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INDOOR AIR PURIFICATION SYSTEMS

COMPETITORS OVERVIEW

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TABLE OF CONTENTS

1	Introduction.....	2
2	Subject overview.....	4
3	Competitors	6
4	Comparative summary table	23
5	Conclusion	25

1 INTRODUCTION

Indoor air purification is a method for eliminating or deactivating indoor air pollutants. It helps to maintain a clean and safe environment at home and in manufacturing and production facilities. Indoor air purification removes contaminated particles and odors, eliminates gaseous pollution and endorses healthy air.

Growing awareness among consumers regarding the ill effects of indoor air impurities on their health boosts the demand for related solutions and products, sustaining growth in the global indoor air purification market. Leading companies in indoor air purification market have been investing heavily in R&D activities aimed at achieving product innovation based on consumer requirements.

The purpose of this paper is to review and analyze air purification manufacturers in the field of indoor air purification, based on the following criteria and limitations:

- The current review considers the markets in the UK, France and Japan.
- Indoor air purification products considered are designed for 100 m²-rooms, and are within the price range of \$200-\$900.

Air purification solutions have been contrasted with a unique single product, the Aura Air innovative in terms of its design and technology, in order to determine its competitive edge vis-à-vis other products in the field.

Our analysis focuses on premium, state-of-the-art air purifiers, i.e. solutions that are advanced and sophisticated in terms of their technology and/or design. Inasmuch as air purification producers met this criterion, we have considered 1) international corporations, offering a comprehensive and diverse product portfolio; and 2) boutique companies specializing solely in air purifiers. This paper's producer list therefore included both types of players.

In terms of their geography and fields of operations, producers were selected based on:

- 1) Indications of their role as players in designated markets (the UK, France and Japan), based on the local economic and business press^{1 2},
- 2) Indications of their business activities and accessibility to local consumers, based on the presence of a local dealership in one of the designated markets. Notwithstanding these two working assumptions, the business reality of online marketing and consumption makes products accessible to local consumers regardless of local dealerships.

Analysis criteria are as follows:

- Detection – which sensors monitor indoor and outdoor air quality
- Purification – which filters are being used (HEPA, carbon, etc.)
- Smoothness of operation (in terms of rattle)
- Price
- Effectivity span (in terms of indoor space)
- Dimensions – size and weight

¹ <https://www.standard.co.uk/shopping/esbest/home-garden/home-accessories/10-best-air-purifiers-2018-uk-philips-dyson-a3762626.html>

² <https://www.forbes.com/sites/forbes-finds/2019/05/14/8-best-air-purifiers-for-your-home/#98857a15563f>

- Filter changing frequency
- Additional features such as availability of remote control, connectability to mobile applications, custom design, warranty range and duration, etc.

2 SUBJECT OVERVIEW

The most economical and effective approach to indoor air pollution is to reduce or eliminate unnecessary sources of pollution and then to remove outside any unavoidable particles, gases, and excessive water vapor that may result from regular indoor activities such as cooking, cleaning, and bathing. Beyond minimizing unnecessary pollution and expelling unavoidable pollutants, it is often possible to lower indoor pollutant levels through ventilation, based on the cleaner outdoor air.

However, opportunities for ventilation are often limited by weather conditions or by outdoor contaminants. When source reduction and dilution are insufficient, air-cleaning devices can be useful. These fall into two general categories: 1) portable air cleaners; and 2) HVAC (Heating, Ventilation and Air Conditioning) or furnace filters and other duct-mounted air cleaners. **Portable air cleaners**, commonly referred to as 'air purifiers' or 'air sanitizers', are stand-alone units that must be plugged in and turned on

Air cleaners are usually available as small tabletop units or larger console units. Used as single-room solutions, rather than for an entire house, they can be removed to re-installed, wherever continuous and localized air cleaning is needed. Larger console units may be useful for houses that are not equipped with forced air heating and/or air conditioning systems.

Purifying techniques

There are two types of air purifying technologies: active and passive. Active air purifiers release negatively charged ions into the air, causing pollutants to stick to surfaces, while passive air purification units use air filters to remove pollutants. Several different processes of varying effectiveness can be used to purify air. As of 2005, the most common methods were high-efficiency particulate air (HEPA) filters and ultraviolet germicidal irradiation (UVGI). High-efficiency particulate arrestance (HEPA) filters remove at least 99.97% of 0.3-micrometer particles and are usually more effective at removing larger particles.

Ultraviolet germicidal irradiation - UVGI can be used to sterilize air that passes UV lamps via forced air.

Activated carbon is a porous material that can adsorb volatile chemicals on a molecular basis, but does not remove larger particles. The adsorption process when using activated carbon must reach equilibrium thus it may be difficult to completely remove contaminants.

Polarized-media electronic air cleaners use active electronically enhanced media to combine elements of both electronic air cleaners and passive mechanical filters. Most polarized-media electronic air cleaners use safe 24-volt DC voltage to establish the polarizing electric field. Airborne particles become ionized, or charged, as they pass through the electric field and adhere to a disposable fiber media pad.

Ionizer purifiers use charged electrical surfaces or needles to generate electrically charged air or gas ions. These ions attach to airborne particles which are then electrostatically attracted to a charged collector plate. This mechanism produces trace amounts of ozone and other oxidants as by-products.

Immobilized cell technology removes micro fine particulate matter from the air by attracting charged particles to a bio-reactive mass, or bioreactor, which enzymatically renders them inert.

Ozone generators are designed to produce ozone and are sometimes sold as whole-house air cleaners. Unlike ionizers, ozone generators are intended to produce significant amounts of ozone, a strong oxidant gas which can oxidize many other chemicals.

The basic components of an air purifier include a filter, or other air cleaning technology mean sand a fan that propels air through that filter/air cleaner. Air purifiers may also have a panel filter with bonded fine granules of

activated carbon, an activated carbon filter encased in a frame, or other sorbent mixtures to remove gases and odorous compounds.

Beyond simple filtration and sorption of odorous compounds using carbon, some air purifiers add further technologies to increase pollutant removal, inactivation, or conversion. Technologies can include electrostatic precipitation, ion generation, or ultraviolet (UV) lamps in combination with catalysts for photocatalytic conversion of gaseous contaminants.³

The global indoor air purification market size was valued at USD 11.34 billion in 2015. Asia Pacific indoor air purification market led the global industry and accounted for over 35% of total demand in 2015.

On the basis of product, the market is divided into dust collectors & vacuums fume & smoke collectors, mist eliminators, fire & emergency exhausts, and others. Dust collectors & vacuums accounted for the largest share in the global indoor air purification market. Fume & smoke collectors occupied the second largest share in the global indoor air purification market. Mist collectors occupied around 11.9% market revenue share of the global indoor air purification market in 2015.

Indoor air purifiers can be equipped with HEPA filters. HEPA is a type of pleated mechanical air filter. It is an acronym for "high efficiency particulate air [filter]". This type of air filter can theoretically remove at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 microns (μm).⁴ The HEPA segment accounted for 40.7% of the total demand in 2015, among all the technologies used in the industry. Activated carbon is anticipated to occupy the second-largest share in the global market.

Filters are measured by a "Clean Air Delivery Rate (CADR)" figure of merit. CADR of an air purifier is a numerical value assigned to an air purifier based on independent tests performed for the Association of Home Appliance Manufacturers (or AHAM). CADR describes how well the cleaner reduces tobacco smoke, pollen and dust. In other words, the CADR is an attempt to provide a uniform, objective standard by which potential buyers can easily evaluate the effectiveness of an air cleaner.⁵

³ <https://www.epa.gov/indoor-air-quality-iaq/improving-indoor-air-quality>

⁴ <https://iaq.zendesk.com/hc/en-us/articles/212107457-What-is-a-HEPA-filter->



⁵ <http://www.airpurifierguide.org/fag/cadr>

3 COMPETITORS



3.1 LG

Company website	https://www.lg.com/hk_en 
Company description	South Korean multinational electronics company headquartered in Yeouido-dong, Seoul, South Korea. Founded in 1958
Product	PuriCare™ 360° Air Purifier
Product description	360° Purification PM1.0 Sensor and Gas Sensor Eliminate 5 kinds of Harmful Gas include Formaldehyde Clean Booster SmartThinQ™ IoT Smart Home Appliance
Room size	58 M ²
Detection	Large Dust, Ultra-fine Dust, Allergen, Life Odor, Formaldehyde, Smog-causing Material
Purification	HEPA, Total Harmful Gas Care Filter
noise	50 / 25 db.
Size and weight	360 x 597 x 360 mm, 11.5 Kg
Structure of filter and Filter changing frequency	See another picture below 
figure of merit	CADR 430 M ³
Price	\$810
Additional features	<ul style="list-style-type: none"> ● Touch Panel ● Smart ThinQ® Application ● Remote Control ● Red dot design award 




3.2 MOLEKULE

Company website	https://molekule.com/#
Company description	Founded in 2014 by Dharendra Yogi Goswami , headquartered in San Francisco
Product	Molekule
Product description	portable air purifier with Dual-Filtration System
Room size	replace the air in a 600 square foot room (large living room) once an hour
Detection	VOCs, bacteria, viruses, and other pollutants
Purification	Pre-Filter and a PECO-Filter
noise	Auto: 42dBa (Hushed Conversation) Silent: 30dBa (Whispered Conversation) Boost: 55dBa (Normal Conversation)
Size and weight	23-inch Height x 8.25-inch Diameter, 8 kg
Structure of filter and Filter changing frequency	Filters delivered in 6-month refill packs for \$65/pack. 
Price	\$799
Additional features	<ul style="list-style-type: none"> • 2 Year Limited Warranty • Portable • controlled using its touch screen display and also can be connected to Wi-Fi and controlled remotely using the iPhone or Android app. 
Markets	United States and Canada



3.3 AIRPURA

Company website	https://www.airpura.com/ 
Company description	Canadian company, founded in 2004. Headquarters located on Laval, Quebec.
Product	https://www.airpura.com/shop/product/air-purifier-uv600-1537 
Product description	The filtration system using Airpura's patented TitanClean™ technology developed by NASA which reduces VOCs, airborne chemicals, odors and microorganisms. Removes a wide spectrum of harmful gases and odors originating from VOCs (Volatile organic compounds) and chemicals.
Room size	cleans 2000 sqft every 30 minutes.
Detection	dust and allergens dust, pet dander, mold spores and plant pollens
Purification	Prefilter, True HEPA filter, Activated Carbon Filter, oxidizer, UV
Noise	28-62 dB
Size and weight	15" x 23", 45lbs
Structure of filter and Filter changing frequency	Poly Prefilter, Vacuumable, Replace: 12 months Activated Carbon Filter, Replace: 24 months True HEPA filter (40 sq. ft), 99.97% of airborne particles ≥ 0.3 microns Replace: 3-5 years TitanClean Photocatalytic Oxidizer, Replace: 18-24 months UV Germicidal Lamp
figure of merit	CADR 560
Price	799\$
Markets	United States, Canada, Hong-Kong, Netherlands



3.4 IQAIR

Company website	https://www.iqair.com/ 
Company description	Swiss company, founded in 1963. Headquarters located on Goldach, Switzerland
Product	https://www.iqair.com/home-air-purifiers/healthproseries/features 
Product description	4-stage air cleaning system only uses the mechanical filters and doesn't emit any ozone or ions. PreMax filter, a certified HEPA pre-filter V5-Cell is the granulated activated carbon filter and the pelletized chemisorption. It deals with chemical contaminants and odors. HyperHEPA H12/13 air filter. It is a non-woven glass microfiber which can capture 99.97% down to 0.3 microns airborne particles. This HyperHEPA is tested to capture 95% of down to 0.003 microns in size.
Room size	cleans 1125 sqft every 12 minutes.
Detection	(VOCs), smoke, odors and other harmful chemicals, bacteria, viruses and combustion particles.
Purification	Pre-filter, True HEPA H12/13 filter, V5-Cell is the combination of granulated activated carbon filter and pelletized chemisorption.
Noise	57 dB
Size and weight	15" x 23", 45lbs
Structure of filter and Filter changing frequency	PreMax filter, a washable HEPA pre-filter needs to be changed after 18 months, V5-Cell is the combination of granulated activated carbon filter and pelletized chemisorption, lasts for 2 years. HyperHEPA H12/13 is a non-woven glass microfiber 
figure of merit	CADR 776
Price	799\$
Additional features	Remote control which is packing within the product box. Timer LED filter replacement indicator
Markets	worldwide


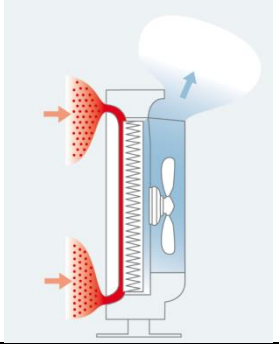

3.5 DYSON

Company website	https://www.dyson.com/en.html 
Company description	British technology company established in the United Kingdom by Sir James Dyson in 1991
Product	Dyson Pure Hot+Cool™ purifier fan heater
Product description	<p>The product simultaneously purifies and heat a whole room. Automatically sensing pollution, capturing ultrafine pollutants, and projecting purified and heated air using Air Multiplier™ technology.</p> <p>All the Hot + Cool Link's settings are adjustable via a remote control, which can handily magnesite to the top of the link when you don't need it. Or, you can operate the unit remotely using an app on your smartphone</p>
Room size	purification coverage in an 81m3 room (TM-003711)
Detection	allergies, pets, dust, smoke, pollen and mold spores
Purification	Activated carbon filters, glass HEPA
Noise	62 dB
Size and weight	764 mm X 248 mm X248 mm 4.98 kg
Structure of filter and Filter changing frequency	https://www.dyson.co.uk/purifiers/dyson-pure-hot-cool-technology.html £65.00
Price	£549.00
Additional features	<ul style="list-style-type: none"> • Adjustable oscillation angle from 45° to 350°, to project purified air around the whole room. • Remote control • Voice control 
Markets	worldwide


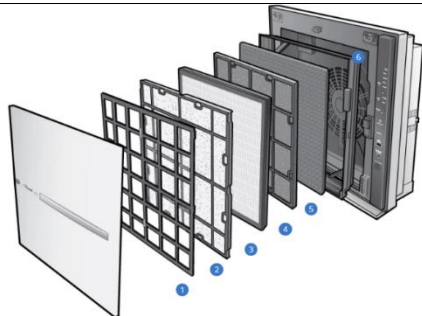

3.6 BLUEAIR

Company website	https://www2.blueair.com/gb/ 
Company description	Blueair is a Swedish company whose Headquarters located in Stockholm. founded in 1996. Parent organization: Unilever
Product	Blueair Classic 405
Product description	Classic air purifier will remove allergy and asthma triggers and other airborne irritants and pollutants from indoor air. The next generation of the Classic is Wi-Fi enabled; adjustments can be made anytime, anywhere via the Blueair Friend app.
Room size	40m ²
Detection	Pollen, dust, pet dander
Purification	HEPASilent+, particle filter
Noise	32 - 52 dB(A)
Size and weight	590 x 500 x 275 mm, 15 kg
Structure of filter and Filter changing frequency	6 months (4,380 hours) when used 24 hours a day, £65
figure of merit	<ul style="list-style-type: none"> • CADR (Smoke) 476m³ per hour (280 cfm) • CADR (Dust) 510m³ per hour (300 cfm) • CADR (Pollen) 510m³ per hour (300 cfm)
Price	£529
Additional features	<ul style="list-style-type: none"> • Wi-Fi connectivity • Remote control 
Markets	Worldwide

3.7 BONECO


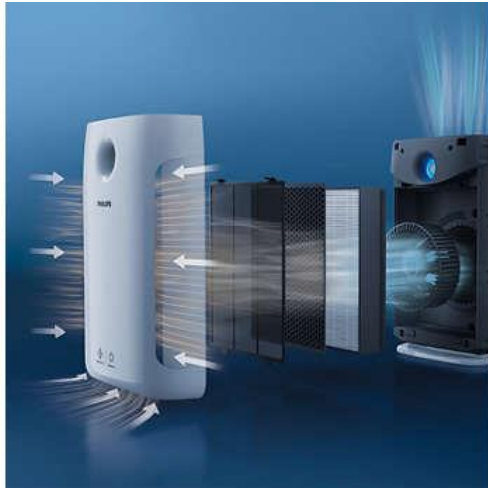

Company website	https://www.boneco.com/en	
Company description	BONECO AG is part of the PLASTON Group and is internationally active in portable air treatment solutions for living areas. Founded in Switzerland in 1956	
Product	Air Purifier P500	
Product description	Three specialized, multi-stage filters act as active protective shields and trap the smallest particles in the air. The P500 comes with filters that can be used individually to meet specific needs: «ALLERGY», «BABY» «SMOG» filter for city residents and smokers.	
Room size	rooms up to 28 m ²	
Detection	allergens, pollen, viruses, dust, pet dander, dust mites, smoke and odors	
Purification	HEPA and active carbon filters	
noise	31 – 60 dB(A)	
Size and weight	224×450×642 mm, 7.35 kg / 8.20 kg (with «ALLERGY» filter)	
Structure of filter and Filter changing frequency	https://youtu.be/6uwJTASQ0o	
figure of merit	258 CADR	
Price	€ 559.90	
Additional features	<ul style="list-style-type: none"> • Easy operation with the remote control • Container for the use of fragrances 	
Markets	US, Europe, Japan	

3.8 RABBIT AIR


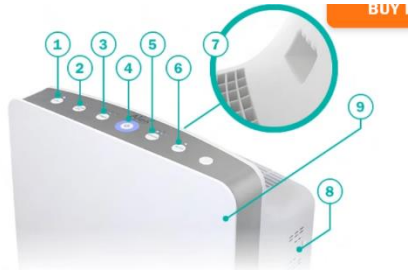

Company website	https://www.rabbitair.com	
Company description	Los Angeles-based company, Founded in 2004.	
Product	MINUSA2 ULTRA QUIET AIR PURIFIER	
Product description	Includes a five-speed fan, a transition light sensor and the ability to cycle the air in an 815 sq. ft. room twice every hour. It also features six layers of filters, including an upgraded BioGS HEPA filter and a customizable filter with pet allergy, germ, toxin or odor defense. BioGS® HEPA filtration system builds and improves on the traditional HEPA; composed of a proprietary fiber material, it traps allergens and particles down to less than 0.1 microns in size at 99.97% efficiency. ⁶ Can be installed on the wall.	
Room size	700 sqft	
Detection	Dust, Pollen, mold and fungi, pet dander, VOC, Bacteria & particles	
Purification	HEPA	
noise	20.8 to 45.6 dBA	
Size and weight	20H x 21.4W x 7D in., 8.8 kg.	
Structure of filter and Filter changing frequency	 <p>The BioGS HEPA filter traps airborne particles down to 0.3 microns in size, 99.97% of the time, and reduces common allergens to support optimum filter efficiency and prolong filter life.</p>	
figure of merit	CADR (Pollen)-171 CADR (Dust)-173 CADR (Smoke)-166,	
Price	\$549.95 Annual Filter Cost: \$42.50 (12hr/day operation) \$85.00 (24hr/day operation)	
Additional features	Ability to customize the filtration to target specific concerns. Customized filter is one of the five filters in the MinusA2 air purifier. This bonus layer of protection enhances the cleaning power of targeted pollutants. Each customized filter has a different proprietary coating or structure which helps target specific allergens or concerns. <ul style="list-style-type: none"> • Germ Defense Filter • Toxin Absorber Filter • Pet Allergy Filter • Odor Remover Filter • Different colors • 5-year guarantee 	
Markets	US, Canada, Japan	

⁶ <https://www.forbes.com/sites/forbes-finds/2019/05/14/8-best-air-purifiers-for-your-home/#38d4387f5563>

3.9 PHILIPS

Company website	https://www.philips.co.uk/ 
Company description	Koninklijke Philips N.V. is a Dutch multinational conglomerate corporation headquartered in Amsterdam
Product	Series 2000i
Product description	Purifiers series 2000i automatically monitors and purifies the air, then give real time air quality feedback via the display and the connected app. Also use the app for outdoor air quality and allergy management advice.
Room size	79 m ²
Detection	allergens, odors, VOCs and even certain bacteria
Purification	pre-filter, HEPA filter remove particles, Active Carbon filter reduces gases and odors.
noise	32–64 dB(A)
Size and weight	412*294*612, 7.7 kg
Structure of filter and Filter changing frequency	
figure of merit	CADR (Smoke) 179 m ³ /hr. CADR (Dust) 198 m ³ /hr. CADR (Pollen) 211 m ³ /hr.
Price	£ 400
Additional features	App-connected – so you can use your smartphone to change settings and review your air quality. 
Markets	Worldwide




3.10 ALEN

Company website	https://www.alencorp.com/	
Company description	American company, founded in 2004. Headquarters located on Austin, Texas	
Product	Alen BreatheSmart 45i HEPA Air Purifier + HEPA-Pure + White	
Product description	cover all major concerns: Allergies, Dust, Mold, Bacteria, VOCs, Cooking, Pet and Diaper Odors. Options include an antimicrobial treatment to capture and inhibit the growth of bacteria and fungi, Alan's proprietary odor-eliminating technology removes unwanted smells at the molecular level, and more.	
Room size	cleans 800 sqft every 30 minutes.	
Detection	allergies, dust, mold, bacteria, chemical fumes and heavy odors	
Purification	HEPA	
noise	55 dB	
Size and weight	25" x 15" x 8.5" ,6.8 kg	
Structure of filter and Filter changing frequency	<p>6-9 months</p> <div>  <p>FUNCTIONS</p> <ol style="list-style-type: none"> 1. Ionizer 2. Filter life indicator 3. Timer 4. Power/Sleep Mode & Air quality feedback light 5. 4-speed fan 6. Automatic mode 7. Handle for easy moving 8. SmartSensor 9. Available custom designer panels in a variety of color choices </div>	
figure of merit	CADR 245	
Price	429\$	
Additional features	<ul style="list-style-type: none"> ● 4-Color LED indicator takes out the guesswork ● 14 diverse color options ● Lifetime guarantee 	
Markets	Worldwide	


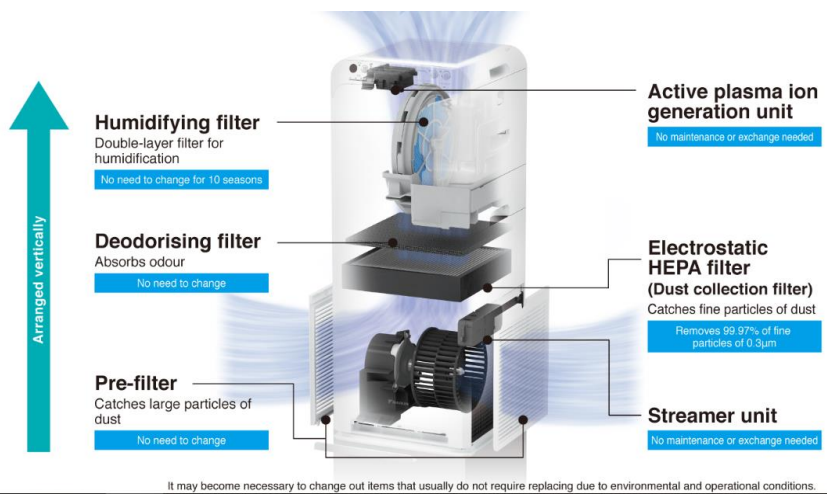

3.11 GUARDIAN TECHNOLOGIES

Company website	https://www.guardiantechnologies.com/ 
Company description	American company, founded in 2002. Headquarters located on Euclid, Ohio
Product	GermGuardian® AC9200WCA
Product description	Pre filter, HEPA filter that captures 99.97% of dust and allergens as small as .3 microns. An activated granular carbon filter attacks odor including smoke, cooking and pets. Reduces VOCs that are emitted by household products and cleaning chemicals. UV-C light technology kills germs including staph, influenza and rhinovirus. The Ionizer helps boost allergen control by attracting microscopic particles from the air which are then captured by the HEPA filter.
Room size	Cleans 31msq every 15 minutes.
Detection	dust and allergens dust, pet dander, mold spores and plant pollens
Purification	HEPA and UV-C light and ionizer
Noise	40 dB
Size and weight	9.75" x 17" x 27", 20.65lbs
Structure of filter and Filter changing frequency	6 months 
figure of merit	CADR 245
Price	429\$
Additional features	<ul style="list-style-type: none"> • Programmable timer • Filter Replacement Reminder • AHAM Verified and Energy Star Certified 
Markets	US and Canada, selected markets via Amazon



3.12 WINIX

Company website	https://winixamerica.com/	
Company description	South Korean company, founded in 1973.	
Product	HR900	
Product description	Air Purifier combines air cleaning technologies with user centric design	
Room size	400 sq. ft	
Detection	Chemical Pet dander Virus/ Germ Tobacco smoke Mold/ Mildew Dust mites Hair/ Pet hair Dust Pollen VOCs Smoke/ Gas Odor	
Purification	Pre-Filter, - Permanent, HEPA filter True-HEPA filter 1 year, Carbon filter Coated Deodorization (CD) Carbon Filter 1 year	
noise	26.4 - 60 dB	
Size and weight	9.6 × 16.3 × 23.6 inch	
Structure of filter and Filter changing frequency		
figure of merit	CADR (Dust / Pollen / Smoke) 264 / 301 / 258	
Price	379 \$	
Additional features	<ul style="list-style-type: none"> • IoT • Outdoor air quality monitoring ability 	
Markets	International shipping via Amazon	

3.13 DAIKIN

Company website	https://www.daikin.com/ 
Company description	Daikin Industries, Ltd. is a Japanese multinational air conditioning manufacturing company headquartered in Osaka. It has operations in the United States, Japan, China, Philippines, Australia, India, Southeast Asia, Europe, and South America. Founded in 1924
Product	AIR PURIFIER MC30UVM6
Product description	<p>Daikin products offer:</p> <p>Air Cleaning -Streamer and filtration technologies remove airborne allergens such as mold, mites, and pollen as well as adjuvant substances, viruses, and bacteria.</p> <p>Deodorization - The causes of bad odors are decomposed and removed by Streamer and filter technologies.</p> <p>Powerful Suction - air intake design which enables a greater volume of air to be cleaned for faster air purification.</p>
Room size	-----
Detection	mold, mites, pollen, odors
Purification	pre filter, HEPA, humidifying filter, carbon deodorizing filter
noise	33 dB
Size and weight	Height:455 mm, Width:280 mm, Depth: 189 mm 5.0 Kg
Structure of filter and Filter changing frequency	
Price	\$265
Additional features	<p>Odor removal Active Carbon filter</p> 
Markets	Worldwide


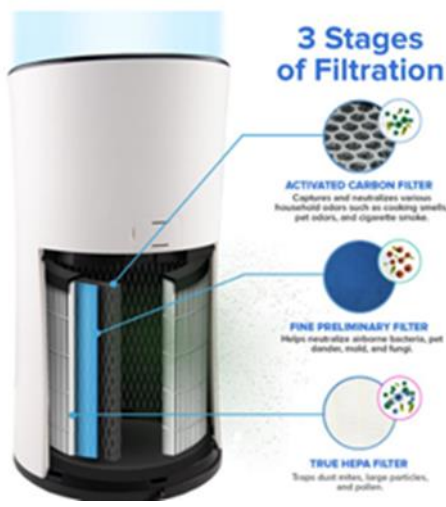

3.14 SHARP

Company website	https://sharpconsumer.eu/ 
Company description	Sharp Corporation is a Japanese-Taiwanese multinational corporation that designs and manufactures electronic products, headquartered in Sakai-ku, Sakai. Founded in 1912.
Product	SHARP HEPA AIR PURIFIER WITH PLASMACLUSTER® ION TECHNOLOGY FOR SMALL ROOMS (FP-F50UW)
Product description	combines patented Plasmacluster ion technology with True HEPA filtration
Room size	up to 210 sq. ft
Detection	pollen, dust, pet dander, smoke, germs, bacteria, viruses, odors, mold, and fungus
Purification	True HEPA filtration Washable deodorizing carbon filter
noise	Noise level in cleaning mode: high / mid / low 49/41/16
Size and weight	15 x 9.4 x 1.3-inch, 0.5 kg.
Structure of filter and Filter changing frequency	Every 2 years
figure of merit	Dust: 153 Pollen: 155 Smoke/Tobacco: 133
Price	\$221.99
Additional features	1-year warranty 
Markets	Worldwide


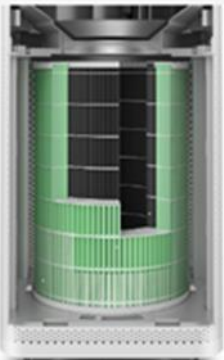

3.15 PANASONIC

Company website	https://www.panasonic.com/global/home.html 
Company description	Japanese multinational electronics corporation headquartered in Kadoma, Osaka, Japan. Founded in 1918
Product	Non-Humidifying nanoe™ HEPA Filter Air Purifier F-PXM35ASM
Product description	<p>air purifier with nanoe technology with direct front suction that reduces allergen content. Nanoe is acidic water particle with a reactive substance and an electric charge. Removes bacteria and viruses.</p> 
Room size	26m ² (280ft ²)
Detection	bacteria, viruses. Allergan
Purification	HEPA, Deodorizing Filter, Humidifying Filter
Noise	44
Size and weight	520 x 300 x 189mm, 4.8kg
Structure of filter and Filter changing frequency	<p>HEPA Composite filter maintain a clean space by removing 0.3um particles up to 99.97%. Super alleru-buster – can inhibit certain kinds of allergens. Green tea catechin – can inhibit certain kinds of viruses. Anti-bacteria enzyme – prevents the reproduction of bacteria and molds.</p>
Price	\$220
Additional features	<p>Direct front suction</p> 
Markets	Worldwide

3.16 LEVOIT

Company website	https://www.levoit.com/	
Company description	Established as a brand in 2017, Levoit is headquartered in Orange County, CA, U.S	
Product	LV-H133 Tower HEPA Air Purifier	
Product description	HEPA Air Purifier for Home Large Room	
Room size	538 ft ² (50 m ²)	
Detection	Allergies and Pets, Smokers, Mold, Pollen, Dust	
Purification	3 filters: preliminary filter, true HEPA filter, and activated carbon filter	
Noise	54db	
Size and weight	2 ft by 1ft diameter	
Structure of filter and Filter changing frequency		
figure of merit	(CADR): 235 CFM (400 m ³ /h)	
Price	\$199	
Additional features		
Markets	Various markets, including US, Japan , UK , France	

3.17 XIAOMI

Company website	https://www.mi.com/global/index.html	
Company description	Chinese electronics company founded in 2010 and headquartered in Beijing.	
Product	Mi Air Purifier	
Product description	High performance smart air purifier, CADR of up to 406m ³ /h	
Room size	400 sq.	
Detection	Dust, pollen, allergens, smoke odors, Formaldehyde	
Purification	3 filter Coconut activated carbon filter, HEPA filter and Primary filter	
noise	31dB	
Size and weight	240 x 240 x 520 mm	
Structure of filter and Filter changing frequency		
figure of merit	CADR of up to 406m ³ /h, 48m ² effective coverage	
Price	\$176	
Additional features	Can use phone as a remote to power on, power off, and switch modes. The Mi Home app allows monitor home air quality from mobile devices.	
Markets	Worldwide	

4 COMPARATIVE SUMMARY TABLE

Company	Purification	Detection	IoT access and control an Air Purifier's function from anywhere	Price
LG	Large Dust, Ultra-fine Dust, Allergen, Life Odor, Formaldehyde, Smog-causing Material	HEPA Total Harmful Gas Care Filter	Yes	\$810
Molekule	VOCs, bacteria, viruses, and other pollutants	Pre-Filter PECO-Filter	Yes	\$799
Airpura	VOCs, airborne chemicals, odors and microorganisms' harmful gases and odors originating from VOCs and chemicals like cosmetics, paints, carpet, upholstery and more	Prefilter, True HEPA filter, Activated Carbon Filter, TitanClean reflectors	No	\$799
IQAIR	(VOCs), smoke, odors and other harmful chemicals, bacteria, viruses and combustion particles.	Prefilter, True HEPA H12/13 filter, V5-Cell is the combination of granulated activated carbon filter and pelletized chemisorption	No	\$799
Dyson	allergies, pets, dust, smoke, pollen and mold spores	Activated carbon glass HEPA	Yes	\$685
Blueair	Pollen, dust, pet dander	HEPASilent+ particle filter	Yes	\$660
Boneco	allergens, pollen, viruses, dust, pet dander, dust mites, smoke and odors	HEPA active carbon	No	\$616
RabbitAir	Dust, Pollen, mold and fungi, pet dander, VOC, Bacteria & particles	HEPA	No	\$550
Philips	allergens, odors, VOCs and even certain bacteria	pre-filter HEPA filter Active Carbon	Yes	\$500
Alen	allergies, dust, mold, bacteria, chemical fumes and heavy odors	HEPA	Yes	\$429
Guardian Technologies	dust and allergens dust, pet dander, mold spores and plant pollens	Pre filter, HEPA filter, UV-C light Ionizer	No	\$399
Winix	Chemical Pet dander Virus/ Germ Tobacco smoke Mold/ Mildew Dust mites Hair/ Pet hair Dust Pollen VOCs Smoke/ Gas Odor	Pre-Filter, Permanent, HEPA filter True-HEPA filter 1 year, Carbon filter Coated Deodorization (CD) Carbon Filter 1 year	Yes	\$379
Daikin	mold, mites, pollen, odors	pre filter	No	\$265

Company	Purification	Detection	IoT access and control an Air Purifier's function from anywhere	Price
		HEPA humidifying filter carbon deodorizing filter		
Sharp	bacteria, viruses, allergens, molds, removing odors and static electricity	Pre-filter Odor filter HEPA filter	No	\$221.99
Panasonic	Odor, dust, bacteria, allergens	HEPA Deodorizing Filter Humidifying Filter	No	\$220
Levoit	Allergies and Pets, Smokers, Mold, Pollen, Dust	3 filters: preliminary filter, true HEPA filter, and activated carbon filter	No	199 \$
Xiaomi	Dust, indoor plant pollen, pet fur	3 filter Coconut activated carbon filter, HEPA filter and Primary filter	Yes	\$176

5 CONCLUSION

Aura's air purification solution, the Aura Air, is a premium product, both in terms of 1) its features and technology, whose 3-layer mechanism consists of a unique combination of HEPA, carbon and copper filters; and 2) its design, positioned by hanging, rather than as a stand-alone device, as most other solutions are. Additionally, the Aura Air tracks and monitors outdoor pollutants and projects their respective indicators for consumers to follow.

Comparisons between the Aura Air and equivalent air purification solutions yields the following conclusions:

- Aura Air is a unique product in terms of its filtering mechanism buildup: no other product was found to rely on a copper filter. Combining the copper filter with carbon/HEPA components significantly magnifies the product's filtering capacity and thereby contributes to its competitive edge.
- Whereas most air purification solutions are stand-alone, portable devices, the Aura Air is installed by hanging. Based on our search, the Rabbit Air is the sole other product that is installed in such a way.
- The ability to track and monitor the levels of outdoor pollutants is another advantage of the Aura Air, compared with alternative solutions. This feature considerably extends the device's detection capacity. It makes it possible for consumers to take into account and accommodate themselves to the outdoor environment by adjusting the indoor filter accordingly. No other air purification solution incorporates this feature.
- In terms of pricing, air purification solutions range between 200\$ and 900\$. The Aura Air can thus be referred to as relatively affordable.