

Cement fibres composites - Organic fibres and their influence on cement

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Where innovation starts



1. Subject of research

1.1. wood board

- Used since 1920
- Spruce and poplar wood, OPC and additives

Wood Wool Cement Boards (WWCB)

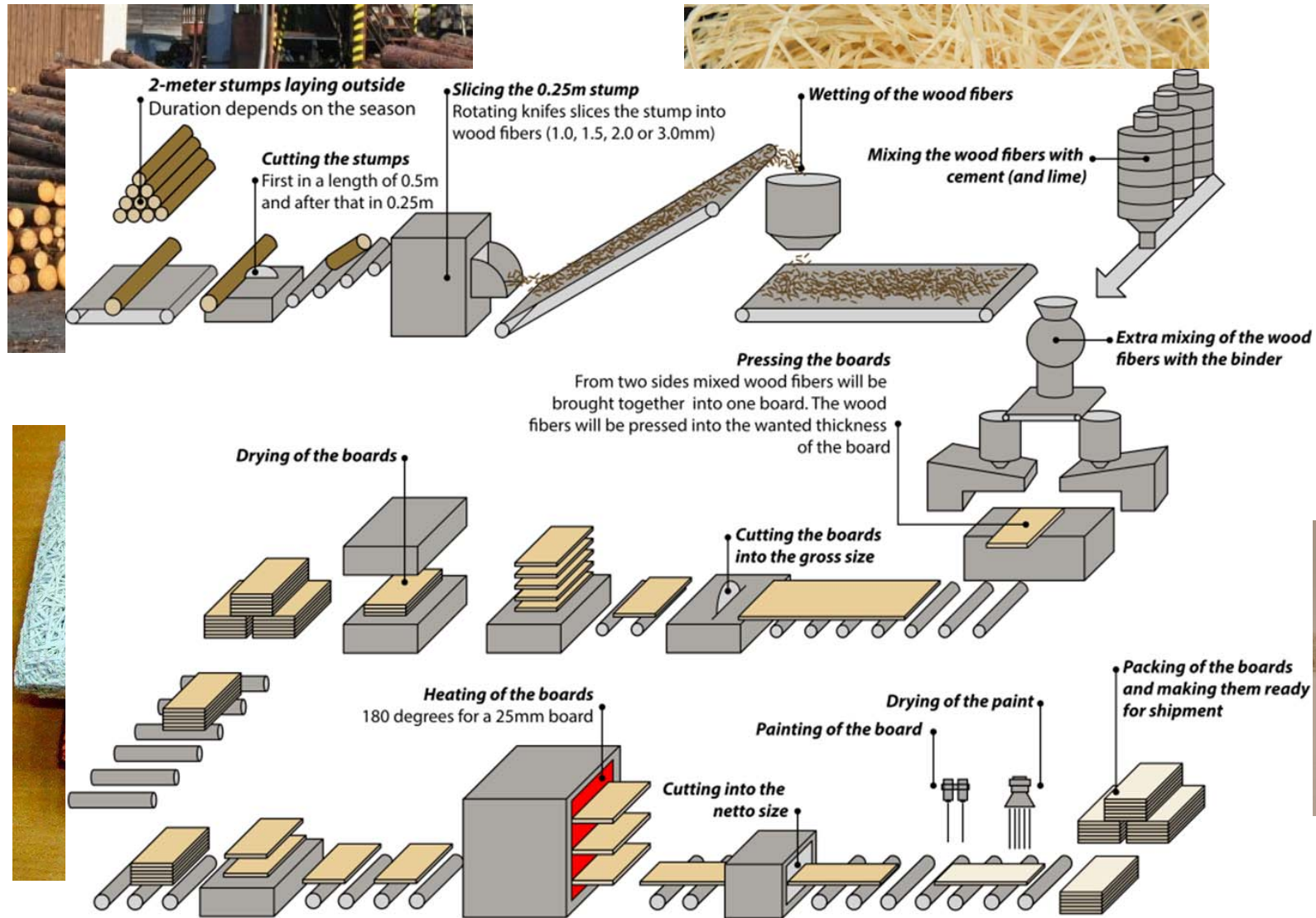


Wood Cement Bonded Boards (WCBB)



1. Subject of research

1.2. Wood board production



2. Motivation – advantages and challenges of recycled fibres

Organic waste fibres

- A growing trend for the use of biofibers
- Field of opportunity – huge amount of fibres non used

Fibres	Worldwide waste per year
<i>Cereal straw</i>	2 billion tons
<i>Rice straw</i>	673 million tons
<i>Oil palm</i>	50 million tons
<i>Coconut</i>	40 million tons
<i>Bagasse</i>	570 000 tons

Advantages

- Eco friendly – reduce waste and CO₂
- Easily processed – flexibility
- Availability
- Low cost

Challenges

- Knowledge gap
- Water absorption
- Sugar content – low strength



Green product



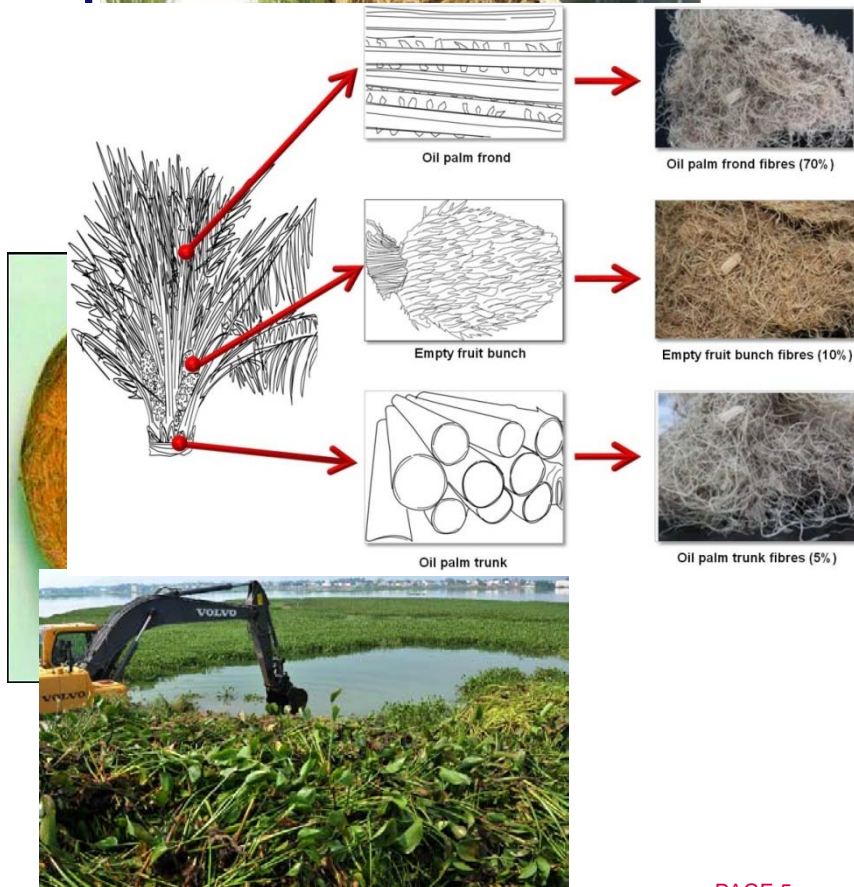
3. Overview of organic fibres

Organic fibres

European fibres

Non-European fibres

1. Hemp



3. Bagasse

- low density, no use, is burned

4. Coconut

- low density, durable

5. Oil palm (empty fruit bunch)

- from oil palm tree

6. Water hyacinth

- is a pest, grows rapidly on water

4. Research object

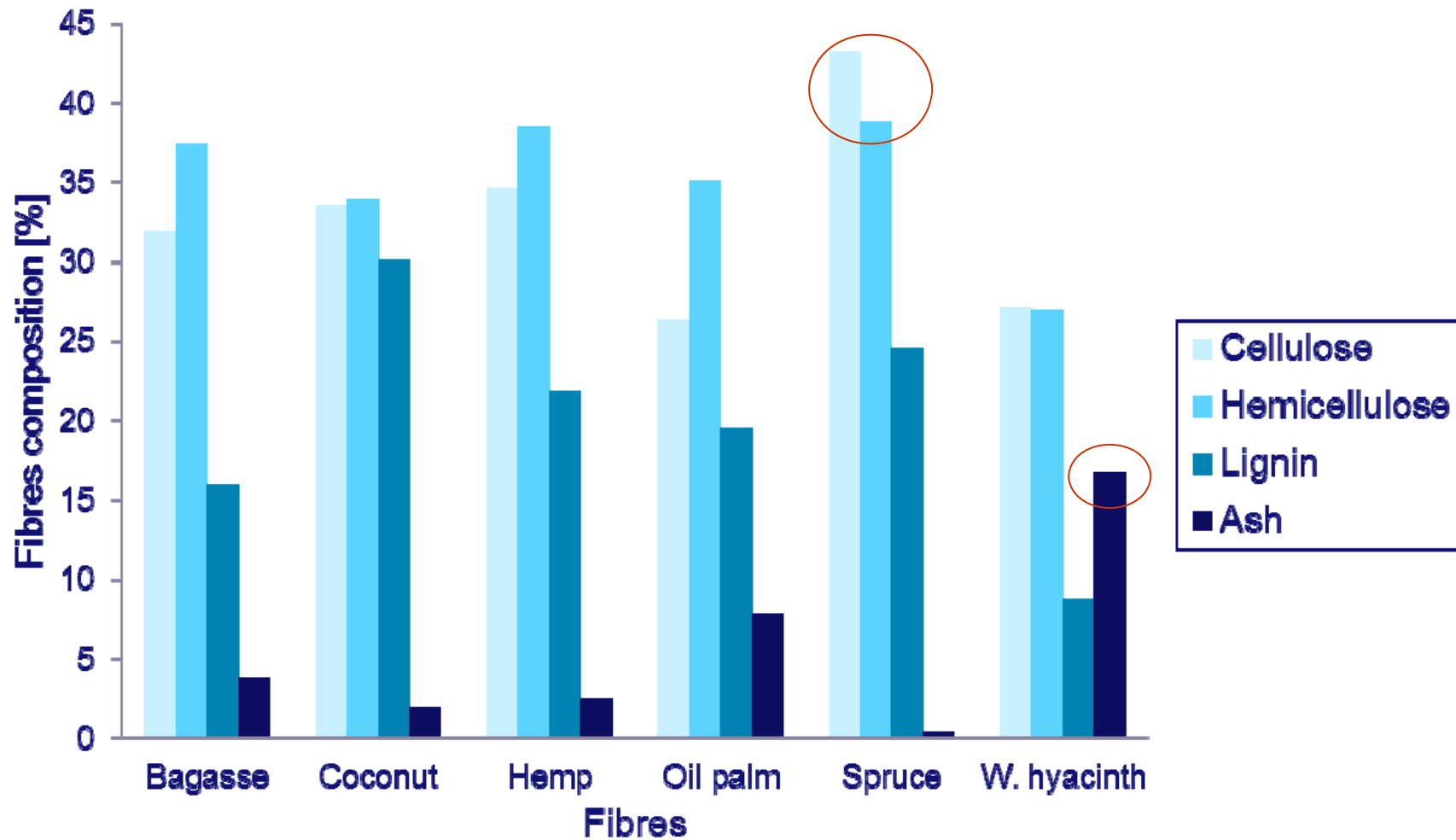
What are the characteristics of fibres?

- Chemical composition
- Leaching sugars and their influence on the cement hydration
 - Pure saccharides
 - Solution from boiled fibres
 - Fibres



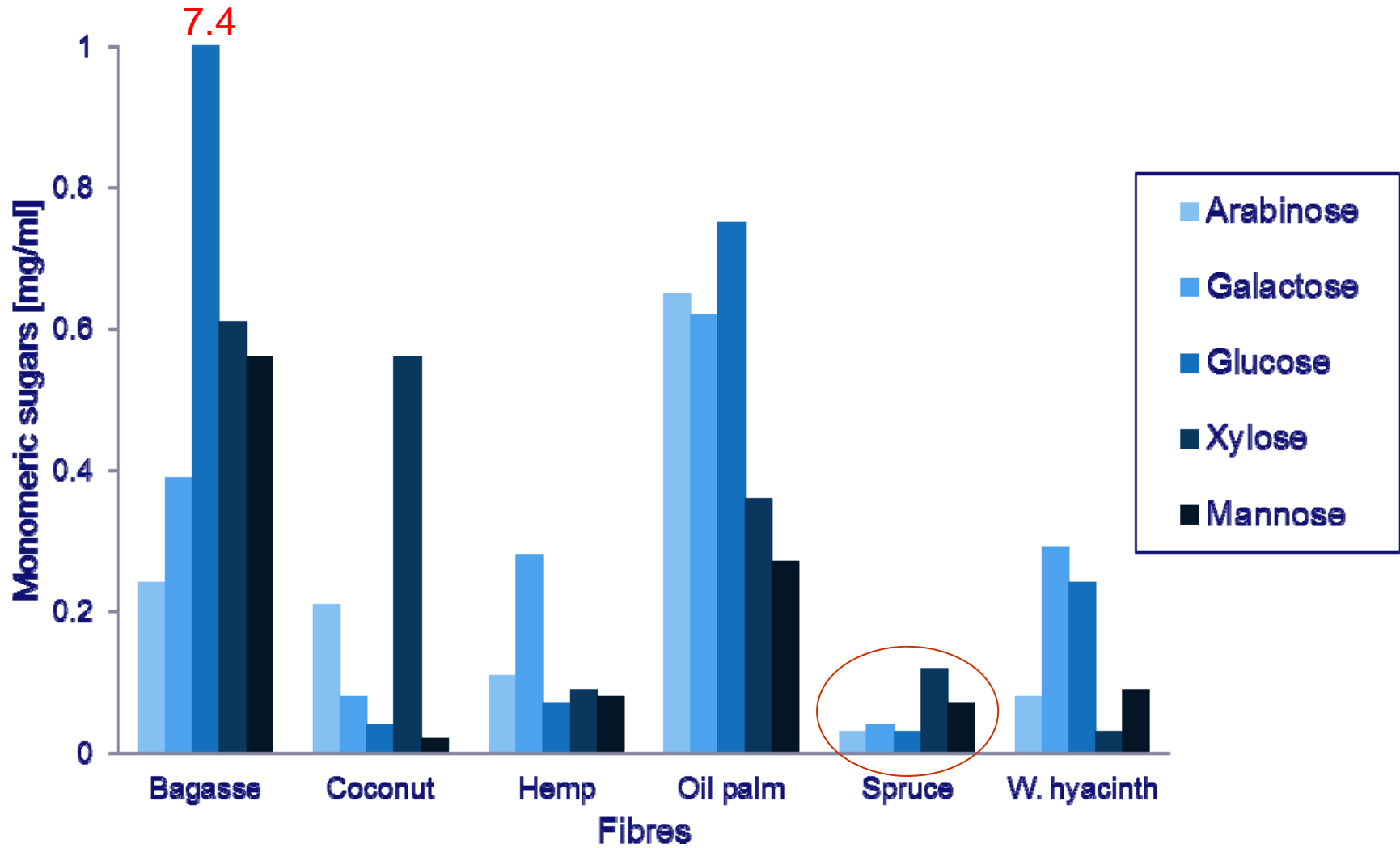
5. Results - Part I: Chemical composition

5.1. Fibres



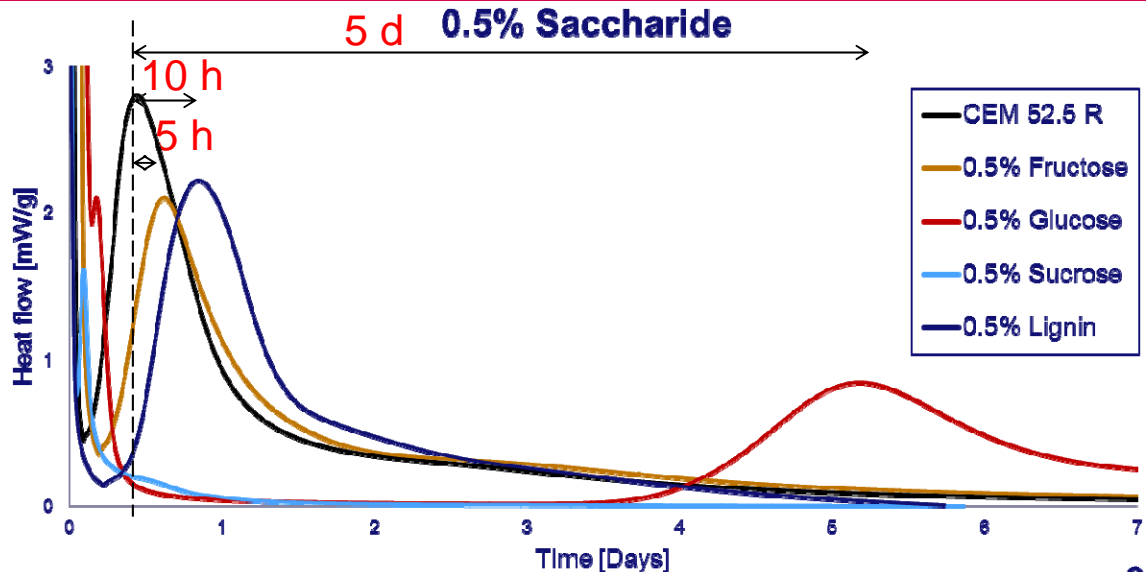
5. Results - Part I: Chemical composition

5.2. Monomeric sugars composition of leachates

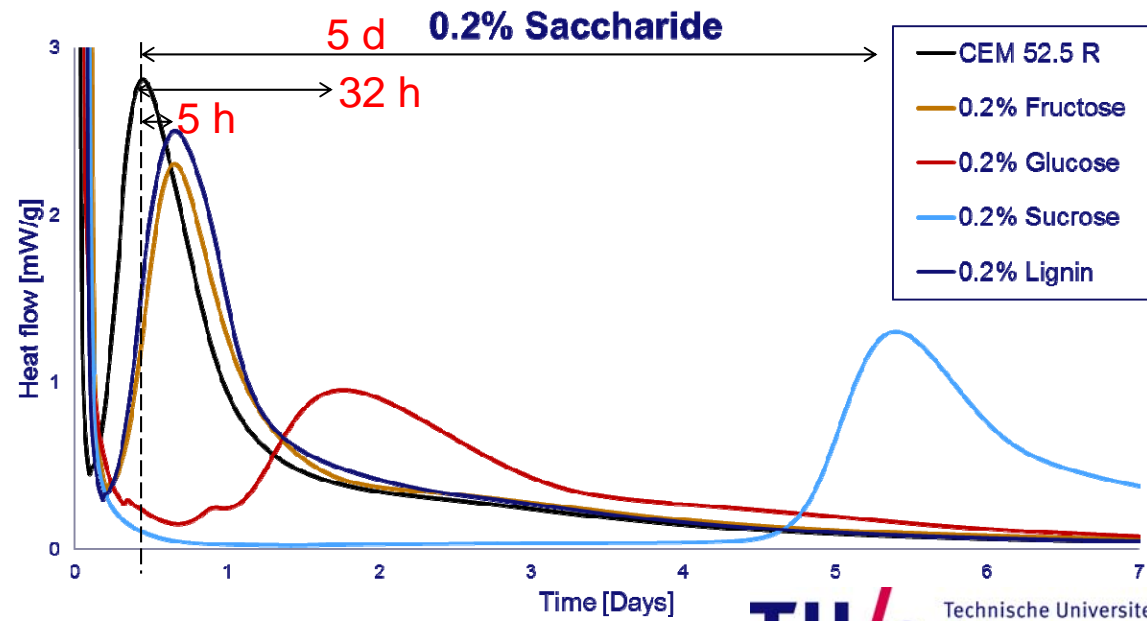


5. Results - Part II: Influence of cement hydration

5.1. Influence of saccharides on cement hydration



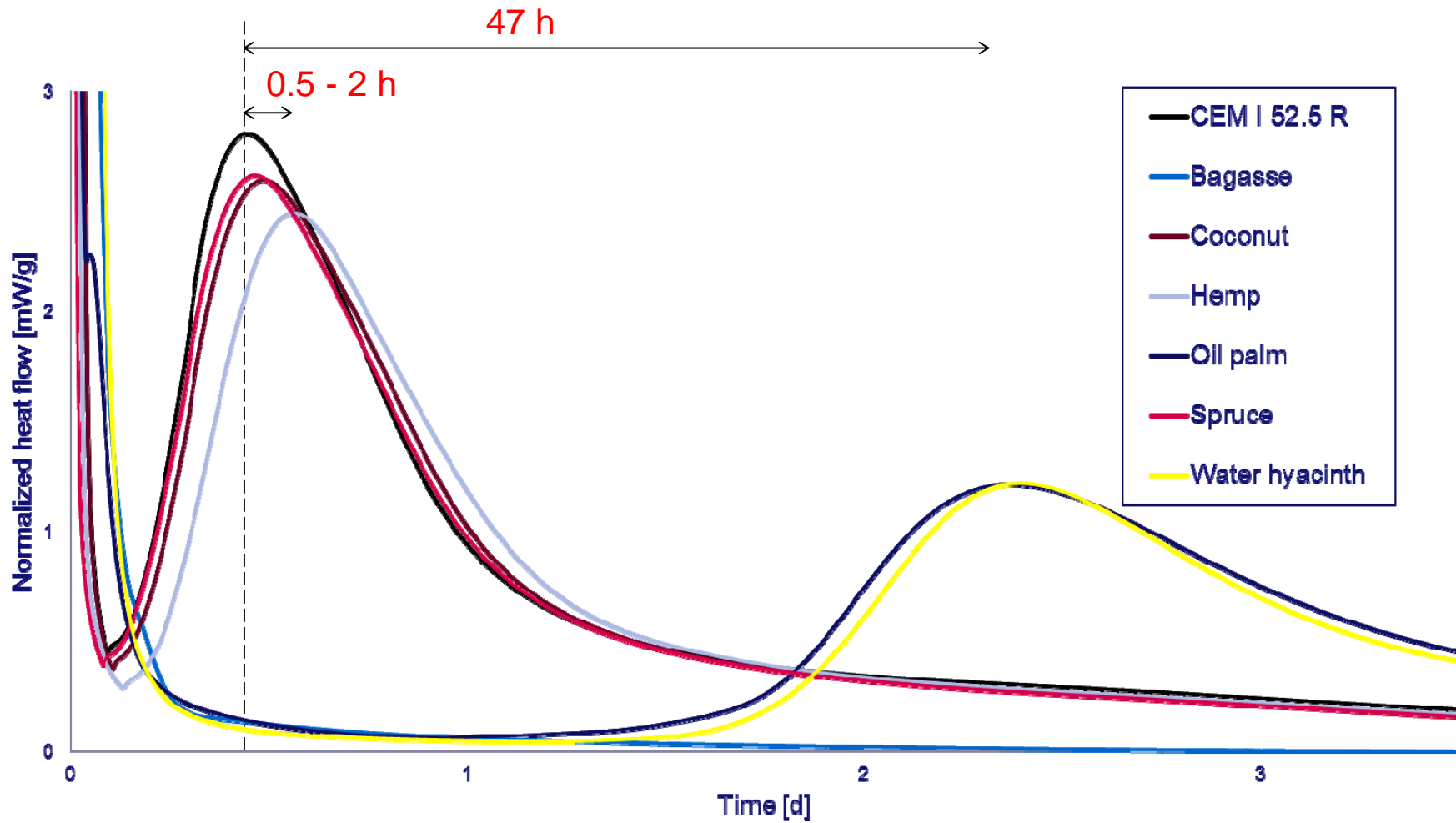
w/c=0.5



5. Results - Part II: Influence of cement hydration

5.2. Influence of solution from boiled fibres on cement hydration

w/c=0.5

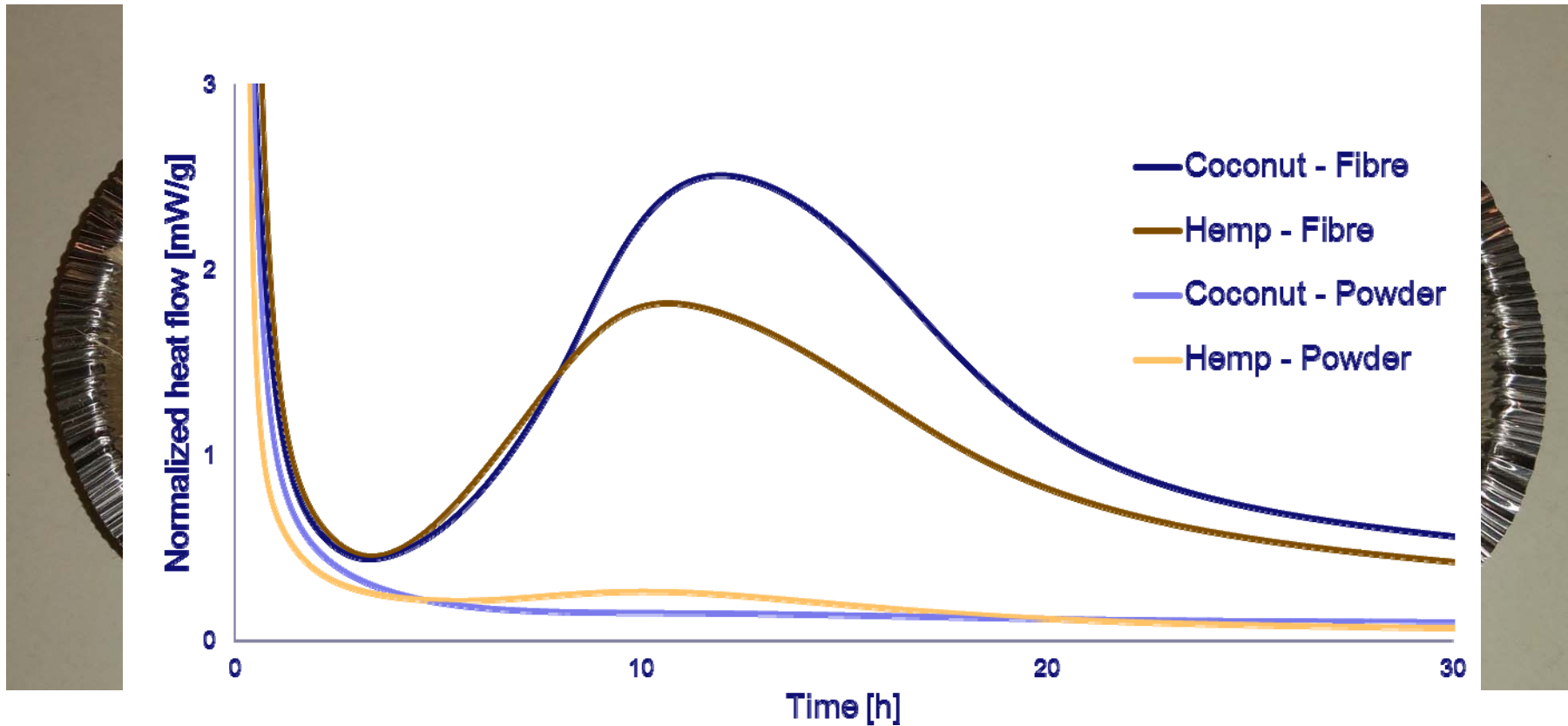


5. Results - Part II: Influence of cement hydration

5.3. Influence of fibres on cement hydration – difference between small and big fibers

$w/c=0.45$

$f/c=0.075$

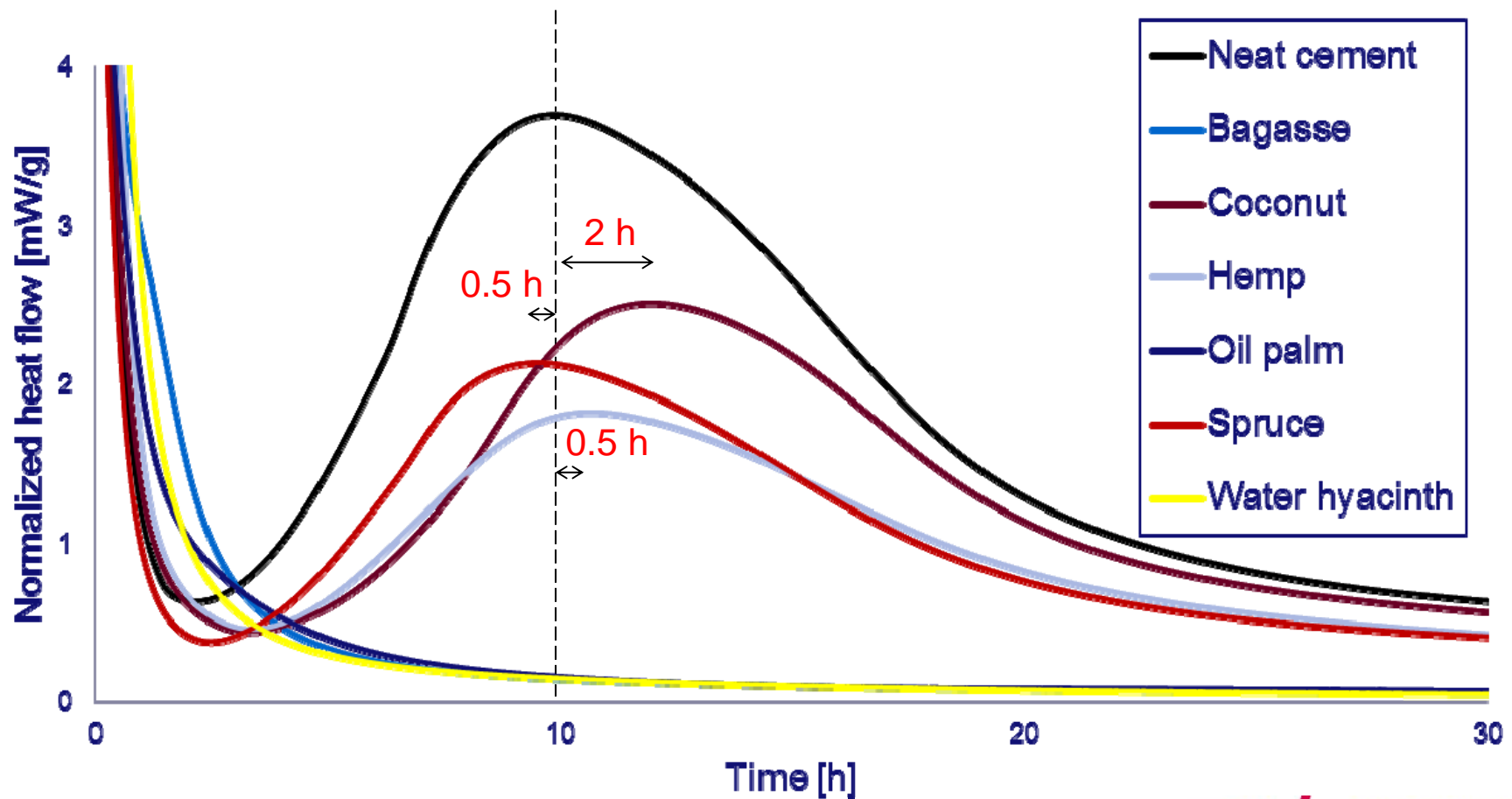


5. Results - Part II: Influence of cement hydration

5.3. Influence of fibres (size $\geq 10\text{mm}$) on cement hydration

$w/c=0.45$

$f/c=0.075$



6. Outlook

Natural fibres with pre-treatments

- What pre-treatment
- Mechanical properties
- Influence on cement hydration

Pre-treatment

- Hot and cold water
- Ca(OH)_2
- NaOH
- CaCl_2
- Na_2SiO_3

Thank you for your attention

Questions???

