

Below are excerpts from an study published on September 28, 2018 in The National Center for Biotechnology Information, a division of the National Institute of Health, a United States governmental agency.

The article uses the term Negative air ions (NAIs), which are Anions.

The complete publication is located here: <https://tinyurl.com/yyfdfseq>

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## Negative Air Ions and Their Effects on Human Health and Air Quality Improvement

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### Conclusions

“...studies have suggested that NAIs had multiple health benefits on humans/animals, might inhibit the growth and/or kill some of microorganisms and promote plant development...”

“...no data showed the harmful effects of NAIs on humans/animals...”

“...evidence showed that NAIs could high-efficiently remove PM (particulate matter) including ultrafine PM, providing an alternative way to clean indoor air especially during haze episodes...”

### Main Body of Study

“PM (Particulate Matter) is the major pollutant during haze episodes. Evidence showed that PM, especially PM<sub>2.5</sub>, seriously affected human health. Based on the data from Lim et al. (2012), around 3.2 million people died in 2010 due to exposure to PM [132]. Annually, 2.1 million deaths occurred in the world due to the increasing levels of PM<sub>2.5</sub> [133,134]. PM mainly led to diseases related to both respiratory and cardiovascular systems. Fine PM such as PM<sub>1.0</sub> and PM<sub>2.5</sub> penetrate deeply into the lung, irritate and corrode the alveolar wall and, as a result, affect lung functions [135] and might also result in lung cancer [136]... PM is the major pollutant during haze episodes. Evidence showed that PM, especially PM<sub>2.5</sub>, seriously affected human health. Based on the data from Lim et al. (2012), around 3.2 million people died in 2010 due to exposure to PM [132]. Annually, 2.1 million deaths occurred in the world due to the increasing levels of PM<sub>2.5</sub> [133,134]. PM mainly led to diseases related to both respiratory and cardiovascular systems. Fine PM such as PM<sub>1.0</sub> and PM<sub>2.5</sub> penetrate deeply into the lung,

irritate and corrode the alveolar wall and, as a result, affect lung functions [135] and might also result in lung cancer [136]...”

“Similarly, there are lots of research articles to present the effects of NAIs on the growth of microorganism (Table S2). The majority of the studies focused on bacteria and the presence of high concentration of NAIs inhibited the growth of bacteria. An early study showed that NAIs caused a significant amount of biological decay of the bacterium *Serratia marcescens* [95]. Exposure to NAIs showed inactivation or growth inhibition of the bacteria *E. coli*, *Candida albicans*, *Staphylococcus aureus*, *P. fluorescens* [96,97,98,99,100] and has a lethal effect on starved *Pseudomonas veronii* cells [101]. NAIs prevented 60% of tuberculosis (TB) infection and 51% of TB disease [102]. Except for the inhibition effect of NAIs on bacteria, reports also showed that NAIs inhibited the growth of fungi and viruses. For example, NAIs could inhibit the growth of *Penicillium notatum* [103]; the use of NAI generators reduced airborne transmission of Newcastle disease virus [104].”

“The negative oxygen ion concentration exceeding 1000 ions/cm<sup>3</sup> has been regarded as the threshold value for fresh air and the concentration should be higher for boosting the human immune system ([80] and references therein). “

“On mental health, exposure to NAIs showed highly significant increase in performance of all tested tasks (mirror drawing, rotary pursuit, visual reaction time, and auditory) [86], alleviating symptoms of seasonal affective disorder (SAD) [87]. Similar effects of NAIs on relieving symptoms in mood disorders to antidepressant nonpharmacotherapy trials were observed [38]. NAIs also showed effective treatment of chronic depression [88]. “

“In addition, some reports also showed the effects of NAIs on inhibiting cancer cells. For example, water-generated NAIs activated natural killer (NK) cell and inhibit carcinogenesis in mice [33]. The presence of NAIs is credited for increasing psychological health, productivity, and overall well-being [38,92,93]. Reports also showed that NAIs attached themselves to particles such as dust, mold spores, and other allergens [37]. As a result, people in the NAI atmosphere relieved symptoms of allergies to these particles. Generally, although some reports showed that air enriched with NAIs have multiple beneficial therapeutic effects in normalizing arterial pressure and blood rheology, supporting tissue oxygenation, easing stress conditions, and augmenting resistance to adverse factors [94], a systematic review suggested no consistent or reliable effects of NAIs on cardiovascular and respiratory system as well as on mental health [35].”