Natureplus Symposium | 19.10.2020

NATURE EUROPE | REALISING HEALTHY BUILDINGS

DIPL.-ING ANDREA KLINGE | ZRS ARCHITEKTEN INGENIEURE
# HOME IS WHERE THE TOXINS ARE

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Innovative materials & construction

Improved Indoor Environmental Quality (IEQ)

- Thermal comfort
- Relative Humidity (RH) - Water vapour adsorption
- Prevention against overheating in summer
- Low emitting materials
- Adsorption of air pollutants
- Sound insulation and acoustic

LCA / LCC

Energy efficiency

Affordability
Highly airtight building envelope

- Address shortcomings associated with modern airtight
- Increased relative humidity levels indoors, damp problems and condensation
- Increased concentration of airborne pollutants
Reaction of the industry

- Application of mechanical ventilation systems with heat recovery in residential buildings
- In combination with lightweight construction, mechanical ventilation leads to ‘overventilation’ and dries out interior spaces in an extreme manner, which leads to healthy impairments of occupants
- Extremely low hygienic requirements for mechanical ventilation systems
- Increased space requirements and cost (investment and maintenance cost)
Scofield - Sterling Diagram

1985

Relevant interaction of microbioms at different relative humidity levels

Optimal Range

Between 40% - 60% RH is the risk of unwanted Microorganisms as well as specific disease symptoms minimal
[H]HOUSE EU RESEARCH PROJECT IMPROVED INDOOR ENVIRONMENTAL QUALITY
MATERIAL INVESTIGATION
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MATERIAL INVESTIGATION

Earth plaster
Earth dry board
Earth cellulose board
Wood fibre board
Dry board

Wood fibre insulation
Hemp insulation
Clothes insulation
Wood fibre flax board
Strawboard
[H]HOUSE EU RESEARCH PROJECT IMPROVED INDOOR ENVIRONMENTAL QUALITY EMISSION TESTING

Test samples for screening emission test

Ref. 3.3.6 Sample 1/1

Ref. 3.3.11 Sample 1/1

Ref. 3.6.1 Sample 1/1

Climate chamber

Test emission chamber

OSSB

Plywood

sampling day

Concentration [µg/m³]

sampling day

Concentration [µg/m³]

Decanal
Benzoic Acid
Nonanal
Octanal
Hexanoic Acid
Benzaldehyde
Heptanal
Hexanal
Pentanal
Acetic Acid
Butanal
Acetaldehyde
Formaldehyde
[H]HOUSE EU RESEARCH PROJECT IMPROVED INDOOR ENVIRONMENTAL QUALITY

VOC ADSORPTION TESTING

Earth plaster - 5 mm thickness
Wall build-up - 72,75 mm thickness
- Gpainted gypsum fibre board - 12,75 mm
- Insulation / timber stud - 60 mm

$\rho_{Ac}$ at half-lifetime [mg/m$^2$]

- 1-pentanol [CAS 71-41-0]
- Hexanal [CAS 66-25-1]
- Butyl acetate [CAS 123-86-4]
- $\alpha$-pinene [CAS 80-56-8]
- n-decane [CAS 124-18-5]
- $\Sigma \rho_{Ac}$ at half-lifetime [mg/m$^2$]
[H]HOUSE EU RESEARCH PROJECT IMPROVED INDOOR ENVIRONMENTAL QUALITY
WATER VAPOUR SORPTION CAPACITY OF DIFFERENT PLASTERS

Graphical illustration of the moisture buffer capacity of different plasters

Comparison of water vapour sorption of an earth and cements based plaster in 24h
WATER VAPOUR SORPTION CAPACITY OF INTERNAL PARTITION WALLS

Water vapour sorption measurements in accordance with DIN 18947 (natural and conventional materials)
Certifications
Selection of certified low emitting construction materials

EPD’s
VOC declaration for relevant products for the interior fitout that might emit

Hygroscopic Materials
Earthen materials, timber, wood fibres, chalk plaster, gypsum fibre boards

Materials that adsorb harmful substances
Earthen materials
RENOVATION AND EXTENSION OF A GDR WASHHOUSE
Existing single storey structure
• Single layer masonry construction
• Chalk plaster

Extension as vapour open, rear ventilated timber frame construction
• Cellulose insulation
• OSB boards (stiffening element, internally)
• Reed mat with earth plaster
• Wood fibre boards (externally, cladded with cement boards)
Internal finishes
- Painted earth plaster on extended metal (substrate) for ceiling
- Painted earth plaster on reed mat (substrate) for external and internal walls

Internal finishes
- Finished earth plaster surface before application of paint
Internal finishes
- Timber-aluminium windows, oiled with linseed oil
- Timber windowsills, oiled with linseed oil

Internal finishes
- Earth paint for ceiling and walls
- Timber floor boards, oiled with linseed oil
RENOVATION AND EXTENSION OF A FORMER GDR WASHHOUSE IN BERLIN, GERMANY
APPLICATION OF HYGROSCOPIC, LOW EMITTING BUILDING MATERIALS

Apartment

Studio
RENovation and extension of a former Gdr washhouse in berlin, germany
Monitoring measurements of RH and temperature in winter

Flat koppenstraße - Natural ventilation and hygroscopic materials

Flat fehrbelliner strasse - Mechanical ventilation and conventional materials
NEW LIFE FOR PEAT SHED, SCHECHEN, GERMANY
INTEGRATION OF NEW VAPOUR OPEN WOOD FRAME CONSTRUCTION
NEW LIFE FOR PEAT SHED, SCHECHEN, GERMANY
SECTION EXISTING AND NEW BUILDING | WALL HEATING ON EARTH BLOCKS
NEW LIFE FOR PEAT SHED, SCHECHEN, GERMANY
GROUND FLOOR FLAT | PASSAGE BETWEEN OLD AND NEW STRUCTURE

www.zrs.berlin
FLEXIM HEADQUARTERS, BERLIN, GERMANY
LOW-ENERGY BUILDING WITHOUT MECHANICAL VENTILATION

1 Baugrund
1.1 Aufschüttung nicht tragfähig ca. 2.0 m
1.2 Gewachsener Baugrund

2 Gebäudehülle diffusionsoffen, feuchte- und temperatursteuernd
2.1 Gründung/UIG als weiße Kanne; U-Wert ca. 0.15 W/m²K
2.2 Außenwände, Holzbau hochdämmed; U-Wert ca. 0.12 W/m²K
2.3 Grundach für sommerlichen Wärmeschutz, Holzbau hochdämmed;
    U-Wert ca. 0.12 W/m²K
2.4 Rohbau, hybrid, Holz-Beton-Verbunddecke
2.5 Fenster-Fassadenelemente; U-Wert ca. 1.0 W/m²K

3 Klimasteuerung passiv
3.1 Sonnenschutz außenliegend, beweglich
3.2 Lüftungsfälle zur Nachtauskühlung, wettergeschützt
3.3 Lichtband, Querlüftungsoffnungen
3.4 Nachtkauskühlung, Feuchteaufnahme (Holz und Lehm)
3.5 Feuchteabgabe, Verdunstungskühlung
3.6 Offenes Oberlicht

4 Klimasteuerung aktiv
4.1 Heizung an kalten Wintertagen
4.2 Optionale Kühlung, heißer Sommertag
4.3 Industrieflächenheizung,
    Bauteilaktivierung

5 Energiequellen
5.1 PV-Anlage, Energiequelle elektrisch, Verschattung der Dachfläche
5.2 Wärmerückgewinnung aus Abwasser, kommunale Vernetzung
5.3 Wärmepumpe (deckt ca. 80% des Wärmebedarfs)
FLEXIM HEADQUARTERS, BERLIN, GERMANY
BOULEVARD ON THE FIRST FLOOR, TIMBER-CONCRETE HYBRID CEILING
THANK YOU FOR YOUR ATTENTION!
FOR MORE INFORMATION: WWW.ZRS.BERLIN