Background and Objective of IEA-EBC Annex 78. Supplementing Ventilation with Gas-phase Air Cleaning, Implementation and Energy Implications

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SUMMARY

The proposed Annex should bring researchers and industry together to investigate the possible energy benefits by using gas phase air cleaners (partial substitute for ventilation) and establish procedures for improving indoor air quality or reduced amount of ventilation by gas phase air cleaning. The project shall also establish a test method for air cleaners that considers the influence on the perceived air quality and substances in the indoor air.

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KEYWORDS

Ventilation, gas phase air cleaning, energy use, indoor air quality, standards

1 BACKGROUND

Ventilation accounts for approximately 20% of the global energy use for providing an acceptable indoor environment. The requirements for ventilation in the most standards and guidelines assume acceptable quality of (clean) outdoor air.
Worldwide, there is an increasing number of publications related to air cleaning and there is also an increasing sale of gas phase air cleaning products. This puts a demand for verifying the influence of using air cleaning on indoor air quality, comfort, well-being and health. It is thus important to learn whether air cleaning can supplement ventilation with respect to improving air quality i.e. whether it can partly substitute the ventilation rates required by standards. Finally, the energy impact of using air cleaning as supplement of ventilation needs to be estimated. This project will focus on gas phase air cleaning. The project will not include filtration.
In many locations in the world, the outdoor air quality is so bad that it is better to avoid ventilation. In such cases, the alternative to use ventilation is to substitute it with air cleaning so that the indoor air can be kept at high quality. Even when outdoor air is of a good quality, the use of air cleaning substituting ventilation air could reduce the rate of outside air supplied indoors and thereby energy for heating/cooling the ventilation air and for transporting the air (fan energy) can be saved.

Since it is expected that air cleaning may in parallel improve the indoor air quality and reduce energy use for ventilation, it should be considered as a very interesting technology that can be

used in the future. There is however a need for better evaluation of its potential to improve indoor air quality (and substitute ventilation rates) and the energy implication of using gas phase air cleaning. There is also a need to develop standard test methods of the performance of air cleaning devices. Consequently, it is proposed to form a new annex on the use of gas phase air cleaning technologies.

2 STANDARDS AND TESTING

Air cleaning is not directly considered in a new ISO standard for indoor environmental quality ISO17772-1; but the corresponding guideline TR 17772-2 opens up for the possibility to partly substitute ventilation air with air cleaning. ASHRAE 62.1, by using the analytical indoor air quality procedure, allows some ventilation rate credits for air cleaning. Besides, there is an increased interest in the development of air cleaning equipment and several products are available on the market. The reason is that air cleaning may be an acceptable way of reducing the rate of outside air delivered indoors by ventilation and saving energy, and still maintaining acceptable (high) indoor air quality.

However, better methods for testing of air cleaners are required because at present the testing is usually based on chemical measurements of specific compounds which does not capture the overall effect of air cleaning on perceived odour intensity or perceived air quality, the latter being referred to in ventilation standards. Testing does not either account for potential risks (breakthrough or production of new compounds). Some air cleaners may be efficient in removing particles, bio contaminants (microorganisms – pollens moulds, allergens) and/or VOC's (emission from materials or resulting from external air pollutants infiltration in the building such as PAH (Poly Aromatic Hydrocarbons)) but they may have zero or even a negative effect if the source of pollution is people (bio effluents).

None of existing standards for testing gaseous air cleaners include human bio effluents as a source and the perceived indoor air quality is not used to evaluate the performance. As bio effluents from occupants are an important source of pollution and becoming major source with the trend to reduce emissions from other sources, and as most criteria for ventilation is based on perceived air quality there is a need to establish new and more relevant test methods for gaseous air cleaners.

3 ENERGY

The energy implications of supplementing ventilation by air cleaning need to be better quantified. A possible scenario is that half of the required ventilation rates in existing codes and standards can be substituted by air cleaning. This will require less energy for heating/cooling the supply air and reduce the fan energy use. Depending on the air cleaning technology the equipment itself will use some energy. In total, a significant reduction of energy use for ventilation in the order of 10-20% is likely.

The project will be an important step towards near zero energy buildings. The air cleaning technology can provide better indoor air quality and health and at the same time reduce energy use for ventilation