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Sensory ratings of emissions from nontraditional building materials

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SUMMARY
Twenty-five subjects assessed the emissions from building materials: linoleum, cement mortar with and without fly ash, gypsum board and tiles with air cleaning properties and natural organic sheep wool. The ratings were made at different material loadings and in combinations with linoleum. The results showed that except for natural organic product, increasing loading and combining materials with linoleum increased intensity of odor.

PRACTICAL IMPLICATIONS
Increased loading of material, as expected, has negative effect on air quality. Increased loadings of all studied materials, except for sheep's wool, in combinations with linoleum reduced the level of odor intensity (OI) below the level of linoleum itself.

KEYWORDS
Sensory assessments; odour intensity; building products; glass chambers

1 INTRODUCTION
Indoor air quality should be one of the main parameters for consideration during design of new and renovation of existing building. Emissions from building materials and furnishing can affect air indoors. Recently, new building materials have been introduced on the market, e.g. materials using recycled elements, organic products or materials that have air cleaning properties. As all other traditional building materials and products, these new materials need to be examined regarding their properties including the assessment of their overall impact on sustainability. The reason is that the use of them may incur risks related to their emissions having impact on air quality and health of building occupants. The objective of the present study is to characterize some selected nontraditional building materials in terms of their effect on the perceived air quality and compare this effect with the impact of some selected traditional building materials.

2 METHODS
Material specimens were placed in seven 100 L glass chambers placed in twin stainless steel chambers. Glass chambers contained the following materials: cement mortar, cement-ash mortar, gypsum board with surface designed to decompose formaldehyde emissions into non-harmful inert compounds, tiles with TiO_2 coating and sheep wool and linoleum. In one chamber, 2-propanone was passively evaporated at a constant rate so that its concentration was 80 ppm. Each material was tested at least at two different loadings so that the ratio of the airflow in the glass chamber (Q, l/s) to the material surface (A, m^2), Q/A covered the possible range of loadings encountered typically indoors for the type of material under study; the loadings were 0.7, 1,4 and 2.8 m^2. The mixtures of the material with linoleum were tested as well at one loading to examine combined effects. Twenty-five college-age healthy subjects (without allergies and chronic diseases) assessed acceptability of air quality (ACC) and odour

intensity (OI). They assessed in random order the air in each of the stainless steel chambers and the air extracted from the glass and presented for evaluations through diffusers. The assessments were made immediately upon exposure, in case of the air exhausted from the chambers upon one inhalation. The experiments were made on 8 consecutive days. The protocol followed the Nordtest method NT Build 482, (Nordtest, 1998). The temperature was set to 23°C ± 1°C, and the stainless chambers were ventilated with the highest possible outdoor airflow rate of 1500 m^3/h resulting in ca. 50 h^{-1}. Relative humidity varied between 13% and 32%. A linear mixed-effects model was used to examine whether the ratings of ACC and OI were different between different loadings and materials. In particular it was investigated whether there was a statistically significant difference between initial loading (1.4 m^2) and additional loadings (0.7 m^2 or 2.8 m^2) for a particular material, and between initial loading (1.4 m^2) and combination of a particular material with linoleum. Exposure-response relationships were established. Ratings of 2-propanone were used to examine stability and drift of the sensory assessments.

3 RESULTS

This paper presents results of the ratings of OI of selected materials, which are shown in Fig.1. In the statistical analyses particular conditions were compared to the baseline; thus loading 1.4 m^2. Only few comparisons did not reach statistically significant difference (Fig. 1), all others confirm that higher loading as well as addition of linoleum changed the odor intensity. The sheep wool had strong odor and changing loading did not have any effect. Cement mortar and cement mortar with fly ash caused more or less similar intensity of odor. Adding linoleum at highest loading reduced OI suggesting either air cleaning effect or hypoaddition. Air cleaning effect was also seen for the combinations of gypsum board and tiles with linoleum.

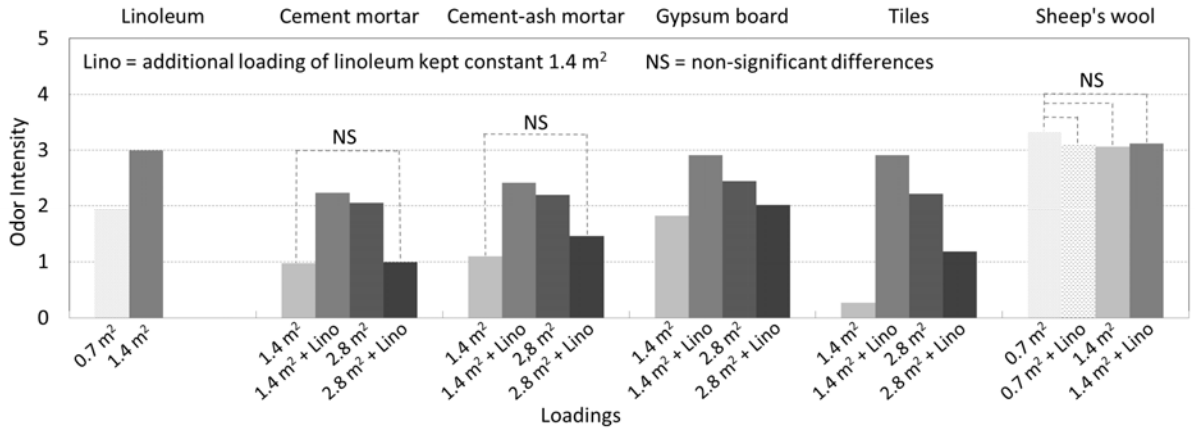

Fig. 1. Average ratings of OI of air polluted by selected materials. 0–no odor, 1–slight odor, 2–moderate odor, 3–strong odor, 4–very strong odor, 5–overwhelming odor.

4 CONCLUSIONS

Present results do show that in general unconventional building materials behave similarly to conventional materials as regards their sensory properties but may also be strong sources of sensory nuisance.

ACKNOWLEDGEMENT

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5 REFERENCES

Nordtest (1998). NT BUILD 482 Building materials: Emissions testing using the CLIMPAQ.