

Needlepoint Bipolar Ionization (NPBI)

Proven Method to Elimanate Harmful Contaminates

Can you recall a recent experience in the mountains, at the beach, or Niagara Falls? What did the air smell and taste like? Fresh? Crisp? Natural? Did you feel any better? If so, you are not experiencing a heightened sense of enlightenment due to your surroundings. There is actually a scientific basis for this phenomenon. It occurs at the molecular level and is the result of ions. Ions are charged molecules that have either lost or gained an electron(s), and its nature's way of purifying the air.

lons are generated via natural processes, such as cosmic radiation, sunlight, thunderstorms, waterfalls, waves in the ocean, etc. Typical levels in the following areas are:

- Mountains and waterfalls ~5000 ions/cm³
- Fresh country air ~1000 ions/cm³
- Outdoor air City ~200 ions/cm³
- Indoor office buildings < 100 ions/cm³

Consequently, the more ions in a given space, the better the air quality and ultimately the better the experience. As such, ion depletion is the largest contributing factor to poor indoor air quality and can lead to a condition known as Sick Building Syndrome (SBS). The Environmental Protection Agency (EPA) characterizes SBS as acute health and comfort effects that appear to be linked to time spent in a building. Physical symptoms include sore throats, headaches, coughs, sneezes, fatigue, and inability to concentrate. According to the World Health Organization (WHO) up to 30 percent of new and remodeled buildings worldwide may be the subject of excessive complaints related to indoor air quality (IAQ). Experts recommend ion levels in excess of ~1000 ions/cm³ in order to effectively "clean" a space.

Fortunately, there are ways to replicate this natural process for indoor spaces. One such method is Needlepoint Bipolar Ionization (NPBI), which is capable of safely producing hundreds of millions of ions without generating ozone. NPBI devices are designed to produce a high voltage electrical field also known as a plasma field. As molecules with an electron volt potential of 12V or less pass through the electrical field, the outermost electron is given enough electrical potential to escape. Different molecules require different amounts of energy (ionization energy) to release an electron, which is how NPBI is able to target specific molecules. Therefore, not all molecules will be ionized as they pass through the field and ozone is not generated. By design, NPBI produces the following ions; N_2 +, O_2 +, N+, and O+.

Once the molecule loses the ion it becomes positively charged, e.g. O_2^+ . Subsequently, the newly unbounded electrons attach to other neutral molecules and form negative ions, e.g. O_2^- . The ability to absorb an electron varies upon the molecule in question (known as electron affinity). This also implies that not all molecules can receive an extra electron. In this case, NPBI is generally focused on Water (H2O), which actually self-ionizes (H₂O + H₂O = OH+ H₃O+). H₃O+, also seen as H+, along with O_2^- ions combine with moisture to form ion clusters. The ion clusters aren't able to travel far by themselves which makes your HVAC system the obvious choice to effectively transport the hundreds of millions of ions throughout a space to deactivate both air and surface contaminates. Since the ions are airborne, even surfaces and cracks that are not visible are affected. The ion clusters are what purify the air and are scientifically proven to remove the following objectionable contaminates in the following ways:







Pathogens (viruses, bacteria, and fungi)

A pathogen is an organism that causes a disease to its host. Pathogens are destroyed or deactivated when the clusters of O_2 - and H+ ions attach to the surface. They then form highly reactive hydroxyl radicals (OH) by breaking the hydrogen bond on the outer layer of the pathogen. Once broken, the viruses do not have a means to attach to a surface and therefore are no longer viable. NPBI has been tested on various pathogens in laboratory settings to include viruses such as the Noroviruses with extremely positive results.

PATHOGEN	TIME EXPOSED	DEACTIVATION RATE
E. Coli	15 mins	99.68%
MRSA	30 mins	96.24%
ТВ	60 mins	69.01%
Noro Virus	30 mins	93.5%
Feline Calicivirus	30 mins	93.5%

Note: independent testing by CDC affiliate; 10' x 10' x 10' cube at 6 ACH

Volatile Organic Compounds (VOCs) (chemicals, odors, and off gassing of materials)

VOCs are another factor that degrade IAQ. According to the EPA, VOCs are organic chemical compounds whose composition makes it possible for them to evaporate under normal indoor atmospheric conditions. VOCs may be contained in household cleaning products; fuels such as propane; and within building materials and furnishings. Adverse health effects from excessive VOCs may include headaches; damage to liver, kidney and central nervous system; or cause cancer in humans. The same hydroxyl radicals used in the deactivation of pathogens also break down VOCs and odors into their base molecules (e.g. $O_{2^{\prime}}$, $O_{2^{\prime}}$, N_{2} and H_{2} O) which are safe and naturally occurring atmospheric gases.

Particulates (dead skin cells, dust, and debris)

Particulates are microscopic particles of solid or liquid matter suspended in air. Very small particulates can affect your health as there is a higher chance your body can absorb from inhalation. Ailments include decreased lung function, irregular heartbeat, or even heart attacks. In the case of NPBI, the ion clusters attach themselves to particulates thereby charging them. Charged molecules are then attracted to other oppositely charged molecules. These particulate ion clusters continue to combine with other particulate clusters forming larger clusters thus increasing the likelihood and effectiveness of filtration.

In addition to the IAQ benefits, NPBI is also a potential way to save on energy related to your HVAC system; however, that is covered in a separate study.

In Summary, NPBI is a device installed in the air handler or ductwork which distributes hundreds of millions of charged ions to the space. These ions have the ability to alter the molecular structure of harmful Pathogens and VOCs both in the air and on surfaces with an efficacy of 95+%. When your HVAC system is on, you can breathe easy knowing your space is being continually cleaned and sanitized.



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