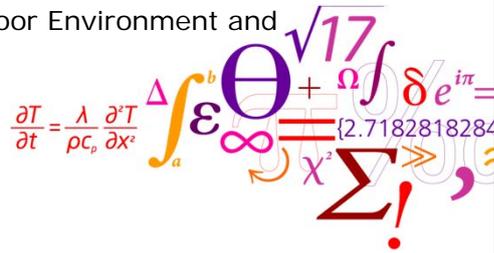


Zero Waste materials Project Introduction

Presentation by: Barbora Krejcirikova

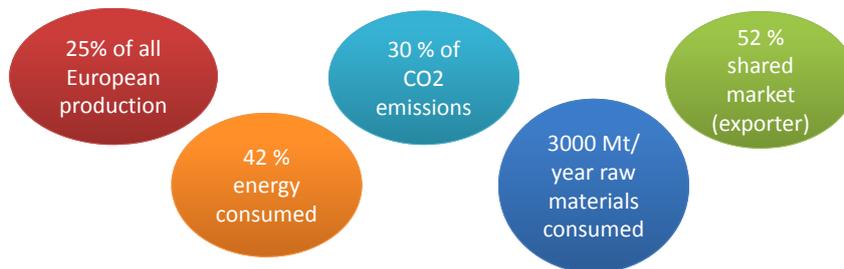
Section for Building Physics and Services
International Center for Indoor Environment and
Energy (ICIEE)



DTU Civil Engineering
Department of Civil Engineering

Why Utilizing Waste?

Construction industry in no.s



+Environmental issue → extraction of raw materials

Redesigned construction materials

How to Utilize Waste?



- Industrial by-products
 - Avoid of landfill disposal and deposit
- **Non-conventional building materials**
 - Mortar, Concrete
 - Concrete ad-mixed products
 - Bricks, Tiles
- Ash in a place of cement/clay
- **Innovative** characteristics



Objectives



Advanced methodology for material testing

- Material Characterization
 - Hygrothermal
 - Mechanical
- Environmental effect
 - Emissions
 - Mould growth
 - Leaching
- Sorption & Sink Effect
 - VOC
 - O₃
- Visual Effect
 - Patterns
 - Colour

Concept of product development and design as optimal solution for future types of sustainable building constructions



Raw material replacement

Previous studies



- Mostly focused on
 - Workability
 - Flexural, Compressive Strength
 - Feasibility
 - (Water absorption)
- Chemical and mineralogical compositions vary between the different SSA → Variable material properties

Effect of fineness of fly ash on properties of fired bricks (fired at 1050 °C for 8 h according to heating rate in Fig. 2) *

| Fly ash:clay (by volume) | Fly ash | Apparent porosity (%) | Water absorption (%) | Bulk density (g/cm ³) | Compressive strength (MPa) |
|--------------------------|------------|-----------------------|----------------------|-----------------------------------|----------------------------|
| 60:40 | Original | 36.65 | 23.62 | 1.55 | 39.6 |
| | Pulverized | 33.88 | 19.53 | 1.74 | 85.9 |
| 70:30 | Original | 39.76 | 27.54 | 1.44 | 27.8 |
| | Pulverized | 38.68 | 24.47 | 1.58 | 51.8 |
| 80:20 | Original | 39.80 | 27.86 | 1.43 | 25.4 |
| | Pulverized | 38.14 | 27.24 | 1.51 | 37.1 |

* X. Lingling, G. Wei, W. Tao, and Y. Nanru, "Study on fired bricks with replacing clay by fly ash in high volume ratio," Constr. Build. Mater., vol. 19, no. 3, pp. 243–247, Apr. 2005

Facilities at DTU BYG



Dry/Wet cup method



Climate chambers/Dessicators



Scanning Electron microscope



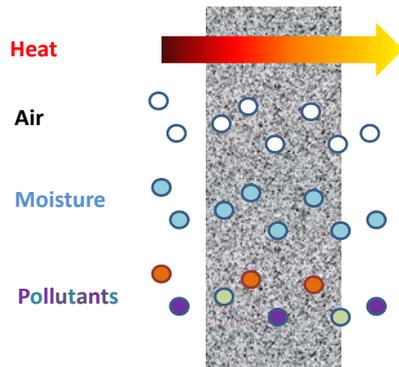
Pressure plate apparatus

Guarded hot plate apparatus



Summary

Combined heat, air, moisture and pollution transport



- Effect on:
 - Material characteristics
 - Indoor Environment quality
 - Occupants' health
 - Material life-cycle
 - Durability etc.

THANK YOU FOR YOUR ATTENTION



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