygrothermal behaviour of a hemp concrete block, experimental and numerical results	405
Assessment of hygrothermal behaviour of an experimental timber-framed house	412
Hygric and thermal characterization of composites coupling recycled or raw bio-based materials and starch	420
Titora used as thermal insulation: properties and potential	427
Is hemp lime concrete a mix of hemp and lime?.....	433
Thermal insulation materials from renewable resources: thermal and hygric performances	443
Effect of water on the characteristics of polyethylene / flax fibers composites.....	451
Hygrothermal behavior of a date palm concrete	456
Hydrophobation of natural fibres for application in WPC materials.....	459
Extruded earth bricks: mechanical and hygrothermal properties, an anisotropic behaviour	463

- Durability

Development of a thermocompression manufacturing process adapted to flax-epoxy laminated composites	469
Durability of natural fibers reinforced calcium aluminate cement matrices	474
Experimental study of the effect of adding fan palm fibers on concrete durability exposed to severe environments	479
A multi-scale analysis of hemp-based insulation materials.....	485
3D printing of fibre cement-based materials: fresh and rheological performances	491
Investigation on the performance and durability of treated hemp concrete with water repellent.....	500
Investigation of mix composition hemp concrete on transport properties, mechanical properties and durability	509
- Life cycle assessment	
Carbon footprint of bamboo particles, rice husk and wood shavings-cement composites.....	519
Multi-objective optimization of bio-based thermal insulation materials in building modeling.....	527
Lime and hemp concrete LCA: a dynamic approach of GHG emissions and capture	533
- Innovative test methods	
Predicting freeze-thaw deterioration in wood-polymer composites.....	543
An assessment of the thermal storage capacity of hemp-lime using the transient performance ratio method	549
Correlations between pozzolanic evaluation methods, electrical conductivity and chemical shrinkage test.....	555

Chp 3. Applications of bio-based building materials

- Valorization of domestic wastes	
Reuse of polyethylene fibres from discarded fishing nets as reinforcement in gypsym-based materials.....	565
Utilisation of cement kiln dust for the activation of fly ash in low strength applications.....	569
Multicriteria analysis of hemp particles' impact on physical and thermo-mechanical performances of hemp concrete.....	574
- Valorization of recycled minerals	
Biochar as a carbon sequestering construction material in cementitious mortar	583
Biochar as a bond enhancement in fiber-reinforced mortar.....	589
Innovative uses of biochar as carbon sequestering building materials in wall plaster and pellets	595
Preliminary investigation on use of sewage sludge ash as partly cement replacement in lightweight aggregate concrete.....	601
- Valorization of agricultural by-products	
Cementitious material with bio-based recycled agricultural waste.....	609
A review of the use of sugarcane bagasse ash with a high LOI content to produce sustainable cement composites	617
Elaboration and physical characterization of an agro-material based on sugar beet pulp and potato starch.	626
New particleboards based on agricultural byproducts: physicochemical properties with different binders	633
Chemical and hygrothermal characterization of agro-resources' by-product as a possible raw building material	640
Systemic approach to reduce energy demand and CO2 emissions of processes that transform agroforestry waste into high added value products (REHAP)	649
- Case studies of recycling and insulating	
Phase Change Material cement-lime mortars for thermal retrofitting of facades	652
Bio-based plaster for improved indoor air quality.....	657
Monitoring and thermal characterization of flax shives for building thermal insulation.....	663
Sustainable insulation of historical wooden and stone buildings with lime-hemp	671
Removal of dissolved and particulate contaminants from aqueous solution using natural flax fibres	676

Designing and building a children's bamboo & hemp playground. 682
Industrial scale-up of bio-based insulating panel production. 691
Development of bio-based insulation materials for the improvement of thermal comfort of housing in Burkina Faso
..... 699

- Additional Paper

Mechanical Performance of Hemp Fibre Modified Mortar 219