

AIR FILTERS FOR BETTER INDOOR AIR QUALITY

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ABSTRACT

The need to separate impurities from air or other gases has increased as regards both the degree of separation and the necessity to separate finer particles. An 85 % efficiency filter is a prerequisite for the correct functioning of ventilation systems and to improve indoor air quality (IAQ).

INTRODUCTION

IAQ is in focus for the moment. In the US, ASHRAE has developed strategies for improved environmental health and defined different areas to tackle. VDI in Germany has prepared a hygienic standard regarding planning, design, operation and maintenance of the air-conditioning systems. In the Nordic countries, 1999 is dedicated to IAQ. Eurovent, the association for HVAC-manufacturers in Europe, is launching a couple of documents about IAQ. The paper describes why air filter shall be used and which quality is needed to protect the ventilation system and to fulfil acceptable hygienic requirements based on different studies and standards.

VENTILATION SYSTEM PROTECTION

Several major studies of IAQ problems have shown that filters would have been able to prevent reduced effect due to dirty ducts, fans and heat exchangers. Other major IAQ problems such as impurities from outside and micro-organisms in the system need not arise given the correct choice of filter. A precondition for maintaining function for a good number of years is that the system should be effectively protected, both on the inlet and outlet exhaust systems. *Impurities must be stopped at the inlet and not be allowed to enter the system.*

HYGIENE REQUIREMENT

Every day we breathe 20-30 kg of air and consume one kg of solid and three kg of liquid food. We should therefore make the same requirement of the air as we do of food and drink. We spent 90% of our time inside and the vision should be that nobody should get sick due to the indoor air environment.

Hygiene requirements for particle concentrations in the air have been based on concentrations of particles smaller than 10µm (particulate mass, PM₁₀). Studies have shown a direct connection between the death rate and finer particles and official requirements are under review, in both Europe and the USA, and are to be based on the concentration of particles smaller than 2.5µm (PM_{2.5}). It has also recently been shown that smaller particles play a major part in affecting our respiratory system finer filters are needed.

Allergy

Allergy and Asthma problems have increased in Western countries. Asthma has increased dramatically over the last ten years and affects nearly 15 million Americans today. 35 % percent of all children in Sweden suffer from some kind of allergy. The tendency to develop Allergy and Asthma is probably inherited, but exposure to a number of pollutants can trigger the reaction. Besides allergic reactions to food and skin contact, allergies can be related to airborne contaminants from animals, micro-organisms, exhaust air, cigarette smoke and from combustion processes. An air filter can effectively reduce allergens in the air.

Carcinogenic potential of pollutants

The size and number of particles do not say anything about how dangerous the particles are. There is a relationship between carcinogenicity (mutagenicity) and traffic pollution as automotive gases and polyaromatic hydrocarbons (PAH). A filter with 80% efficiency on 0.4 μ m reduces their effect by 80 %.

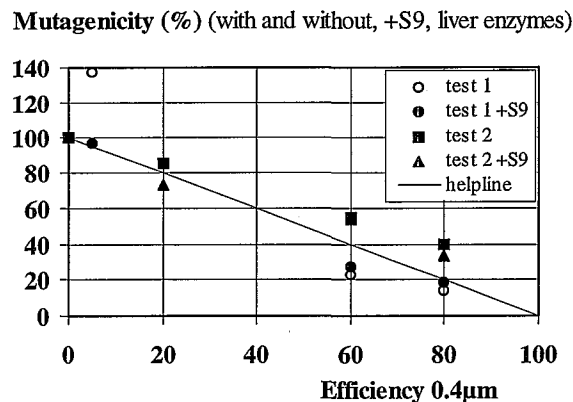


Figure 1. Example of the reduction of mutagenicity vs. 0.4 μ m particle efficiency of filters.

Filter itself

Hygiene considerations are being applied more and more to filter replacement. Studies have shown that with average relative humidity, RH, higher than 80 % for three days there is a risk of microbial growth in the filter and in the ventilation system. As it is in many cases difficult to avoid a high relative humidity in the air intake, filtering should take place in two steps. The first filtration step should be carried out using a filter of at least F7 quality (80% dust spot efficiency according to EN779) which should be changed after a maximum period of one year's continuous operation or earlier if final pressure drop is reached. The second filter step of at least F7-quality is not exposed to high RH and effectively stops micro-organisms and particles. This filter can remain in place for about two years, as long as the final pressure loss is not reached within this period.

CONCLUSION

It is clear that air filters will/could play an important role for achieving better IAQ. A filter can do an excellent job to prevent contaminants from entering the system, keep ventilation system in good shape, maintain the air flow, temperature and RH as designed and keep the efficiency of equipment at high level.