Vertical green from earthenware blocks and their thermal performance

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The Siam Paragon, Bangkok since 2005

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Vertical Green application

- Interior or exterior decoration. *Blanc. (2008)*
- Shading device for window. *Hoyano. (1988)*
- Insulation for solid wall *(Wong et al. 2010)*
- Clean toxic in the air. *Biowall Queen's University. (2007)*

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Other benefit

- Sound insulation. *Azkorra et al. (2015)*
- Psychological benefit. *T Bringslimark et al. (2009).*
- Water retention. *Metselaar ,K . (2012).*
- Edible façade. *Fukaihah, A. (2011), Koyama et al. (2013) Šuklje et al.(2013)*
- Restore Ecology

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Thermal performance research on Vertical Greenery

- *Hoyano (1988)*
- *Sandififer and Givoni (2000)*
- *Stec et al. (2005)*
- *Dunnet (2005)*
- *Wong (2010)*
- *Sunakorn and Yimprayoon (2011)*
- *Chen et al. (2013)*
- *Koyama et al. (2013) Šuklje et al.(2013)*

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Vertical green technique in Thailand

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Objective

- Develop a new technique for vertical green using local material and DIY installation
- Observe thermal performance of the new vertical green comparing with insulation material.

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Methodology

- Investigate local material
- Design the vertical green wall system
- Observe growth using photographic technique
- Comparing air temperature behind vertical green wall comparing to empty wall and insulated wall.
- Conclusion

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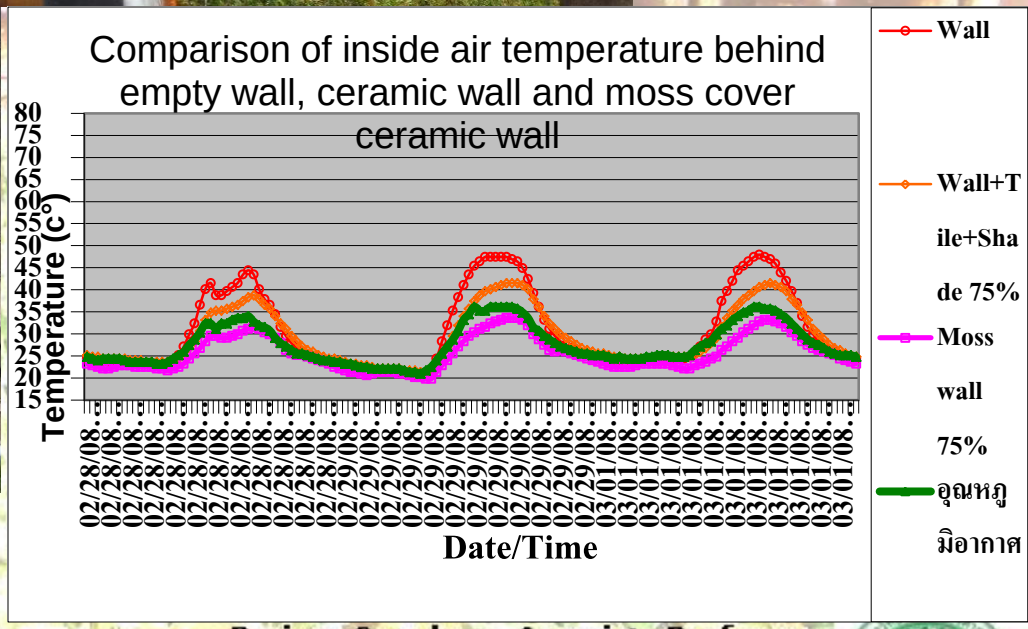
Moss and fern grow naturally on earthenware water container

Moss wall on clay-tile ceramic



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Clay-tile or earthenware potteries in Thailand

Design of Earthenware block
E block

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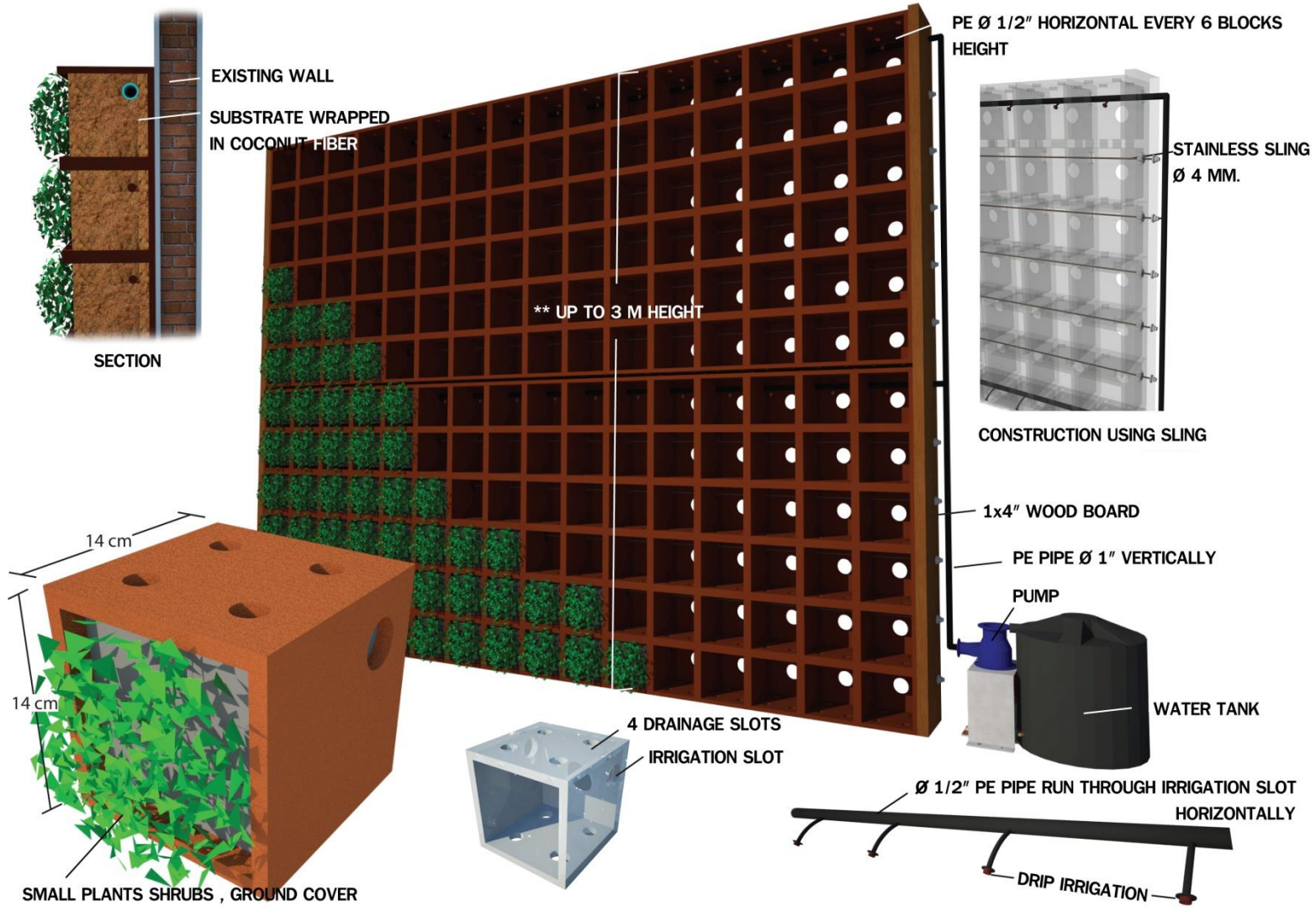
INSTALLATION OF EARTHENWARE BLOCK WALL FOR VERTICAL GREENERY



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Plants

- Size of the block comes from normal size of planters(6 inches) which can grow ground covers or small to medium size bushes in Thailand. So plants were selected based on the size of block.
- Lantana *(Lantana camara L.) and* Elfin Herb (*Cuphea hyssopifola H.B.K.)* were local common plants in Thailand, with easy maintenanace , was chosen for experiment.

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Growth result

Result showed that E block wall at 1.80 m width , 2.10 m height can hold plants on vertical surface using 1 set of automatic drip irrigation for each column of 6 blocks height. Plants survived and grew well during 5-6 months of experiment on west brick wall on 7th floor roof deck of Architecture building

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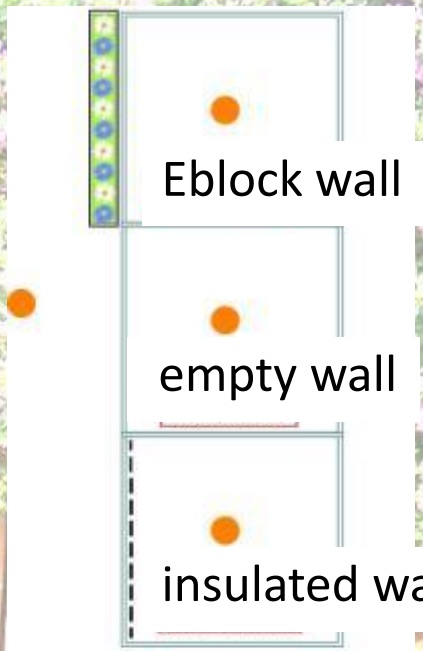
Experiment set up

Three polystyrene chambers were constructed behind the wall with vertical green block, insulated wall and empty wall to measure temperature of internal air of each box.



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Equipments and method

"Just cool ". Insulation material 20 mm thick Covered with al. foil , used for wall and ceiling

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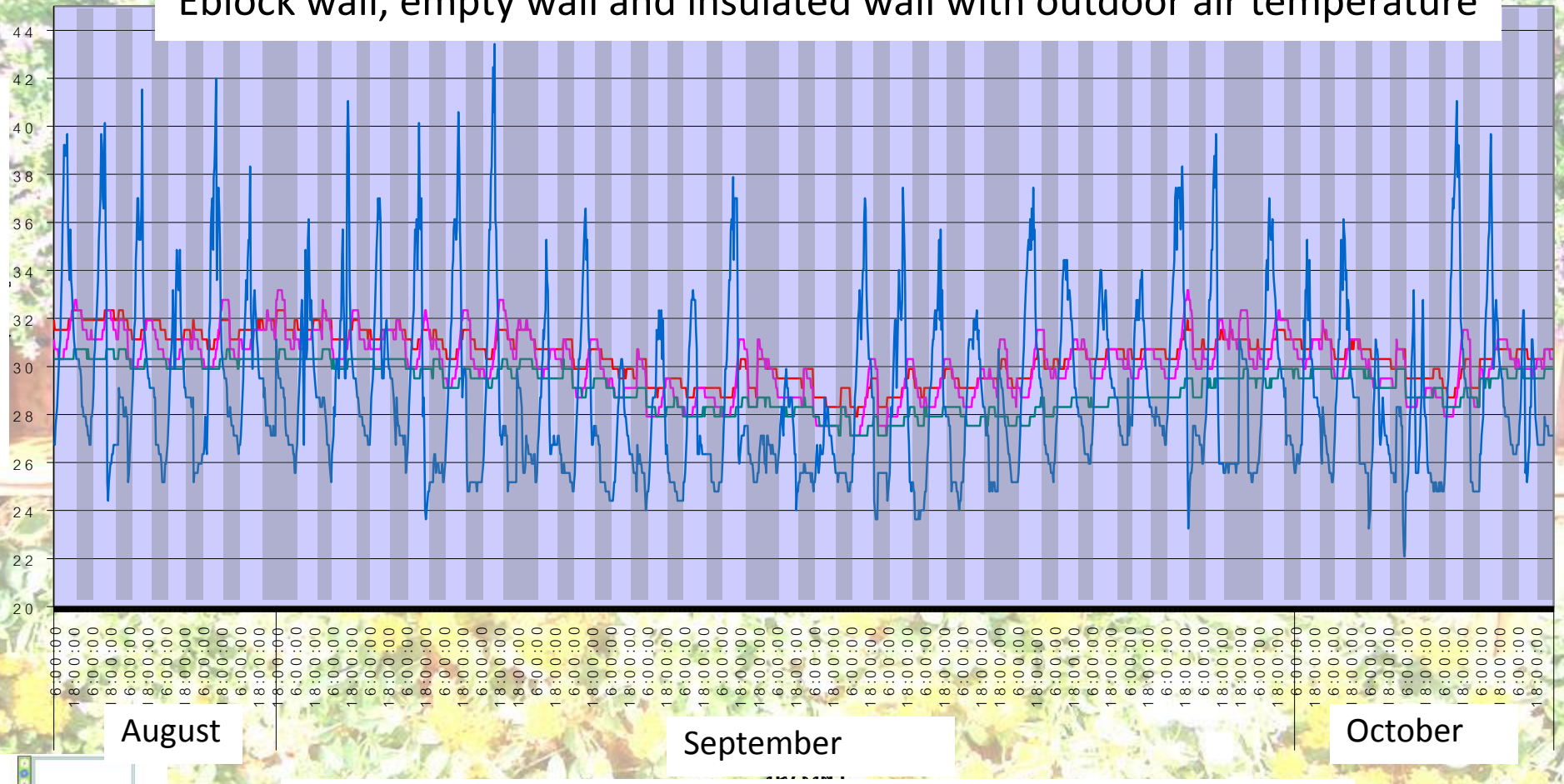
Comparative air temperature behind Eblock wall, empty wall and insulated wall with outdoor air temperature



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Thermal performance result

Result founded that Eblock chamber has best performance in heat reduction. In daytime, air inside Eblock chamber has the lowest temperature through 2 months experiment (28-32 degree c), 1-2 degree c lower than air in insulated chamber and 2-2.5 degree c lower than air in empty chamber. At night Eblock chamber still has lower temperature than insulated chamber, but higher than empty wall which dissipated heat easier

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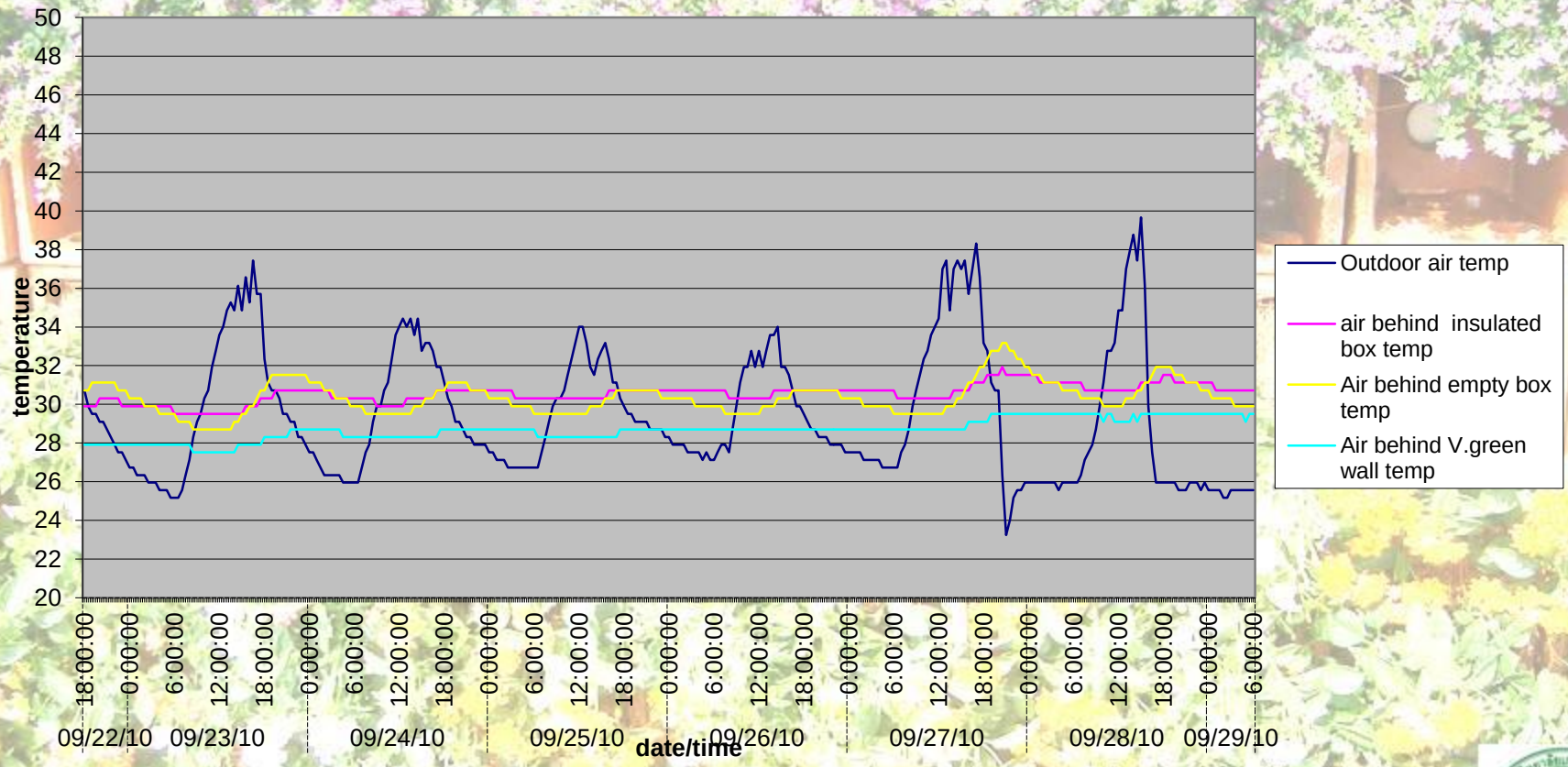
Comparative air temperature behind 3 wall
: empty wall, insulated wall and v.green wall



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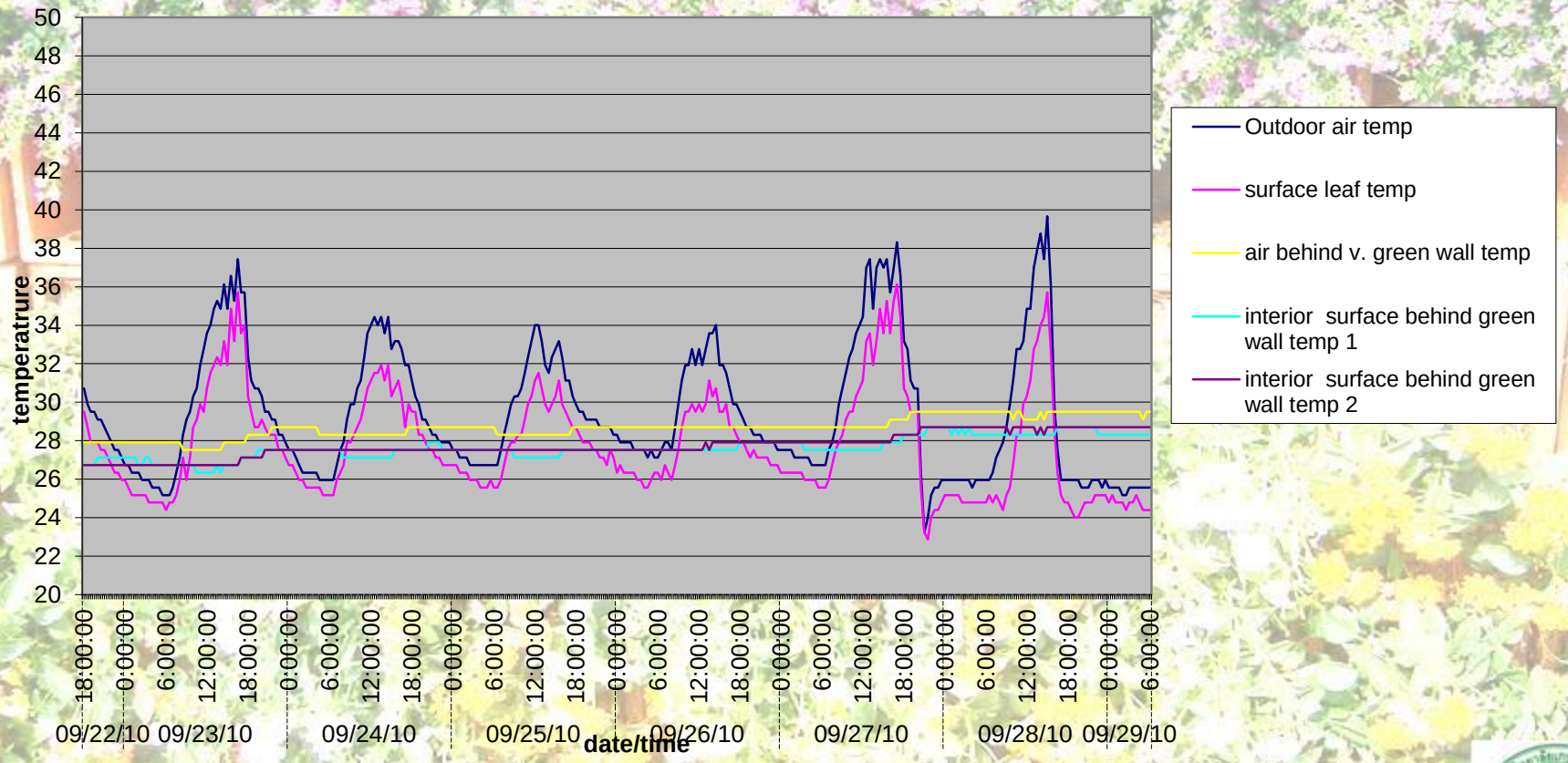
Comparative surface and air temperature of vertical green wall box



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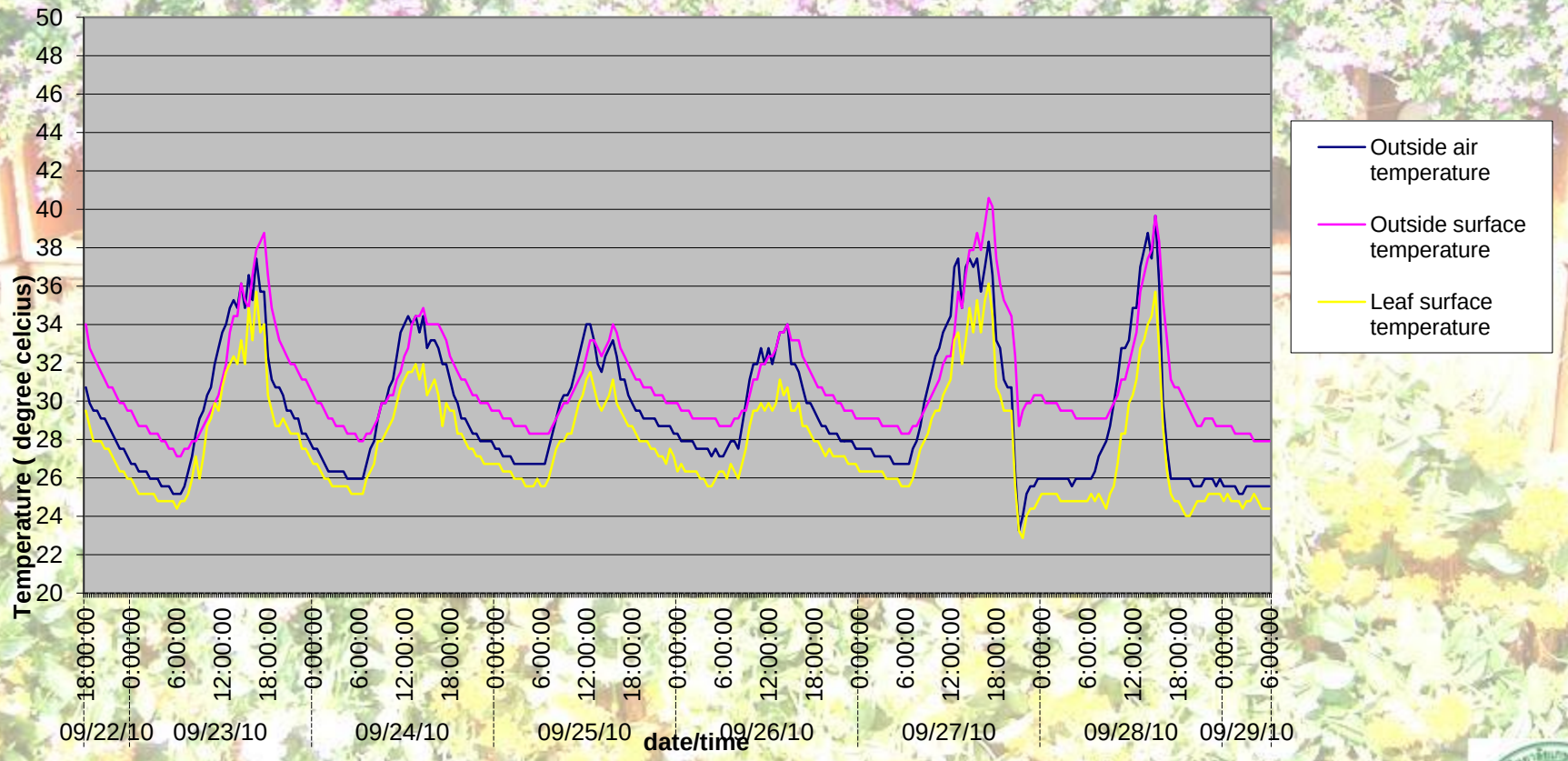
Comparison of outside air and surface temperature



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Conclusion and discussion

1. E block system works very well and easy to maintenance, suitable with plants of different kind . Only problem is the weight, but it stood as a wall itself, not just decorative on the wall.
2. The cooling effect is much less than expected due to continuous of wall which use for 3 configuration, observing from surface temperature of naked wall is not as high as usual.

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May 2011 Further experiment using concrete with different shape

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Rooftop farm 2011

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May 2012

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Terracotta green wall, the Bali Ecological center

http://inhabitat.com/bali-ecological-center-creates-a-modular-terracott-green-wall-with-local-craftsmen/bali-eco-green-wall-single-pot2/?extend=1

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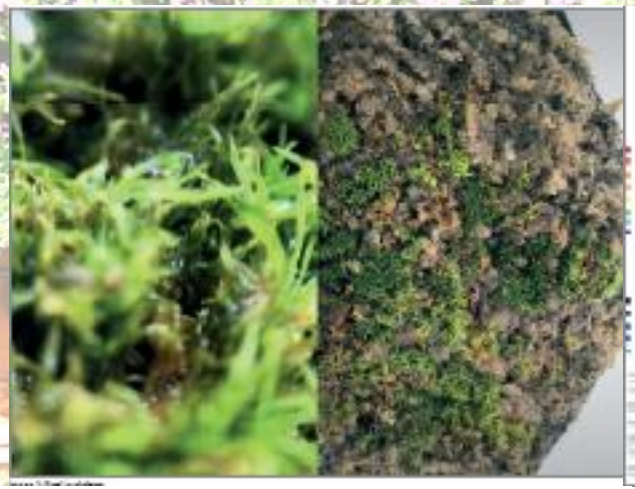
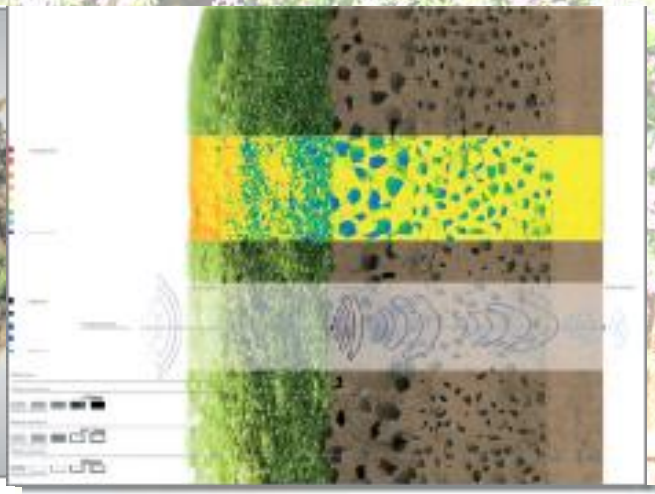
Bio Ceramic





Bio Ceramic

Moss-grafted clay tiles for green roofs, Barcelona, Spain

Holcim awards
for sustainable construction

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Future work

- Shape of block can be developed further to decrease the weight and reduce material, may use interlocking technique.

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