Emissions from bio-based building products

Lothar Clauder[1], Elie Mansour[2],
Graham Ormondroyd[2], Alexander Pfriem[1]

[1] Eberswalde University for Sustainable Development, Friedrich-Ebert-Straße 5, 16225 Eberswalde, Germany, +49 (0)3334 657-379, lothar.clauder@hnee.de

[2] BioComposite Centre Bangor University, Deiniol Road Bangor, Gwynedd LL57 2 UW, Bangor, United Kingdom +44 (0) 1248 382075, Elie Mansour e.mansour@bangor.ac.uk

COST ACTION FP1303
Workshop / Management Committee Meeting

HNE Eberswalde
Eberswalde University for Sustainable Development
University of Applied Sciences

Background

Formaldehyde

as reactant in adhesive……..

© diparthut.com

……. or from **natural timber.**

© products.royomartin.com

Volatile organic compounds (VOCs)
Aldehydes: Hexanal, Furfural, ... Terpenes: α-Pinen, β-Pinen, etc.
Organic acids: Formic acids, Acetic acids ...

are inherent or created by the drying process ….. induced by heat and moisture.

HNE Eberswalde
Eberswalde University for Sustainable Development
University of Applied Sciences

Aim of the project

Approach for the reduction of emissions of wood

- Prevent damaging of Art objects caused by:

  acidity, alcality, Formaldehyde, VOCs

© Thinkstock

Emission-free wood

- Allow the application as display material in the museum environment

© Vitrinen Berger

Emissions from bio-based building products

HNE Eberswalde
Eberswalde University for Sustainable Development
University of Applied Sciences

Set up overview

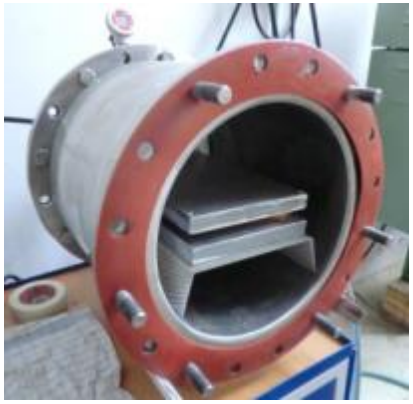
Samples

Buffer

© pronat.ipn.uni-kiel.de

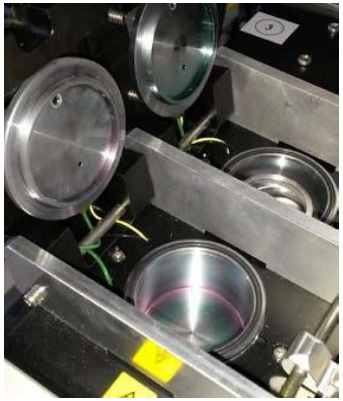
Impregnation

Vacuum drying



Corrosion test

Emission test



Material & Methods

Observed species: Ash, Oak and Alder (fresh sawn)

Buffers: weak acid/ alkaline & corresponding salt = control the pH-value

Boric buffer solution	Phosphate buffer solution		
pH - value : 9.4	pH - value : 8.0	pH - value : 7.2	pH - value : 6.8

Impregnation parameters: Vacuum: 50 mbar; 30 min, Pressure: 9 bar; 90 min

HNE Eberswalde
Eberswalde University for Sustainable Development
University of Applied Sciences

Material & Methods

Kiln drying
(laboratory Kiln)

2 Step Process:

1st step → 55 °C until FSP
2nd step → 80 °C until 12% EMC

Vacuum drying
(pilot scale autoclave)

40 mbar vacuum
40 °C until 12% EMC

HNE Eberswalde
Eberswalde University for Sustainable Development
University of Applied Sciences

Material & Methods

Code	Buffer solution	pH- value of the buffer solution	Drying Method
UT-KD	Untreated control	None	Kiln drying
UT-VD	Untreated control	None	Vacuum
B 9,4_VD	Boric buffer	9.4	Vacuum
B 9,4_VD	Boric buffer	9.4	Vacuum
B 9,4_KD	Boric buffer	9.4	Kiln drying
P 6,8_VD	Phosphate buffer	6.8	Vacuum
P 8,0_VD	Phosphate buffer	8.0	Vacuum
P 7,2_VD	Phosphate buffer	7.2	Vacuum

HNE Eberswalde
Eberswalde University for Sustainable Development
University of Applied Sciences

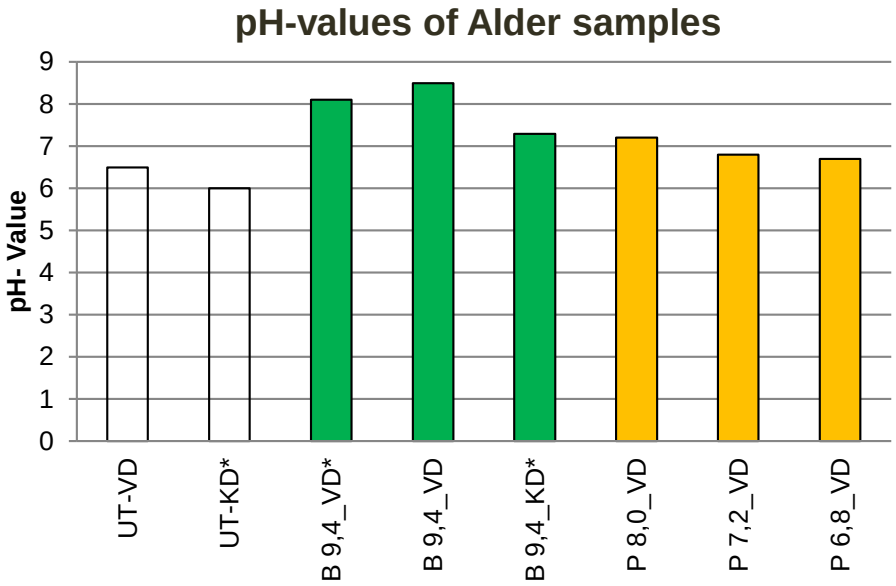
Material & Methods

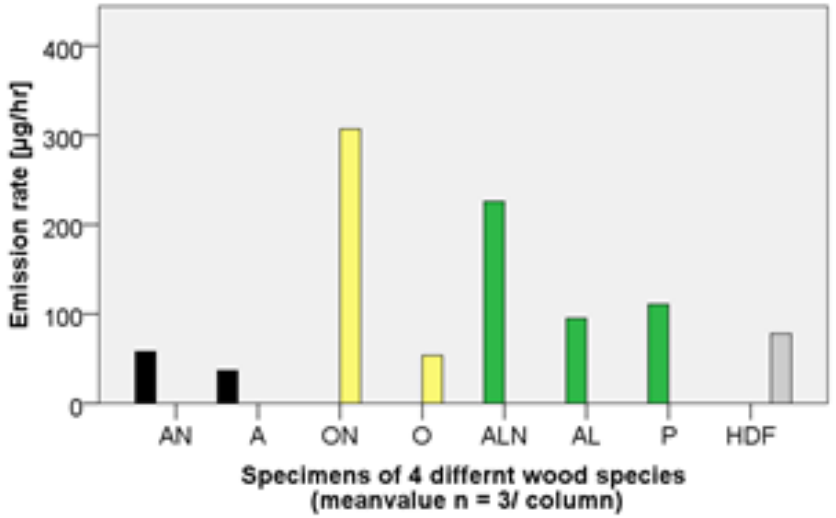
Corrosion test: Oddy Set-up

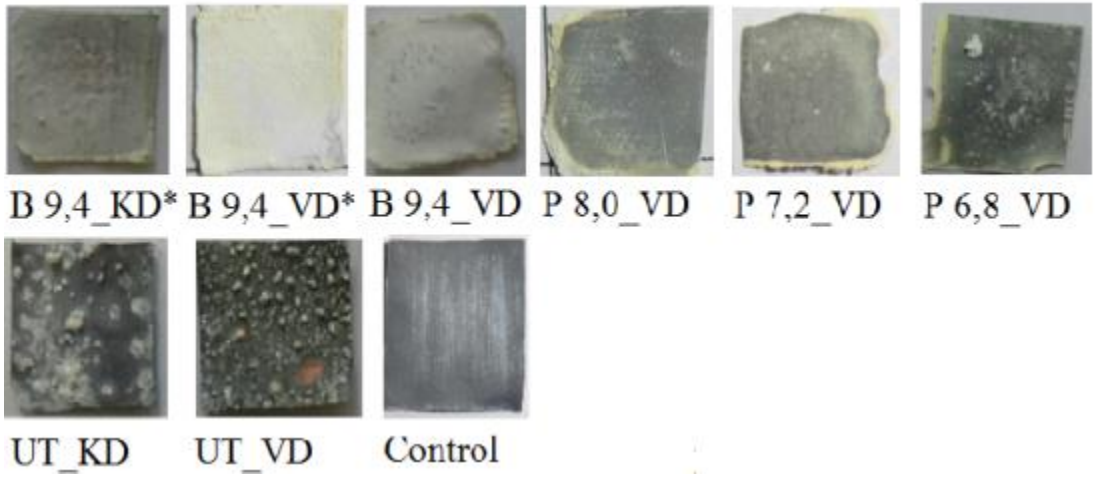
Permanent	Temporarily	Unsuitable
No corrosion	Light corrosion	Heavy corrosion

HNE Eberswalde
Eberswalde University for Sustainable Development
University of Applied Sciences

Results



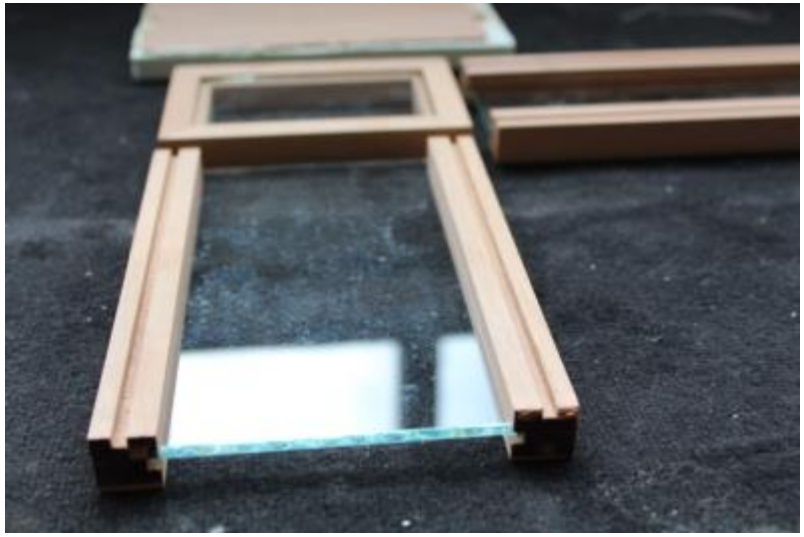




HNE Eberswalde
Eberswalde University for Sustainable Development
University of Applied Sciences

Results

Mini test display-cases



Are the test requirements *„fair“* for testing wood?

Results

- Reduction of emission rates of VOCs.
- Temperature (60 ° C) and water during the test period support development of VOCs.
- Acidic/ alkaline vapours are in the focus.

Conclusions

- Test set up does not reflect realistic conditions.
- Modifying the test set up in order to create more realistic, but even elevated, test conditions → reduce water inside the test set up.

Thanks for your attention!

Thanks to all colleagues at

BioComposites Centre
Innovation in biomaterials for industry

Thanks for funding of STSM by

COST FP1303
Performance of bio-based building materials