CERIS : Civil Engineering Research and Innovation for Sustainability

INDEED – Indoor Air Quality Regulation through the Usage of Eco--Efficient Mortars

Summary

The importance of this project study is to analyse the effect that earth mortars may have when exposed to environments with a concentration of several pollutants in public environments, namely schools, during spring/summer and autumn/winter and assesses how earth mortars contribute for the improvement of indoor air quality.

Therefore, this study is part of the following societal challenges: health, demographic change and wellbeing. Understanding the determinants in health is a major issue for society to present better conditions in health, since we spend most of our time in buildings. Another important factor is prevention, since if we increase the indoor air quality we are increasing the health of the people who inhabit these buildings, improving health throughout life. Besides this, by improving rendering mortars behaviour, it is expected a cost decrease of the National Health Systems due to Sick Building Syndrome (SBS) issues.

The occupants of a sick building often give a set of discomfort symptoms including lethargy, headache, fatigue, nose and throat irritation and lack of concentration. It is very difficult to estimate the cost of this type of pollution. These problems have an impact on the availability of individuals to work (absenteeism), low productivity, premature deaths, asthma problems, resulting in an increase in medical expenses.

Better measurements to inform understanding of what happens in a wide range of existing buildings and related indoor conditions are required to define and specify improvement measures. The use of earth as a building material also offers many advantages in terms of sustainability: it is natural, most probably non-toxic and ecological, with low energy intensity, low carbon emissions; reusable, recyclable and the bulk of materials are locally available within a short distance from the construction site. Earth is often obtained as a waste in construction sites. Because this technique uses the material from the construction site, presents or can reduced costs, and also contributes for society by cultural factors (transmission of wisdom, generation to generation), becoming a social-economic positive factor, and may boost employability.

We are trying to prove that earth-based mortars can contribute to improve indoor air quality and as a moisture buffer, contributing to balance the relative humidity of the indoor environment of buildings. Earth-based plasters (Figure 1) have a high humidity buffering capacity and promote the comfort and health of inhabitants: first of all because a high relative humidity environment increase the discomfort associated with the perception of heat or cold; and in second hand because by balancing the relative humidity of the indoor environment earth-based plasters contribute, in one hand, to mitigate health conditions associated with high relative humidity, like infections, allergies or asthma, and in another hand, contribute also to mitigate the probability of mucosal membranes irritation and inflammation associated to exceedingly dry indoor environments. Earth-based plasters may also contribute to indoor air quality if clay can act as a passive removal material, lowering indoor ozone concentrations, and therefore lowering the probability of occurrence of indoor ozone reaction with other building materials. This may lead to lower concentrations of oxidized reactions products, which could be toxic and irritating to mucosal membranes and other tissues.

Figure 1. Indoor environment partially coated with an earth plaster.

Indoor air has many pollutants (NO_2, SO_2, CO_2, CO), suspended particulate matter and also have gases eliminated by volatile organic compounds (VOC). VOC are substances derived from highly volatile petroleum products (aromatic hydrocarbons). They oxidize in the presence of air and react with heat. They are found in paints, solvents, foams in general and phenolic products. In closed environments, products containing VOCs can take up to one year to be completely eliminated. Their degradation is 100 times slower indoors. Synthetic paints that include VOCs in their formulation, as do water-based paints (with 2% of VOC). In indoor public spaces there are too frequently high levels of carbon dioxide (CO_2) and indoor air pollution can be up to 5 times worse than outdoor air pollution. Who breathe polluted air may have health problems including respiratory, cardiovascular, immune level,

INDEED Indoor air quality Eco-efficient mortars

Project Reference

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Leading Institution

ISEL-IP – Instituto Superior de Engenharia de Lisboa do Instituto Politécnico de Lisboa (Portugal)

Partners

NOVA University of Lisbon (Portugal), IPS – Polythecnic Institute of Setúbal (Portugal), IPT – Polythecnic Institute of Tomar (Portugal), Aldeias de Pedra, Construções Lda (Portugal)

CERIS Principal Investigator

Maria Idália Gomes
(idaliagomes@dec.isel.pt)

CERIS Research Team

Paulina Faria

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CERIS

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Project Website

http://www.indeed.ipt.pt/pt/projeto/

among others. Because of all these reasons it is important to improve better air quality.

Since earth construction focuses on the transmission of knowledge, from generation to generation, it is considered a sociocultural technique, preserving a dynamic cultural heritage, which often boost the development of innovative solutions that generate new forms of employment and self-employment.

Furthermore, integration research and education involving students from the polytechnic schools in a multidisciplinary project prepares the students to undertake scientific challenges in innovate ways and, thus, creates the potential knowledge to innovative solution that may emerge. Students also gain experience with this research project and in the professional field they can apply the knowledge learned.