

# Advanced wood-cement compatibility with nano mineral

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## • Wood cement products:

### • Advantages:

- stable against bio degradation,
- good fire resistance,
- no formaldehyde emission.



### • Disadvantages:

- longer pressing time (slow curing),
- high density (weight),
- not every species are suitable.

## • Cement compatibility:

- Hydration and so final strength of WCC is sensitive on wood extractives.
- Water dissolves water soluble chemicals of wood - some of these are inhibitors.
- Typical inhibitors: hemicelluloses, sugars, tannins

## • Sugar in wood cement system

- pH of cement is 9 - alkaline
- Hemicellulose dissolves to water soluble monosaccharides (Peeling reaction) in alkaline conditions.
- Broad leaves species has higher total amount of mono-, di- and polysaccharides than conifers, so these are less suitable for CB products.

## • Avoid or minimize inhibition:

- **Technological:**
  - Chose well felling time.
  - Store the logs for several months to decompose retardants.
  - Minimise moisture content of wood so minimise the amount of solved retardants. Optimal MC: 20-30%.
- **Chemical:**
  - By blocking the peeling reaction of hemicelluloses or
  - by destroying of decomposed products.

## • Using of conventional additives:

- Using additives (eg.  $MgCl_2$ ,  $CaCl_2$ ,  $Al_2(SO_4)_3$ ,  $Na_2SiO_2$ )
- the hydration of cement can be accelerated
- to avoid inhibition effect of sugars,
- and the hydration skin can be formed around it.
- Silica fume blocks the alkaline dissolve of hemicelluloses
- $MgCl_2$  (and other salts) in appropriate concentration increases the strength

## • Testing methods:

- hydration temperature's maximum ( $T_{max}$ )
- time to reach the  $T_{max}$
- state of curing (hardness)

## • Novel technique:

- Wood: poplar (*Populus euramericana* cv. 'I-214')
- Portland cement
- Apply PDDA [Poly(diallyldimethylammonium chloride)] in 0.1% on wood
- Add montmorillonit nano particles in 0.1% on wood
- Control with  $MgCl_2$  and Ca-formate
- **Compared to wood attacked by fungi - no curing in case of conventional additives because of hydrolysis of hemicelluloses into sugars**



## ADVANTAGES (compared to conventional additives):

- cement cured also in case of fungi attacked wood
- higher strength
- very little amount of additive
- cheap additive
- non corrosive additive



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