

# **Introduction of Air Dome**

## **Selected as Excellent Inventions**

**(Hosted by the Korean Intellectual Property Office and  
Korea Invention Promotion Association)**

Wearable air purification

Air Dome

Clean and fresh the polluted air

**Innovative Digital Company**

# What is Air Dome?

- **H13 (ultra fine dust collection 99.95%)HEPA filter application and positive pressure**

**(internal pressure is higher than external) completely shuts off the outside air.**

- **A large-capacity two way valve quickly and smoothly discharges carbon**

**dioxide emitted by itself.**

- **It provides enough fresh air (8 ~ 16L per minute) for easy breathing, no**

**unpleasant smell, and no fogging when wearing glasses.**

- **Mass industrial waste generated by the use of disposable masks is greatly**

**reduced (up to 98%).**

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# 1. Product Overview

- **Definition of Product:** Wearable Air Cleaning Mask that purifies contaminated air and provides only purified air to the user.
- **Technology and Features:** Force the surrounding air to be drawn and purified using ultra-small centrifugal driven air compression technology. Therefore, it allows for the flow of purified air into the user's respiratory system. It features a structure that allows users to breathe out quickly and has an external air shielding function.
- **Patent technology:** By applying an air buffer filter that can also be used as a humidifying filter inside the Air Dome(product name), it can play a role that does not move or deviate from the face even when intermittent excessive breathing (cough or sigh).If you are forced to inhale a large amount of air at a moment due to an involuntary risk of life due to your constitution and illness, you have an emergency valve structure that can respond to emergency situations in which valves are kept open by rapid decompression.  
(Out of 4 patent registrations and 2 patent reviews)



The air buffer filter is applied to prevent intermittent over-breathing from causing separation and movement in the face. (The air buffer is also used as a humidifier by wetting it.)

Valve structure to respond to emergency situations in which the valve is opened by rapid decompression if a large amount of air is inhaled consciously and unconsciously due to the threat of life.



## 2. Example of wearing an air dome



- ▣ The Vehicle System Air Dome is fully capable of responding to fine dust and is comfortable and safe to wear for a long time.

### 3. Problems of existing yellow dust mask

- If the existing yellow sand mask is not in close contact with the face, fine dust will inevitably flow even if the mask is worn.
- If it is close to the face and the blocking rate of fine dust is high, breathing becomes uncomfortable and difficult to wear for a long time.
- If it sticks well and has a high level of fine dust blocking, it can cause you to continuously inhale carbon dioxide from your body, and it is very dangerous for pregnant women, the elderly, the children and the general public as it is difficult to enter outside air. Never applicable, especially to patients with respiratory and lung diseases.
- Breathing is the maintenance of life by supplying oxygen to tissues in the body through gas exchange between the atmosphere and the body, regulating brain blood flow, controlling heart rate, and secreting various enzymes and removing carbon dioxide generated in these processes and discharging it to the atmosphere. It is an important physiological phenomenon. Masks with a high blocking rate that do not take into account these physiological phenomena can be fatal for those who are vulnerable to fine dust, such as pregnant women, the elderly, and children.

Fine dust mask for children in Korea, prohibited for children in advanced countries

Change after wearing fine dust mask

Experiment with 20 pregnant women wearing N95 masks similar to KF94

Total breathing volume: 23% reduction

Amount of oxygen inhaled: 13.8% reduction

Amount of carbon dioxide exhaled: 17.7% reduction

<I'm going to choke while trying to stop the fine /

Source: Dong-A Ilbo 2018.04>

It contains 4% of carbon dioxide in the breathing that is exhaled during a single breath, and continuous inhalation will have a fatal effect on the human body.

Increased involuntary Respiration: 3.0

Stimulation in the eyes, neck, etc.: 4.0

Increased conscious Breathing:6.0

Headaches, Dizziness, Blood pressure increase: 8.0

Vomiting, Unconsciousness, Death:10.0

<1hour continuous suction condition >

The persistent lack of oxygen in the human body is very dangerous because it causes Acute anoxia.

The normal oxygen intake during a single breath is 21%, so the blood oxygen saturation level should be maintained.

Normal state:21

Oxygen default:18

Increased breathing, Headache: 16-12

Excitement, Instability, Memory loss: 14

Breathing stop, Cardiac arrest: 10-6

< (left) Effects of continuous carbon dioxide inhalation on the human body and (right) effects on the human body due to decreased oxygen saturation in the blood/ Source: Medical information from Seoul National University Hospital, etc. >

## 4. A paper on causing severe headache when wearing N95 (KF94 grade) mask

- According to the 2006 paper "Headaches and the N95 Face-mask amongst Healthcare Providers" published by Singapore National University Hospital, medical workers analyzed that the constant use of N95 (KF94-level) masks used to prevent infectious diseases would not only cause headaches but also require the use of miscarriages painkillers in severe cases.
- The more frequently people wore, the more frequent they left the industry due to habitual headaches, which led to the recommendation that medical workers reduce the time to wear N95 face-mask as much as possible.

### Headaches and the N95 face-mask amongst healthcare providers

Lim ECH, Seet RCS, Lee K-H, Wilder-Smith EPV, Chuah BYS, Ong BKC. Headaches and the N95 face-mask amongst healthcare providers. *Acta Neurol Scand* 2006; 113: 199–202  
© 2006 The Authors Journal compilation © 2006 Blackwell Munksgaard.

**Background:** During the 2003 severe acute respiratory distress syndrome epidemic, healthcare workers mandatorily wore the protective N95 face-mask. **Methods:** We administered a survey to healthcare workers to determine risk factors associated with development of headaches (frequency, headache subtypes and duration of face-mask wear) and the impact of headaches (sick days, headache frequency and use of abortive/preventive headache medications). **Results:** In the survey, 212 (47 male, 165 female) healthcare workers of mean age 31 years (range, 21–58) participated. Of the 79 (37.3%) respondents who reported face-mask-associated headaches, 26 (32.9%) reported headache frequency exceeding six times per month. Six (7.6%) had taken sick leave from March 2003 to June 2004 (mean 2 days; range 1–4 days) and 47 (59.5%) required use of abortive analgesics because of headache. Four (2.1%) took preventive medications for headaches during this period. Multivariate logistic regression showed that pre-existing headaches [ $P = 0.041$ , OR = 1.97 (95% CI 1.03–3.77)] and continuous use of the N95 face-mask exceeding 4 h [ $P = 0.053$ , OR = 1.85 (95% CI 0.99–3.43)] were associated with development of headaches. **Conclusions:** Healthcare providers may develop headaches following the use of the N95 face-mask. Shorter duration of face-mask wear may reduce the frequency and severity of these headaches.

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< Paper Abstract, 2006 at Singapore National University Hospital >

# 5. Country warning for N95 mask and vicious cycle of environmental pollution when disposable mask is used

## 1) Warning of N95 masks by national government agencies

Singapore Health Ministry	<ul style="list-style-type: none"><li>-If the air quality is very poor (PSI&gt;200), the elderly, pregnant women, or people with lung or heart problems should consult a doctor about using the N95 mask.</li><li>-There is no international certification standard for the use of child masks; certification standards apply only to adults.</li><li>- If a child with chronic heart and lung diseases has any doubts or discomfort with the child when using the mask, consult your doctor.</li></ul>
U.S Food and Drug Administration (FDA)	<ul style="list-style-type: none"><li>-N95 masks can make breathing more difficult when worn, so those who may experience difficulty breathing due to chronic respiratory, heart or other medical symptoms should consult the medical team before using the N95 mask.</li><li>-If the mask is damaged or contaminated, or if breathing becomes difficult, remove the mask and discard it properly and replace it with a new one.</li></ul>
Hong Kong Environmental Product Declaration (EPD)	<ul style="list-style-type: none"><li>-N95 masks have relatively high levels of particulate contaminants and can provide sufficient protection on days when prolonged outdoor activities are unavoidable.</li><li>However, those with diseases such as seniors, chronic lung disease, disease, or paralysis and pregnant women should stop using these masks and consult with their doctors if they feel uncomfortable when wearing particle filter masks because of reduced lung capacity or respiratory problems.</li></ul>
Japan (cautions on products sold in Japan)	<ul style="list-style-type: none"><li>- Do not use infants or those with respiratory problems.</li><li>-If you feel the smell of the mask bothers you, if you feel it's hard to breathe, or if your condition is bad, stop using it.</li><li>- If you experience symptoms such as itching and skin upset, stop using it immediately.</li></ul>

< Source: 2018 Hankyoreh Media Do you really know "fine dust"? some of the contents >

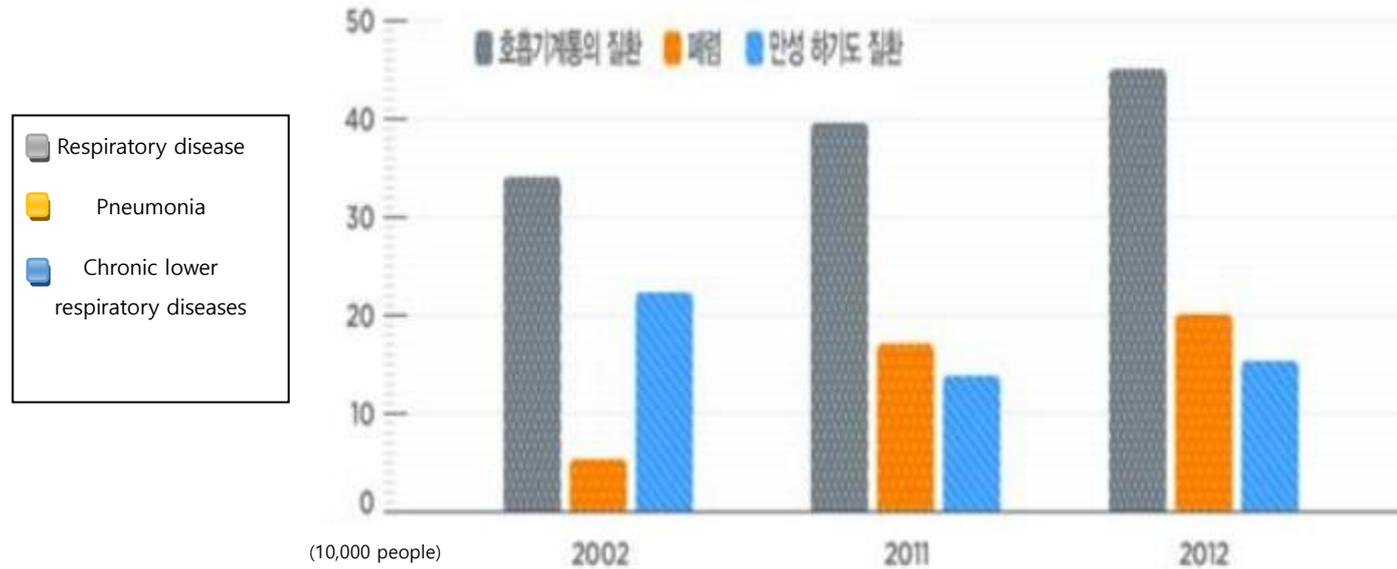
## 5. Country warning for N95 mask and vicious cycle of environmental pollution when disposable mask is used

### 2) The vicious cycle of environmental pollution in disposable health (yellow dust) masks

- Recently, various disposable yellow dust masks have been used due to the severity of fine dust, and the huge amount of yellow dust masks that must be discarded after one use must be a series of vicious cycles that cause other processing costs and environmental pollution.
- In the case of Air Dome, filter replacement cycles can be reduced by 97% of the minimum existing yellow dust mask waste (from 1 day to 8 hours to 30 days), and approximately 98% of the existing yellow dust mask waste can be reduced by 4 hours per day.

## 6. Causes of increased respiratory disease and costs of social loss (1.4214 trillion won)

■ The number of deaths from diseases of the respiratory system in Korea has increased by 5.8% each year from about 330,000 in 2002 to about 550,000 in 2012.



<Mortality rate due to lung disease and respiratory disease / Source: Statistics Korea 2012 data>

■ It is analyzed that the prevalence rate has increased due to rapid aging and air pollution as a major cause of the Chronic Structural Pulmonary Disease (COPD) and the social cost of treatment is expected to increase further because there are no clear symptoms despite chronic diseases.

< Source: Kim Young-kyun, chairman of the Korea Tuberculosis and Respiratory Association, and others >

■ According to data released by the Tuberculosis and Respiratory Research Council for 2017, the cost of domestic socioeconomic burden due to the Chronic Structural Pulmonary Disease (COPD) reached 1.42 trillion won annually.

■ According to the details, insurance and medical expenses are 234 billion won, unofficial medical expenses 50 billion won, nursing expenses 562.6 billion won, transportation costs 4.8 billion won, productivity loss 461.2 billion won, and early death costs 109 billion won.

< Source: Announcement of "15th Lung Day" in 2017 and Reprocessing JoongAng Ilbo >

# 7. Safety of Air Dome

■ According to a press release and action report from the Ministry of Environment's Chemical Policy in 2016, an anti-bacterial filter was detected with harmful OIT components, which resulted in massive collection.

The Food and Drug Administration, which is in charge of health mask certification, does not certify anti-bacterial products.

■ Inorganic material additions are difficult to be certified as a yellow sand mask even if the inorganic client proves harmless when adding inorganic substances because the properties of the atoms vary in many ways according to the number of Outermost Electrons , as well as materials that are changed by chemical action can have new chemical components into substances that have not been verified in the present.

National happiness			
Press release			
Report Date	Report immediately		
Department in charge	The Chemical Policy of the Environment Ministry	Chief Hong Jung-sup/Lee Seung-joon, an official.	044-201-6770/6783
	Ministry of Commerce, Industry and Energy National Institute of Technology Standards Product Market Management Division	Chief Jung Min-young/Shin Sang-chun, an official.	043-870-5420/5422
Distribution date	2016.7.20/ Total 13		

**Air cleaner · Car air conditioner OIT antibacterial filter risk assessment results**

◇As it is confirmed that OIT is released in the process of using the product, it is planned to disclose the product name and collect it jointly with relevant ministries.

◇Although it is not an OIT, filters using antibacterial substances are also taken first, such as voluntary collection for the safety of the people, and the safety glasses are quickly verified.

< Antibacterial filter evaluation and action points for chemical policy of environment in 2016 >

■ For filters applied to Air Dome, machined filters can be applied only with H13 grade non-woven components to ensure safety.

## 8. Performance of Air Dome\_1

- Even though the fabric of the filter is rated H13 (collection rate 99.95%), the collection rate is inevitably reduced due to cutting in the processing process, bending and adhesion in the folding process to maintain the shape, and gaps in the assembly process with the injection.
- As with all products, the filter cannot be used alone and is inserted or attached to a separate device to use the filter. Due to the structural problems of the insertion and installation of the filter, leakage may occur through some gaps without passing through the filter, so the fine dust prevention rate and leakage rate must be tested in the actual conditions of use must be checked for accurate performance.
- Air Dome has secured 99% dust collection rate for the use of finished products.
- ※ The TEST agency is a health mask test agency designated by the Ministry of Food and Drug Safety, and was conducted in the same way as the health mask (yellow sand mask) test method at the government-funded agency, Gyeongbuk TP.

1. Client

Agency name: Vehicle System Inc.

Address: Seoul Gwanak-gu's Nanhang 7-gil 68

2. Test item/material/Description: Air Dome Mask

3. Test date: 2019.01.25

4. Test Method: Guidelines for the Standards of Health Mask

5. Test results

1) Dust collection efficiency-Sodium chloride (Type: 90 LITERS/MIN)

	FLOW (LITERS/MIN)	RESISTANCE (mmH2O)	PENETRATION (%)	Dust collection efficiency (%)
Air Dome Mask Filter	94.4	151.4	1.30	99

<Data photography>

<Currently, health masks (yellow dust masks) using electronic devices are not subject to certification by the Food and Drug Administration, so tests are conducted on the same conditions.>

# 9. Performance of Air Dome\_2

- Completed acquisition of KC, CE and FCC to certify national stability



<Status of securing reliability by country of finished product condition> (From left to right KC, CE, FCC)

- Supports a minimum of 8ℓ/min to 16ℓ/min above the minimum ventilation (6ℓ/Min) of a step-by-step wind flow general adult



<Ultra air flow rate of final stage purified air 8ℓ / min (4ℓ + 4ℓ)>



<Ultra air flow rate of final stage purified air 16ℓ / min (8ℓ + 8ℓ)>

# 10. The scope of application of the Air Dome

■ Air Doms must be applied first to workers in public institutions.

(subway workers, organization workers, traffic police, external exposure public service workers, etc.)



■ A national disaster that cannot be safe from fine dust, such as the elderly, pregnant women and children as well as the general public.

(Applicable to all the people)



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# Thank you

-All employees of Vehicle System Inc. -