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New method to measure the mechanical collection mechanisms of full-scale air filters

Original

New method to measure the mechanical collection mechanisms of full-scale air filters / Tronville P.; Rivers R.. - STAMPA. - (2013), pp. 17-17. ((Intervento presentato al convegno FILTECH 2013 tenutosi a Wiesbaden nel 22-24 October 2014.

Availability:

This version is available at: 11583/2589646 since:

Publisher:

Filtech Exhibitions Germany

Published

DOI:

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October 22 – 24, 2013
Wiesbaden – Germany

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Abstract Book

October 22 – 24, 2013
Rhein-Main-Hallen
Wiesbaden · Germany

International Conference & Exhibition for
Filtration and Separation Technology

FILTECH 2013

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Abstract Book

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Conference Dates:

October 22 – 24, 2013

Venue:

Rhein-Main-Hallen · Rheinstr. 20 · 65028 Wiesbaden · Germany

Organizer:

Filtech Exhibitions Germany Germany GmbH & Co KG

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Abstract Book
USB-Stick

ISBN 978-3-941655-06-5
ISBN 978-3-941655-07-2

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NEW METHOD TO MEASURE THE MECHANICAL COLLECTION MECHANISMS OF FULL-SCALE AIR FILTERS

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ABSTRACT

Air filters are chosen for the minimum particle-capture efficiency they can provide in a specific application. Some media can achieve high efficiencies at low resistance to air flow by adding electrostatic charges on fairly coarse fibers. However, prolonged filter exposure to fine particles reduces the electrostatic enhancement effect. The filter efficiency must then rely mainly on mechanical collection mechanisms, and can fall well below the initial value. It is useful to test filter media when the effect of electrostatic charges is eliminated.

To estimate the efficiency drop that may occur, air filter test standards include filter conditioning procedures to inhibit the effect of electrostatic charges. These treatments should leave only particle capture effects from mechanical collection mechanisms such as sieving, aerodynamics and diffusion, but not reduce or enhance these effects. EN779:2012 and ISO 21220:2009 describe such a conditioning treatment for filter media, and ASHRAE 52.2-2012 describes one for full-scale filters.

The ASHRAE 52.2-2012 optional treatment suggests that air filters be exposed to a potassium chloride aerosol having approximately 35 nm count mean diameter. Following the charge-elimination treatment, procedures measuring efficiency as a function particle size are performed. In ISO/TS 21220:2009 and EN779:2012 the discharging treatment is also mandatory, but is performed on samples of the media used to manufacture the filter. This treatment requires a 2 minute soak in essentially pure isopropyl alcohol (IPA), after which the media samples are dried for 24 hours before further tests. This method presents problems, namely, that soaking in a liquid may alter the mechanical efficiency of media, and that samples of media may not be representative of the media used in the full-scale filter.

A new approach, developed by T. Hayashi in Japan, eliminated electrostatic effects in electret-enhanced media sheets by exposure to IPA vapor for 16 hours or longer. This procedure was successfully duplicated by J. Cai in China, and at the Politecnico di Torino. ISO/TC142/WG9 in 2010 ran an inter-laboratory comparison to assess this procedure, and in 2011 organized another comparison which extended the method to full-scale filters. The full-scale tests have included three different types of air filters, comparing the results with the other approaches previously mentioned. These results will be useful for revising the current ISO 29461-1 test method and also for developing the new ISO 16890 series for general ventilation applications. Here we summarize the data obtained at the Politecnico di Torino, and describe the new test protocol that could be adopted by future international filter test standards.

KEYWORDS

Filter test, Filter Efficiency, Electrostatic Charges, Service life, ISO standards, EN 779:2012, ASHRAE