

Bipolar Air Ionisation Overview.

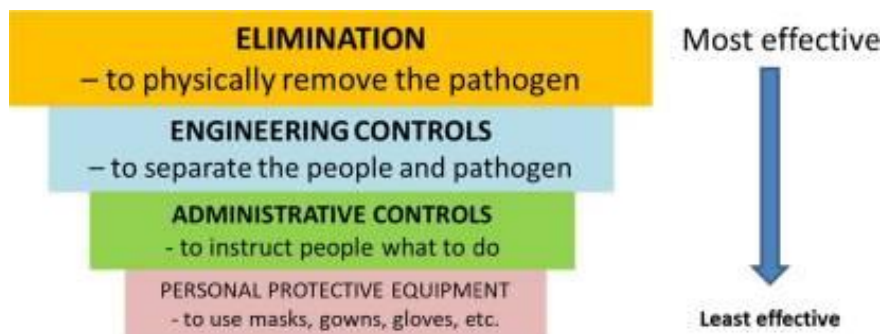
Professor Chris McLellan PhD

Indoor air quality (IAQ) presents one of the top 5 threats to general health on the basis that people are spending 90% of their daily lives time indoors. IAQ is affected by gases (such as carbon monoxide and carbon dioxide), volatile organic compounds (VOCs), microbes (including bacteria, viruses and mould fungi) and aerosolised immunocompromising pathogens and as such, the quality of air inside homes, offices, commercial retail, aged care facilities, gyms and other private and public spaces where people spend a large part of their life, is an essential determinant of population health and wellbeing.

In general, the great majority of human infections are transmitted by direct (infected people coughing, sneezing or touching an infected person's hands or face) and indirect contact (touching surfaces like doorknobs, elevator buttons, etc. then touching your nose, eyes, or mouth to provide a conduits of entry into the body). In relation to viral transmission, and specifically the well reported transmission characteristics of the novel coronavirus SARS-CoV-2 COVID-19 that is spread via direct and indirect contact, Horyzen Labs are providing a continuous indoor environmental sanitizing technology for commercial and residential buildings, hotels and casinos via a unique Bi-polar Ionisation (BPI) device delivered through existing heating, ventilation, and air conditioning (HVAC) systems to neutralise up to 99.9 percent of airborne and surface pathogens.

The Horyzen BPI air purification technology acts to continuously disinfect and remove contaminants from indoor spaces to suppresses airborne and surface microbials and pathogens, including viruses, bacteria and mould, and reduces odours as well as unhealthy and irritating VOCs via pathogen elimination, the most effective system for continuously cleaning and decontaminating indoor air available worldwide (Figure 1).

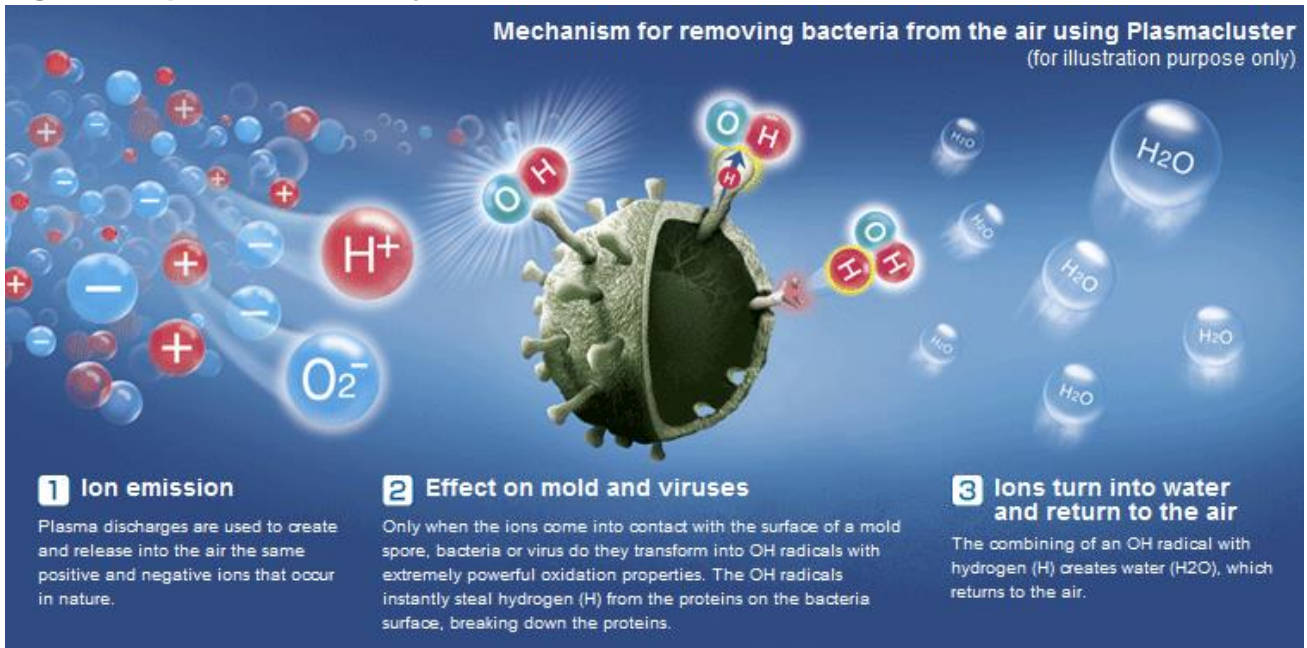
Figure 1: Effectiveness of Indoor Air Decontamination Methods



(Adapted from Morawska et al 2020) (1)

Bipolar Ionisation (BPI) is created when an alternating voltage source (AC) is applied to airflow as it passes through the bipolar ionisation tube. The tube energizes the air to form bipolar (positive and negative) air ions. The airflow distributes the energized ions into all the spaces served by the duct system in an in-duct installation, or into the applicable space if a standalone unit is used (Figure 2). The Horyzen BPI system integrates into existing commercial and residential HVAC systems and unlike most air purification systems actively seeks out particulates and contaminants, including germs and does not wait for pollutants to find their way into air-conditioning filters.

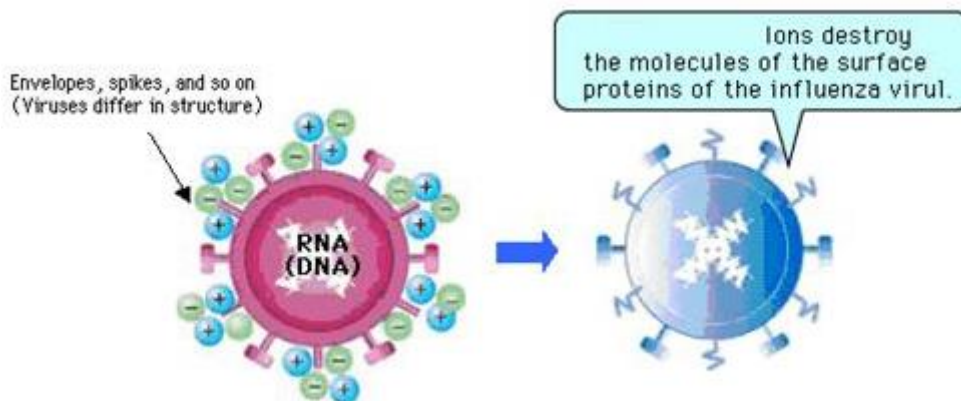
Figure 2: Bipolar Ionisation System



These positively and negatively charged ions have an impact on VOC's via a process of '**Agglomeration**' which occurs as a result of oppositely charged ions causing particles to attract to other particles and become bigger and heavier enabling an improved efficiency of HVAC system filters to remove the larger particles from circulating air. The BPI process causes particles to drop to the floor quickly taking them away from breathable air while simultaneously interrupting the reproductive ability of these organisms and reducing the risk of infection.

The BPI process causes ions attach to airborne pathogens, such as viruses causing a chemical reaction on the cell membrane's surface that compromises the integrity of the pathogen cell structure, rendering it neutralised. This deactivates the viruses, rendering them harmless, so they can no longer spread or cause infection (2,3,4) (Figure 3).

Figure 3: Bipolar Ionisation Destruction of Virus Cell Membrane



A further key feature of the BPI system relates to its capacity to kill microbes without damaging DNA (therefore it does not cause cancer) in the interior of cells and unlike other physical and chemical agents, such as UV light, radioactivity and use of caustic chemicals, BPI is totally GREEN and it does NOT adversely affect the environment in any way.

Unlike most air purification systems, BPI technology proactively emits bi-polar ions that attack VOC's and involve no harmful chemicals, radiations or by-products. Additionally, the technology doesn't involve filters or other invasive and high-energy-consumptive processes.

Bi-Polar Ionisation (BPI) combined with HEPA Filtration

High efficiency particulate air (HEPA) refers to an efficiency standard of air filter already utilised in shopping centres, retail outlets and commercial facilities in Australia with efficiency ratings of 99.995% which assures a very high level of protection against airborne disease transmission. HEPA filters are critical in the prevention of the spread of airborne bacterial and viral organisms and, therefore, infection. ***The combination of HEPA filtration and PBI air purification technology produces a unique multi vector methodology to produce the most effective system for continuously cleaning and decontaminating indoor air available worldwide via simultaneous elimination (HEPA diffusion at the site of the filtration unit), agglomeration (pathogens fall to floor via BPI) and pathogen destruction (chemical reaction on cell surface via BPI).***

Summarised benefits of the Bipolar ionisation system:

- *Removes up to 99.9% of COVID-19 virus from circulating air and surfaces - BPI compromises the DNA of bacteria and viruses rendering them neutralised, thereby protecting operating space's inhabitants from illness and disease.*
- *Removes up to 99.9% of airborne and surface VOC's - Bipolar ions break down toxic gasses and compounds from dangerous chemicals such as cleaning products, pesticides, paints, solvents, mould, mildew and more*
- *Removes up to 95% of Ultra Fine Particles (UFP's).*
- *Improved effectiveness of existing HEPA filtration systems to provide a two-vector pathogen removal and neutralisation system targeting >99.9% of airborne and surface VOC's.*
- *Reduced dust and mould particles - Bipolar ions that bond with contaminants gain size and mass and drop to the floor, or return to the filter, making them easily cleaned from the air we breathe.*
- *Reduced odours - Bipolar ions break down odours at their source and eliminate them — no masking or diluting required.*
- *Improved energy conservation - Reduced energy bills on heating and cooling ventilated air.*
- *Significantly reduced maintenance -. There are no filters to change or collector cells to clean. Simply replace the BPI tubes every two years.*
- *A safe, natural and environmentally friendly process - The bipolar ionisation technology uses no chemicals, heavy metals or mercury, and produces no harmful by-products such as ozone (O3) or ultra-violet light.*

References

1. Morawska et al. (2020). How can airborne transmission of COVID-19 indoors be minimised? Environ Int. 142: 105832. doi: 10.1016/j.envint.2020.105832
2. Daniels SL. On the Ionisation of Air for Removal of Noxious Effluvia. IEEEtransaction on Plasma Science, 30:1471-1481, 2002.
3. Oxford JS. Efficacy of Cluster Ions on Various Pathogens Confirmed Through Collaborative Research. Retroscreen Virology, Ltd, London UK, PC: 2017.
4. Tierno. (2017). Cleaning Indoor Air using Bi-Polar Ionisation Technology. NYU School of Medicine and NYU Langone Medical Center. (Unpublished)

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Considered one of the leaders in high performance science internationally Professor McLellan has over 20yrs experience in applied Immuno-Surveillance incorporating Point of Care (PoC) endocrine and immunological monitoring methodologies to extreme environmental conditions including thermoregulatory and high altitude environments for the optimisation of human performance. With a diverse skill set that includes a Phd in Exercise & Sports Science, a Masters of Physiotherapy and Bachelor of Exercise Science, Professor McLellan has led innovation in the incorporation of normobaric hypoxia incorporating modified air quality technologies and immuno-compromise targeting infection risk mitigation in professional sports internationally. Professor McLellan is the Head of the School of Health and Wellbeing at the University of Southern Queensland, with a comprehensive track record that includes over 17 years in academia and over 26 years of applied high-performance roles in professional team sports around the world. Professor McLellan holds editorial board and reviewer positions with ten (10) international scientific journals and his research has resulted in over one hundred (100) published works in peer reviewed journals, published abstracts and presentations at national and international conferences.