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Air Cleaners

The Seven Sins Of Air Purifier Manufacturers

With estimated sales of over 4 million units in 1999 in the United States,[1] room air purifiers have become standard appliances in many households and offices. Manufacturers of room air purifiers must strive - harder than any-one else in the air purification industry - to provide low cost products to their consumers. This has resulted in air cleaners with HEPA technology selling for as little as $80.00. While making air cleaning technology affordable is a commendable goal; misleading marketing statements and questionable air cleaning performance have many users disappointed.

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This article at-tempts to draw attention to a number of deceptive marketing practices, that air purifier manufacturers use, which are detrimental to the credibility of the air cleaning industry as a whole.

Since the science of air cleaning is a complex one, finding one's way through the maze of unsubstantiated claims and misinformation is a difficult task even for the most alert and critical consumer. Seven common industry practices in particular continue to confuse consumers and air cleaning professionals.

Sin #1: Theoretical HEPA Efficiency vs. Actual System Efficiency

Due to the high efficiency, reliability and proven track-record, HEPA technology has become the industry standard for particulate filtration in critical environments, such as semi-conductor cleanrooms and hospital operating rooms. Recognizing the great marketing potential of the term "HEPA", many manufacturers are using it to project a high-performance image onto their room air purifiers. What most HEPA-based air purifiers manufacturers conveniently omit to tell the consumer, is that their air purifiers provide nowhere near the performance level of professional HEPA filter systems used in hospitals and cleanrooms.

Often consumers are misled about an air purifier's efficiency in removing pollutants. Statements like "effectively removes 99% of all airborne allergens" or "efficiently scrubs the room free of air pollutants", lead consumers to believe that these air purifiers remove virtually all of the impurities from the air in a normal indoor environment.

Claims about HEPA-based air purifiers often state 99.97% filtration efficiency. In most cases, this is also not true. The actual efficiency, for particles of 0.3 microns or larger, of many HEPA-based air purifiers sold today is below 80%. The "99.97%" refers to, in most cases, the theoretical efficiency rating of the filter paper that is used in the air cleaning device at 0.3 microns or larger.

The performance gap between HEPA-based room air purifiers and professional HEPA filter systems is mainly due to cutting corners in mass-production and profit maximization. There are a number of reasons why most HEPA-based room air purifiers do not achieve actual HEPA performance:

1. HEPA-rated filter media is not used.
2. The HEPA filter media gets damaged during the pleating process (HEPA media breaks easily).
3. There is leakage between the pleated HEPA filter pack and the filter frame.
4. There is leakage between the HEPA filter frame and the air purifier housing.

Only very few manufacturers state the actual overall efficiency of their device, and even fewer guarantee and certify their air purifiers.

Sin #2: Overstating Actual Air Delivery Rates

Even the most efficient room air purifier in the world would not impact a room's air quality level, if it were not able to pass enough air through its filters. The amount of air that an air purifier is able to process (airflow rate) is usually expressed in cubic feet per minute (cfm). Consumers are often misled by exaggerated or false claims by manufacturers regarding air flow rates.

One common trade practice is to state the free-flow air handling capacity of the fan motor (i.e. without filters installed), rather than the actual airflow rate (i.e. with all filters installed).

Many manufacturers don't even make this vital air purifier statistic available to consumers. Instead, many state a suitable room size, without mentioning how many air changes per hour the air purifier would manage to produce in that size room.

Only very few manufacturers state the actual airflow rate of their device (with all filters installed), and even fewer guarantee and certify their air purifier's air flow rate.

Sin #3: ULPA is NOT Better than HEPA

In an effort to differentiate air purifiers from the mass of HEPA air purifiers on the market, some manufacturers have introduced air purifiers, which supposedly use ULPA technology. ULPA stands for Ultra Low Penetration Air and is used in modern cleanrooms. The difference between HEPA and ULPA is the efficiency rating of the filter media. Typical HEPA filter media has an efficiency of 99.97% at 0.3 microns, whereas ULPA media has an efficiency rating in excess of 99.999% at 0.12 microns.

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Stressing the higher efficiency at smaller particle size, manufacturers of ULPA-based air purifiers claim that these devices are superior to HEPA-based air purifiers. Unfortunately, this is a perfect example where the search for a better sales pitch has resulted in an inferior product, since the reverse tends to be the case. All things being equal, an air purifier that uses ULPA filter media will be less effective in reducing the particle concentration in a typical room, than the same air purifier equipped with HEPA filter media. And as with many HEPA-based air purifiers, many ULPA-based air purifiers come nowhere close to actually delivering 99.999% particle-free air.

While ULPA filter media has the potential to remove more particles than HEPA filter media, that advantage is lost in room air purifiers, due to the reduction of air flow caused by the denser ULPA filter media. ULPA filter media typically allow 20-50% less air to pass than HEPA filter media, resulting in fewer air changes per hour in a given room.

Sin #4: Ineffective Gas Phase Filtration

In many cases room air purifiers are purchased to deal with gaseous contaminants and odors. So it comes as no surprise that most manufacturers claim to use some technology to reduce gases and odors.

The most common technology adopted by air purifier manufacturers for the removal of gaseous pollutants is activated carbon. While activated carbon in its granular form is unquestionably effective for the removal of many gaseous contaminants, most room air purifiers on the market today use carbon fiber pads, which are only impregnated with activated carbon dust. These filter pads contain only a few ounces of actual activated carbon and as a result, are essentially ineffective for the removal of gases and odors.

Some manufacturers claim that their activated carbon filter eliminates all gaseous pollutants and odors, a feat that is scientifically impossible. Specific gaseous contaminants need specific gas phase filtration technology. Activated carbon does not efficiently adsorb low molecular weight gases.[ii] For this reason, special sorbents are needed to effectively deal with pollutants, such as formaldehyde, hydrogen sulfide and ammonia.

Many room air purifiers that use granular activated carbon also use zeolite. Zeolite is a natural mineral, whose pore structure is supposed to be better suited for the removal for gaseous compounds like formaldehyde and ammonia. In fact, there is no reliable scientific evidence to show that zeolite is able to remove any gaseous compound better than specialty impregnated carbons or impregnated alumina. So why is Zeolite used? Zeolite is an inexpensive "filler" that is less expensive than activated carbon. Secondly, the concept of using two different substances to control gases and odors sounds quite promising to the unsuspecting customer.

Sin #5: Sacrificing Long-Term Performance

While most tests and evaluations of air purifiers assess only air purifier performance during its first few hours of usage, the real test for air cleaning effectiveness is long term performance. Unfortunately, most manufacturers cut costs on features that would enhance long-term performance.

One standard industry practice is the use of ineffective pre-filtration. In HEPA based air purifiers, it causes the HEPA filter to become clogged at a rapid rate. This in turn reduces the air flow rate, thus resulting in fewer air changes per hour in a given room.[iii] This is a particularly serious issue, since some manufacturers inform their consumers that their HEPA filters will only need replacing every 3 to 5 years.

Insufficient pre-filtration, also, causes air purifiers with substantial granular activated carbon filters to quickly lose their gas phase adsorption potential. Dust particles - that should be trapped by pre-filtration - clog the miniscule pores of the activated carbon, and destroy its holding capacity to adsorb gases.

Another reason for poor long-term performance of air purifiers is that some air cleaning technologies suffer drastic reductions in air cleaning efficiency without regular maintenance or frequent filter change.

Air purifiers with electrostatic precipitator technology experience drastic efficiency reductions as the collector plates become covered with particles. Air purifiers that use electrostatically charged fibers (electrete) also rapidly loose filter efficiency with particulate loading, especially in the presence of tobacco smoke.[iv]

Sin #6: Frequent and Expensive Filter Replacement

While the initial purchase cost for many room air purifiers is relatively low, the cost of replacement filters can be substantial. Here are some reasons why many air cleaners require frequent and expensive filter replacement:

- Lack of effective pre-filters that protect activated carbon and HEPA filters from premature clogging.
- Use of small filter cartridges with low holding capacity for pollutants.
- Filter replacement instructions that base filter replacement intervals on time passed (e.g. every 6 months) rather than actual usage and degree of air pollution.
- Combining several different filter stages in one filter cartridge, thus forcing the user to replace all filters at once, even if only one filter stage is used up.

Sin #7.:Trying to be All Things to All People

While many air purifier manufacturers offer several models, these models often vary only in size, rather than air cleaning technology. And since manufacturers like to have their product appeal to as many potential customers as possible, they sell one and the same unit as the ideal solution for pet allergens, pollen, mold spores, microorganisms, tobacco smoke, odors, traffic fumes and chemicals, etc. In fact, some manufacturers claim that by virtue of using a multitude of filter stages their air purifier is more effective. Unfortunately, the effectiveness of the air purifier suffers, because more filter stages mean higher air resistance and lower air delivery. Air purifiers that only contain filter stages matched to the user's requirements, offer superior filtration efficiency and air flow.[v,vi]

Conclusion

Industry organizations, like AHAM, have set out to establish some reference point for air purifier performance, they have not succeeded to make comparison shopping for air purifiers a simple task. AHAM's testing protocols do not evaluate actual particle retention, gas phase filtration or long-term performance of air purifiers.[vii]

So what are the lessons when evaluating air purifiers? Don't believe every claim made by manufacturers. Realize that a $80 air purifier will have serious limitations. Ask manufacturers to substantiate their claims with independent evidence. Check the underlying technology and investigate whether it has been properly implemented. Use tools that allow objective evaluation of air cleaning performance, such as laser particle counters, to check manufacturer's particulate efficiency claims and evaluate actual particle reduction.

Misleading claims regarding air purifiers and air filters have in the past led to decisions and orders of the Federal Trade Commission against manufacturers, and are likely to do so in the future unless manufacturers practice better self-restraint and self-regulation. Participating in sound business practices and making scientifically proven claims will restore lost faith in room air purifiers, allowing consumers to make informed purchase decisions - based not only on price but, also, on actual performance.

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