ISOBIO – Highly insulating, Construction Materials from Bio-derived Aggregates

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Project Objectives

ISOBIO

Development of new approach to insulating materials through the novel combination of existing bio-derived aggregates with low embodied carbon with innovative binders to produce durable composite construction materials.

ISOBIO project targets

50% *reduction in embodied energy & CO_2 emissions*

15% *reduction in total cost*

20% *better insulation properties than conventional materials*

5% *Total energy reduction over the lifetime of a building*

Project Consortium

The ISOBIO project is coordinated by TWI Ltd .

The consortium is formed by 12 partners across 6 different European countries.

Approach

Challenges

- *Uptake of liquid water initiating the decomposition of bio-derived material via the latent bacteria and fungal spores present at the surface*
- *Protection of material against fire exposure and decay*

Solution

New protective treatment

- Durability
- Fire retardancy

Improvement of existing products

- Fibre insulation
- Hemp Lime
- Clay Board

Development of new products

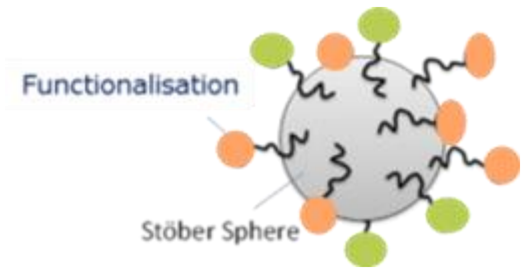
- Use of natural lignins to bind bio-aggregate

Main Outcome

- New uses for cellulose-based co/byproduct and waste stream materials: Panel system of primarily bio-derived composition suitable for use in modular construction
- Development of a silica based treatments containing no environmentally deleterious elements for bio-based materials to enable fire and decay resistance

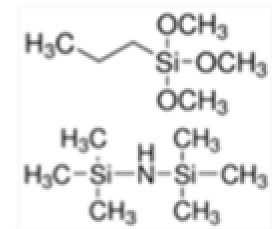
Technical Approach

Basic building block – silica nanoparticle



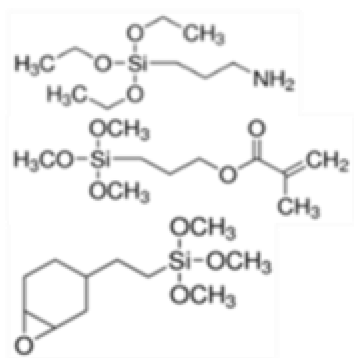
2 To provide hydrophobicity:

- N-propyl silane
- Hexamethyldisilazane



1 Compatibility with the substrate:

- Amino silane
- Methacrylate silane
- Epoxy silane



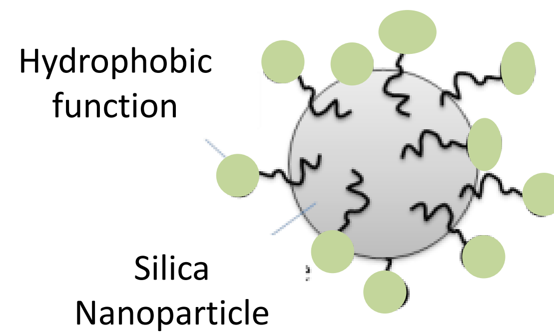
Retain desirable properties

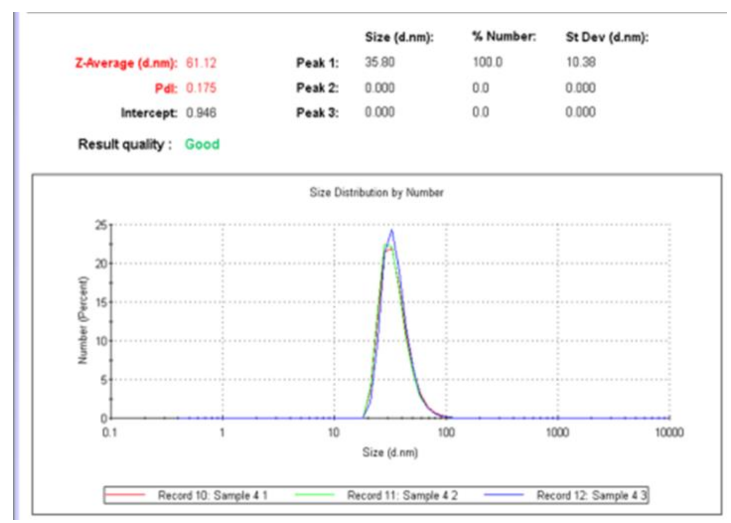
- Hygrothermal properties
- Moisture buffering
- Thermal insulation
- Specific heat capacity

Treatment development

Structural Unit – Mono Functionalised Silica Nanoparticles

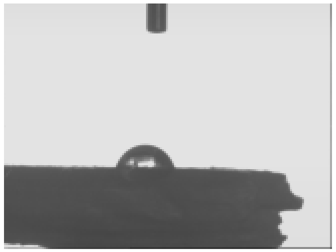
Appearance – Single phase, clear liquid with slight blue haze
Post fabrication pH: 7.7 – 8.2
Non-volatile content: 4.5%
Silica content of NV: 86%
Particle size (DLS Z_{ave}) = 61nm
WCA on glass substrate: 114°





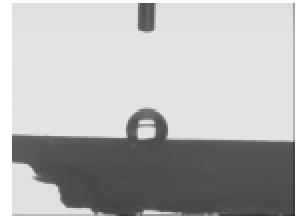
Early Results

Treated Hemp shiv by

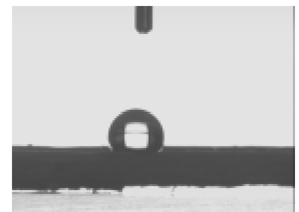


Untreated hemp shivs
WCA: 73.7^{o}

Increase ~45^{o}

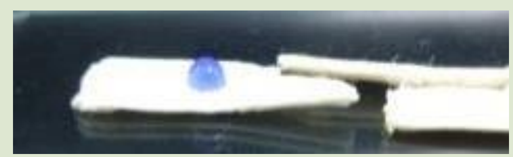


Dip coated hemp shivs
WCA: 119.1^{o}



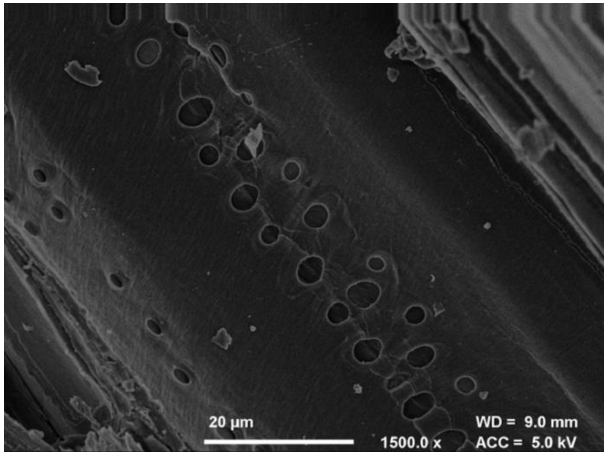
Spray coated hemp shivs
WCA: 114.6^{o}

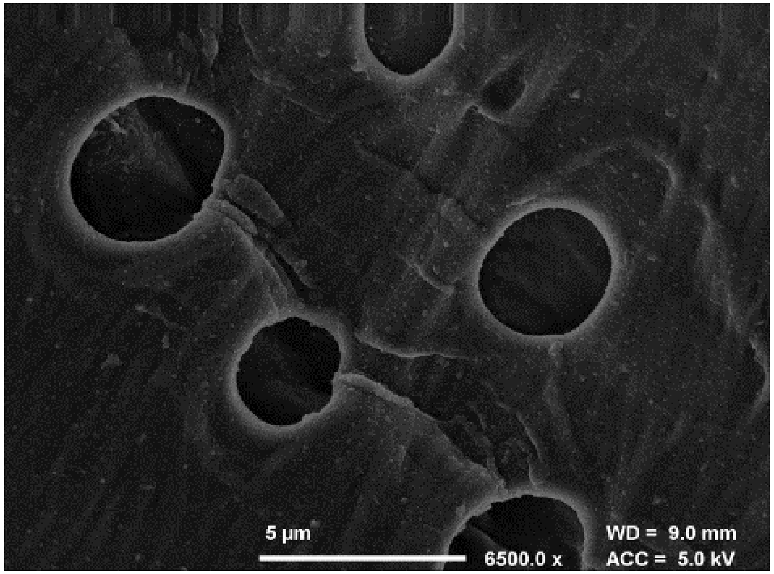
Stability

	Time 0	Time 2 hours
Dip coated hemp shivs		
Spray coated hemp shivs		

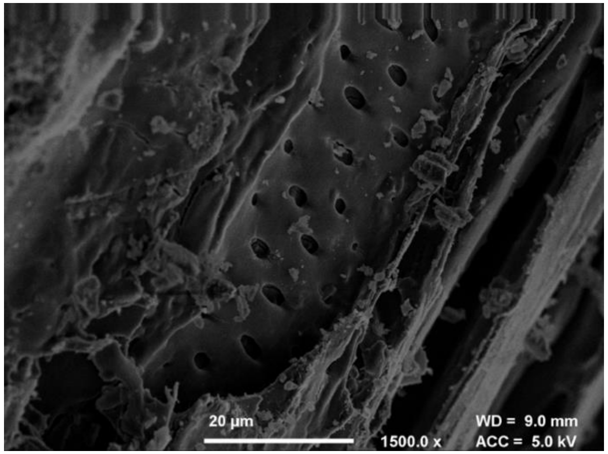
Early Results

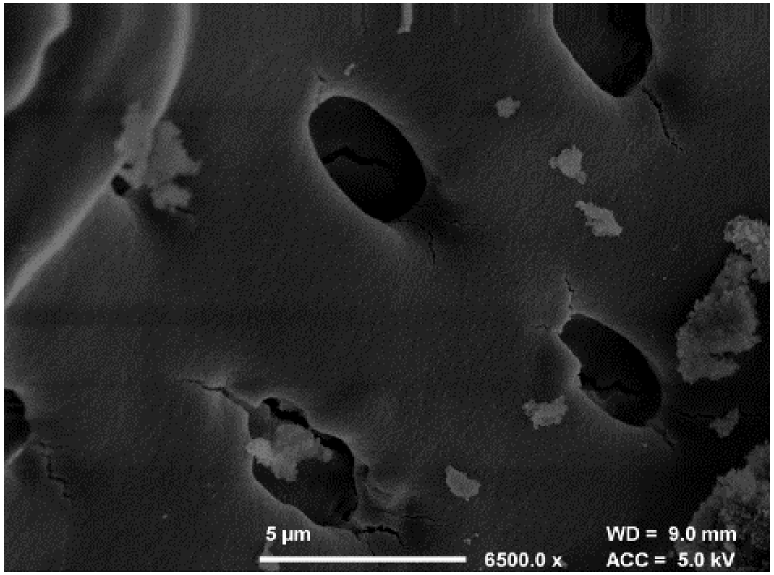
Untreated Hemp shiv





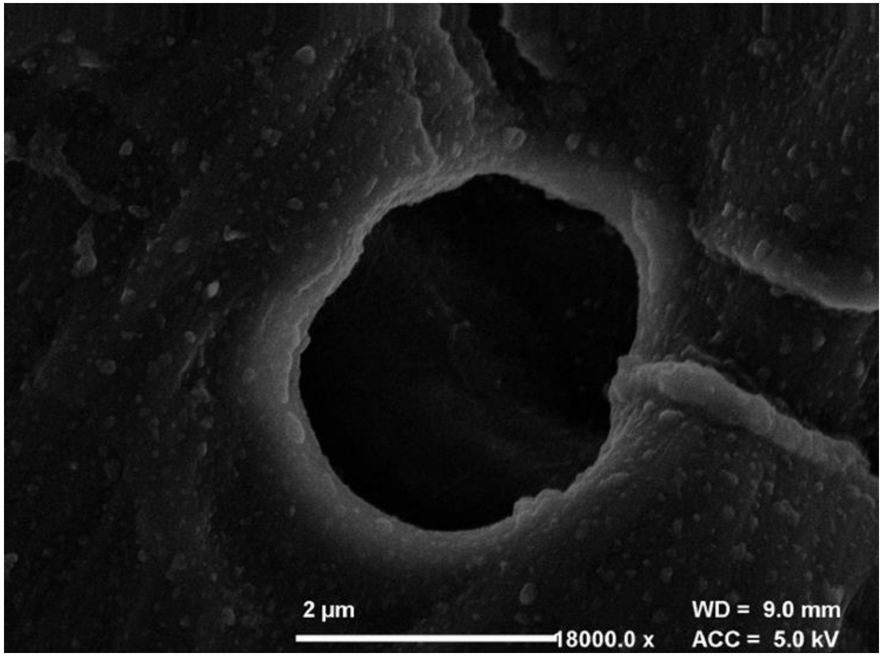
Treated Hemp shiv



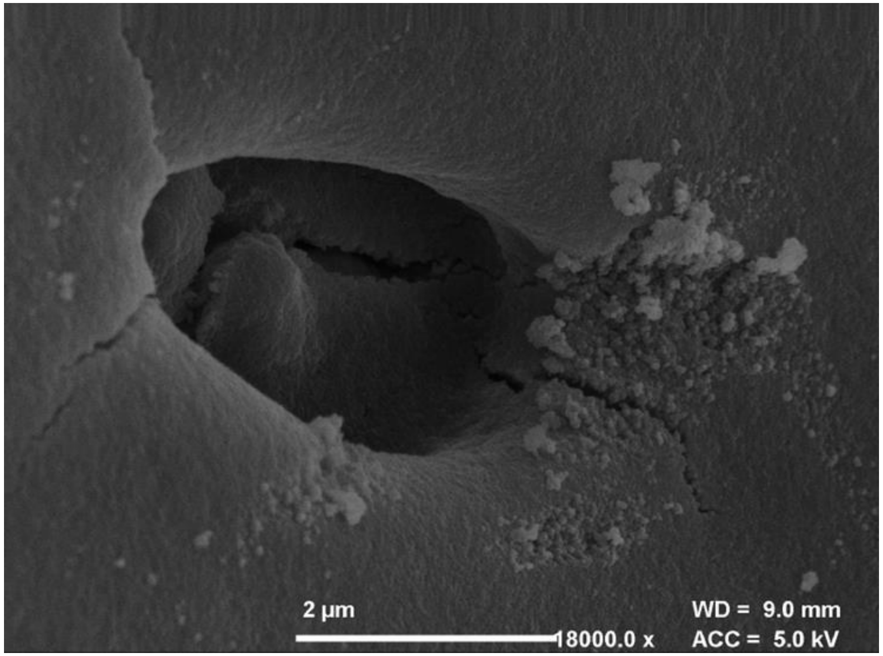


Early Results

Untreated Hemp shiv

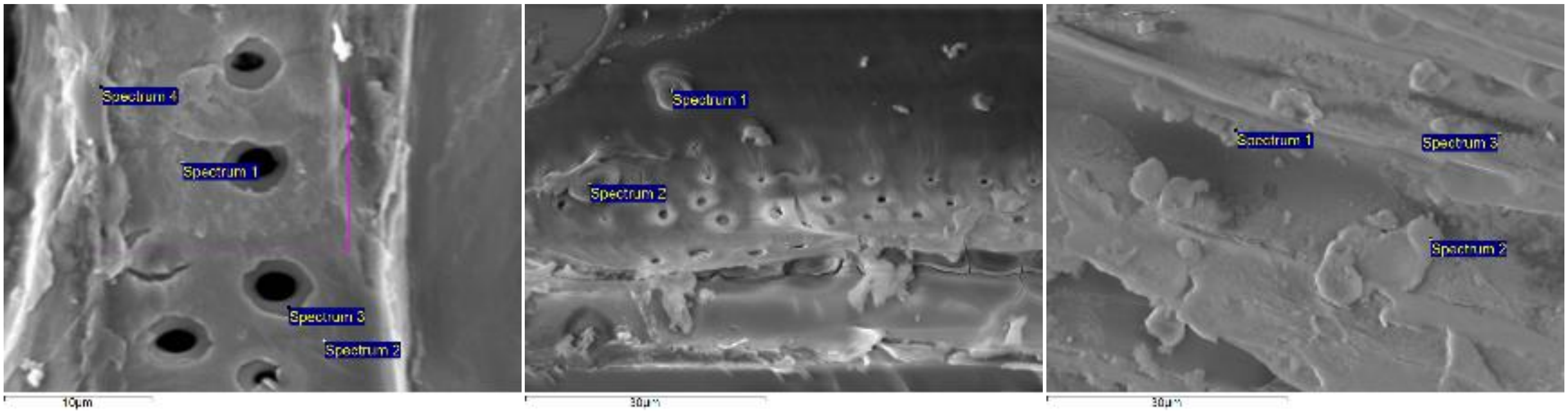


Treated Hemp shiv

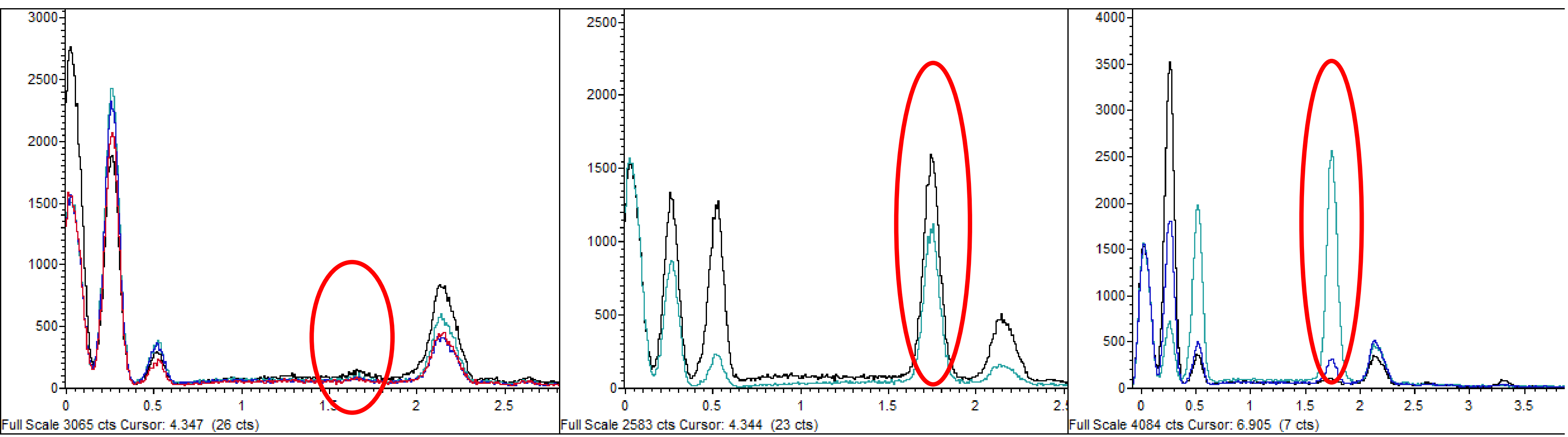


Early Results

SEM-EDX



Raw hemp shiv　　Dip coating　　Spray coating



Early Results

Use of natural lignins to bind bio-aggregate

Extraction process from Raw Material

- Investigation of different process to extract lignin from Straw material:
- Identification of potential supplier

Stramit – Lignin bound Straw

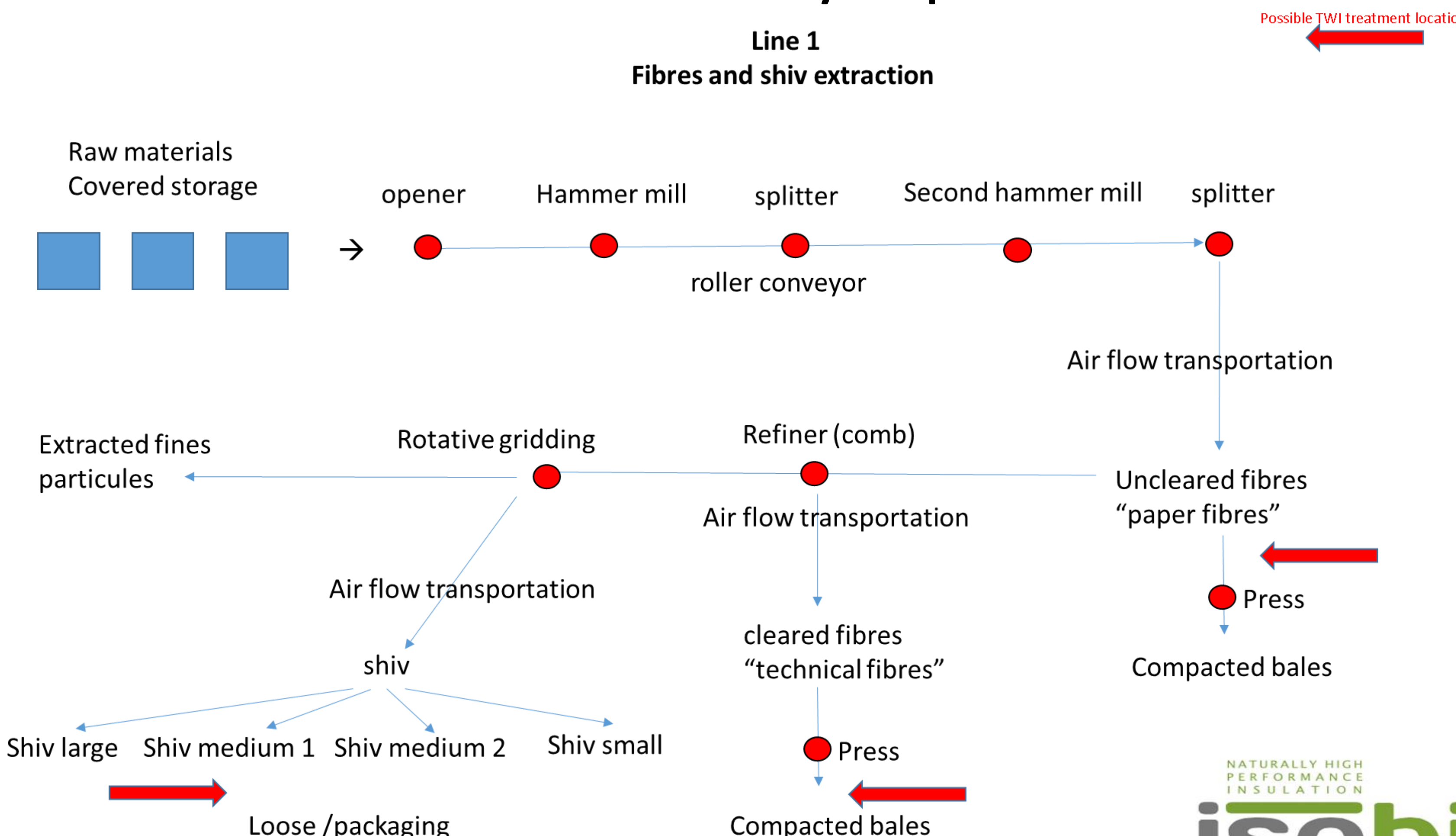
Binding Mechanism

- Condensation at high temperature
- Non soluble product
- Potential alteration of the hygric properties

Lignin bound Hem Shiv

Production synoptic

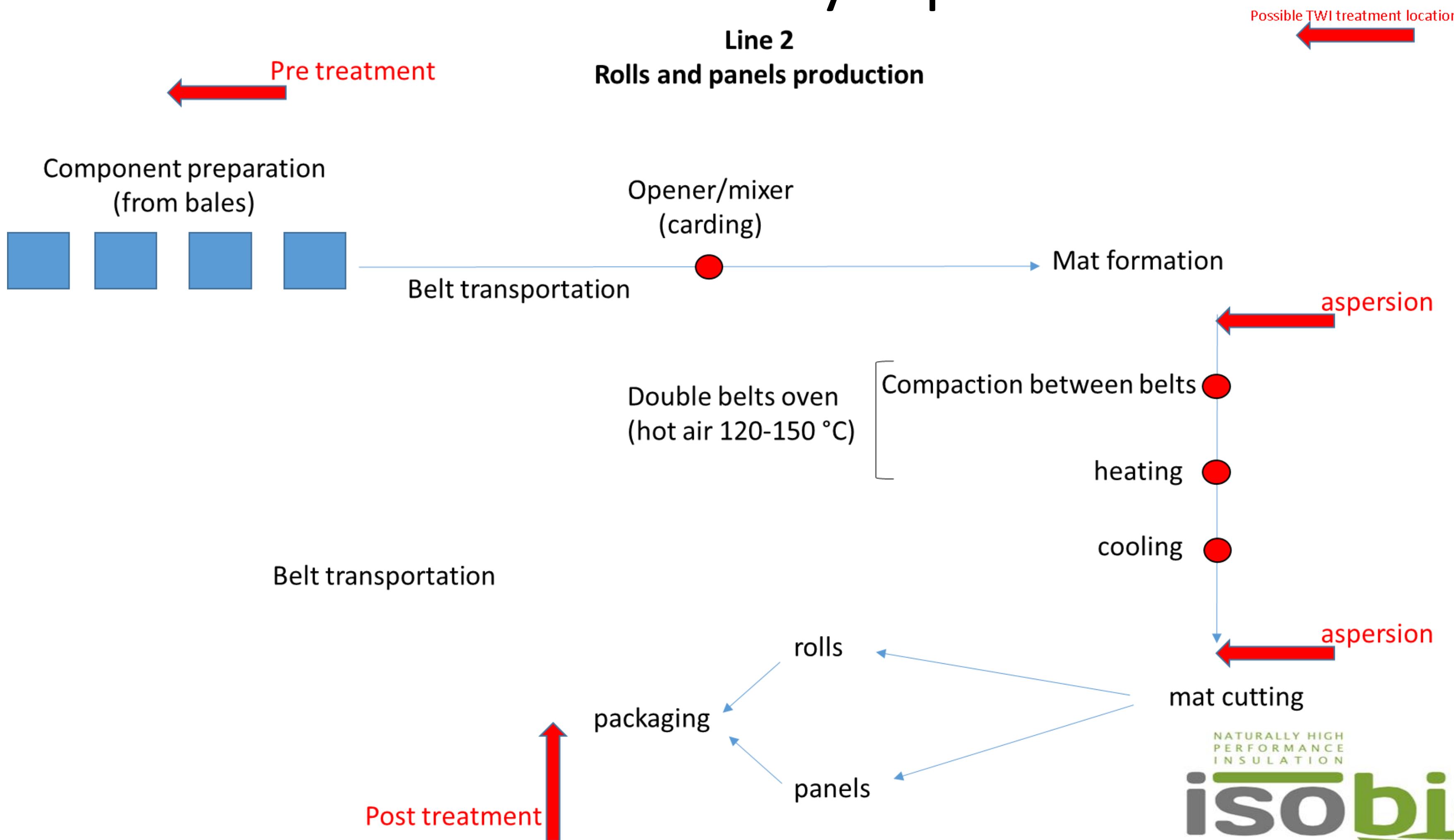
Line 1
Fibres and shiv extraction



Early Results

Production synoptic

Line 2
Rolls and panels production



ISOBIO Stakeholder Workshop

The experts of the ISOBIO project are pleased to invite you to a workshop on bio-based insulation materials

Science and technology solutions for bio-based insulation

4 February 2016

University of Rennes, France

The event, hosted by the University of Bath, will bring together the academic and research community, and will focus on the theme of 'science and technology' in bio-based insulation. The project partners will share their experiences, present the project's approach and the first year's results, as well as discuss and gather feedback on the innovative products under development.

The workshop will be held in English and is free of charge, but registration is required. To receive an invitation or for further details please contact Dr Helen Cornwell at the University of Bath, UK. Email H.Cornwell@bath.ac.uk

An agenda and further details will be circulated in January 2016.

We are looking forward to seeing you in Rennes!

NATURALLY HIGH PERFORMANCE INSULATION

Brindisi, December 3°, 2015

Thanks for your attention!

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