A Comparative Review of the Erlab GreenFumeHood® and the Air Science EFT™ Enhanced Filtration Technology

Chambre, Andre; CEO, Air Science, LLC
March, 2009

Abstract

At the Pittsburgh Conference, New Orleans, March, 2008, the Erlab Company launched a marketing campaign promoting the company's GreenFumeHood® (GFH) Neutrodine® filtration system claiming that the new system offered "a variety of installation, operational and environmental benefits to any laboratory." In months following this announcement, corroborating data in terms of filtration efficiency appears to have been confined to independent tests on three chemicals. A similar test program conducted on the Air Science EFT™ filter suggests a higher retention capacity for the EFT™ system on two of the three chemical categories tested. In the third remaining category, it can be argued that the Neutrodine® advantage needs to be evaluated with regard to the corrosive impact on metal components and blowers used in ductless fume hood in applications involving moderate to heavy usage of hydrochloric acid.

Background

The Erlab Company launched the GreenFumeHood® at the Pittsburgh Conference (PITTCON) in March 2008. Erlab stated at that time the GreenFumeHood® with its "breakthrough" Neutrodine® technology was "a revolutionary system". Although the product was not to be available at the earliest until the fourth quarter of 2008, numerous claims and statements made by Erlab warranted consideration by facility planners and laboratory safety officers.

The author has carefully researched each of these claims and statements and summarized his observations and opinions below:

Erlab Claims about GreenFumeHood® and Neutrodine® Filtration Technology

Erlab has made the following assertions concerning their Neutrodine® system as compared to filtration systems in other ductless fume hoods.

- "50% + increase in retention capacity, which doubles filter life" *(Page 3 GreenFumeHood brochure 2008)*
- "Increased variety of retained molecules to 99.9% of commonly used chemicals within the laboratories." *(Page 3 GreenFumeHood brochure 2008)*
- "In fact, Neutrodine® can handle such a broad spectrum of molecules that it allows GreenFumeHood® to compete with the usage capabilities of traditional fume hoods." *(Page 2 GreenFumeHood brochure 2008)*

Erlab Filter Retention Capacity

The only known independent data available concerning the filtration effectiveness of Neutrodine® is derived from test reports issued by Intertek Testing Services on behalf of Erlab. Only three chemicals were tested: isopropanol, cyclohexane and hydrocloric acid.

GSA Schedule Contract GS-07F5832P

- The tests were done according to the AFNOR NFX 15-211 protocol to determine the retention capacity of a single filter module at 1% of the TLV.
- The results have been posted on the Erlab website. *P 15/219 Intertek report clyo8ro366, P 17/219 Intertek report clyo8ro366, P 17/198 Intertek report clyo8ro736*

Comparative Testing, Air Science EFT™ Enhanced Filtration Technology

Similar filtration efficiency testing was independently performed by IBR Testing Lab on the Air Science EFT™ Enhanced Filtration Technology system.

- The Air Science EFT™ report is contained in test report IBR JN: 10483
- The Air Science Enhanced Filtration Technology (EFT™) is a universal filtration system developed for use with a wide range of core chemical families. These include organic acids, alcohols, aliphatic hydrocarbons, aromatic hydrocarbons, esters, aldehydes, ketones, ethers, halogens and others.
- Although the EFT™ system is weighted to accommodate these families, it can handle inorganic acids as well.
- The Air Science EFT™ system is available as an option on Air Science Advanced™ ductless fume hoods, the Air Science Purair Eco™ Series fume hood, and can be retrofitted on many Air Science ductless fume hoods already in service worldwide.

Chart 1:

Retention Capacity (grams) for a Single Module at 1% of the TLV (Threshold Limit Value)

Specification	**ANFOR NFX 15-211**	
Testing Laboratory	**IBR**	**Intertek**
Product Manufacturer	Air Science	Brand E
Filter Type		Green
Test Results		
Isopropanol (alcohol)	2052	673
Cyclohexane (aliphatic hydrocarbon	1531	914
Hydrochloric acid (inorganic acid)*	1205	2729*

What the Test Means

Assuming that isopropanol and cyclohexane represent filter performance on the "core" chemical families typically used in ductless fume hood applications, the Air Science EFT™ filter appears to offer significant advantages (see chart 1).

With respect to inorganic acids, however, the EFT™ filter provides a lesser but realistic capacity because, with moderate to heavy acid applications, ductless fume hoods made of metal are subject to corrosion and rust. In those applications Air Science recommends polypropylene or total exhaust hoods with a specially formulated heavy duty acid filter.

Another possible comparison can be made between the Neutrodine® results and the retention capacity "at SETRAF value" for the Erlab Toxicap® 800 published in their 1994 "chemical listing".

- For isopropanol the Toxicap retention capacity with the T4AS filter was stated as 625 grams – only 7.7% less than the Neutrodine® value.
- On cyclohexane with the T4AS filter retention was stated at 890 grams – only 2.7% less than Neutrodine®.
- On hydrochloric acid with the T4BE filter the difference was a much more significant 49.9%.

Chemicals Compatible with Carbon Filtration

Traditionally, reputable suppliers of ductless fume hoods including Air Science have indicated that carbon filtration is appropriate for about 600 commonly used chemicals in laboratories.

- Conventional, industry-wide criteria suggests that a chemical to be considered compliant for use with carbon filtration should have a molecular weight greater than 30 and a boiling point greater than 65°C.
- A follow-up consideration is filter retention capacity for each qualifying chemical to establish and provide a reasonable filter lifetime.
- Erlab does not appear to have published independent testing results to support the claim that the Neutrodine® filtration system "increases the variety of retained molecules to 99.9% of commonly used chemicals within laboratories".
- Rather, Erlab has released detailed information on only three chemicals - isopropanol, cyclohexane, and hydrochloric acid – independently tested by Intertek.
- Erlab does not appear to have provided a comprehensive listing of chemicals either included or excluded from its definition of "commonly used" chemicals.
- Erlab company literature states that "*the remaining are either non-toxic or extremely rare molecules used by less than 0.1% of labs.*"(Page 3 GreenFumeHood Brochure). Yet, most manufacturers of ductless fume hoods have historically stated that carbon filtration is not appropriate for hydrogen, helium, methane, ethane, ethylene oxide, carbon monoxide, carbon dioxide, nitrogen monoxide, propylene, acetylene, radioisotopes, and perchloric acid among others. Boiling point and molecular weight are important factors in this selection process.

- Based on attempts to narrow the definition of included vs. excluded chemicals accommodated by the Neutrodine® system, it appears through the lack of specific published information that the range of chemicals not accommodated by the Neutrodine® system may be broader than the original marketing literature implies.

Without a specific knowledge of chemicals safely accommodated by the Neutrodine® filtration system, it is left to the customer or laboratory safety officer to determine whether the marketing literature describing the Neutrodine® system is sufficient to deploy the Erlab solution with confidence in its overall performance and protection.

Ductless vs. Ducted Fume Hoods

Because ducted fume hoods exhaust air and pollutants within the hood directly to atmosphere, ducted hoods are not usually subjected to restrictions on the type and quantity of chemicals that can be accommodated in the work area.

- High installation and first costs, high energy consumption and environmental pollution offset the benefits of ducted fume hoods in many facilities, encouraging the application and improvement of ductless fume hoods, especially in search of energy savings, environmental impact, reduced installation costs and portability.
- While ducted fume hoods offer almost unlimited capability, ductless fume hoods are inherently restricted and dependent on filter technology, both in terms in *what chemicals* the filter will accommodate and *how much* of a chemical load the filter can adsorb.
- Indications are that the Neutrodine® filter is subject to some of those same limitations as other carbon filters in terms of chemical range and capacity.

Ductless fume hoods should never be marketed as a universal solution to chemical vapor capture and laboratory safety. Instead, because the decision to use a ductless fume hood should be application based, this requires full disclosure by the manufacturer as to what chemicals various filters can safely accommodate, and an understanding by the customer as to what chemicals will be used and under what conditions.

While multiple-use filter systems like the Neutrodine® and the Air Science EFT™ Enhanced Filtration Technology offer a greater flexibility, the concept is not new. Air Science has always offered multiplex filters specifically formulated for use with multiple chemical families, as well as with HEPA/ULPA filters for biological applications.

Conclusion

Because selection and use of a ductless fume hood directly impacts laboratory safety, user safety and environmental impact, there is no allowance for ambiguity in performance specifications. While the industry will continue to improve the efficacy of ductless fume filters, filter combinations, monitoring and alarm techniques, product safety must never be compromised or misrepresented to the marketplace through incomplete or misleading information.

When considering a ductless fume hood for your laboratory, it is critical to evaluate the following:

- What is your application?
- What supporting documentation does the manufacturer offer to corroborate the efficacy of their product for the application(s) listed?
- If your purchase criteria requires a "green" fume hood for LEED or other initiative, please understand that all ductless fume hoods can be considered "green" when:
  - — Contaminated air is not exhausted to the environment.
  - — Filtered air is recirculated back into the laboratory, saving on heating and cooling costs.
  - — Installation and layout planning is simplified because there is no requirement for ductwork or connection to a facility exhaust system.

These "green" features are not revolutionary; they have existed ever since ductless fume hoods came into existence over 40 years ago.

Marketing the Concept

All ductless fume hoods, including the Erlab GreenFumeHood® and the Air Science Purair Series, as well as all ductless fume hoods manufactured by competitors, have inherent limitations imposed by carbon-based filtration systems. These limitations include:

- Range of chemicals accommodated by the filters.
- Retention capacity or volume of chemicals accommodated.

Responsible suppliers of ductless fume hoods have always taken great care to insure that potential users understand these limitations. When considering any ductless fume hood, it is the buyer's responsibility to look beyond marketing and advertising to verify that product and application claims are independently confirmed for the intended use.

About the Author

Andre Chambre is the CEO of Air Science LLC. He has been associated with the ductless fume hood industry for more than 20 years. He was formerly the US Vice President for Captair Labx and President, Astec Microflow, US. He was named President of Filtco Corporation Corporation in 2003. He serves as a Director of Air Science Technologies Ltd.

Air Science®

PO Box 6229 • Fort Myers, FL 33907
T/239.489.0024 • Toll Free/800.306.0656 • F/800.306.0677
www.airscience.com

Air Science, LLC is an Executive Member, SEFA.
EFT™ Enhanced Filtration Technology is a trademark of Air Science, LLC. GreenFumeHood® and Neutrodine® are registered trademarks of Erlab Group.

ENERGY STAR PARTNER

GSA Schedule Contract GS-07F5832P

CERTIFIED ISO 9001:2008 ISO 14001:2004 COMPANY
Certificate No CQR-1502 A / B