Topics

Generation of Pure Airborne Negative Ion via Soft-Corona Discharge

Takayuki Kato, Business Development Group

A negative ion is defined as an airborne ion having a negative charge. Negative ions are abundant in the air near waterfalls, mountains and forests.

Negative ions can easily be produced artificially through air ionization via corona discharge. Oxygen molecules and air molecules are ionized through collisions with electrons which are generated upon the ionization of air.

These ions combine with airborne water molecules and stabilize in air.

Therapeutic effects, such as stress reduction, recovery from fatigue and mental and/or physical relaxation, are expected if negative ions are taken into the body by breathing or through the skin.

Although negative ion generators are becoming very popular, most commercial negative ion generators develop by-products such as ozone and nitrogen oxides, which are contaminants that cause unpleasant odors. A number of manufacturers claim that their negative ion generators work to both deodorize using ozone and provide relaxation via negative ions. However, ozone is hazardous to the human body when such systems are used in small enclosed spaces such as automobiles.

Tourmaline is a mineral which generates a very small amount of negative ion when external heat or a kinetic shock is applied; however, this mineral does not generate negative ions by itself, so that little effect is anticipated from the tourmaline.

In order to eliminate the hazardous effects associated with the negative ion generator, a new generator is inverted using a soft-corona discharge method. The new generator consists of a needle electrode and a conductive polymer electrode. The most important requirement when suppressing the ozone generation is to ionize the air using a weak corona discharge. However, when weaker ionization is provided, the quantity of the negative ions is reduced accordingly. The newly developed negative ion generation system is shown in **Fig. 1**. The voltage applied to the needle is approximately 2,800 V, which is lower than the voltage which is conventionally thought to produce air ionization.

A voltage is applied between the needle electrode and a plain conductive polymer electrode having multiple apertures. The corona discharge between the needle electrode and the conductive polymer electrode, the resistance of which is approximately 100 GΩ, may cause a surface discharge on the conductive polymer electrode.

The air ionization region disperses well so that efficient air ionization can be expected. At the microscopic scale, since the corona discharge between the needle electrode and the conductive polymer electrode becomes extremely weak, the yield of hazardous contaminants, such as ozone and nitrogen oxide, compounds is reduced remarkably. Consequently, pure negative airborne ions are produced in large quantity.

Typical data collected using the apparatus described herein is presented in **Fig. 2**. The concentration of ozone generated under these conditions was less than 0.001 ppm. Japanese ozone regulations require that ozone density be lower than 0.06 ppm. The density of NOx was found to be less than 0.001 ppm, which is the equivalent to the NOx concentration normally observed in air.

Toyota group companies are expecting to utilize the newly developed technique to realize a harmless negative ion generator for various applications, such as applications for vehicles, applications for care-taking equipment for disabled or elderly people, desktop applications, and applications for equipment installed in electric appliances.

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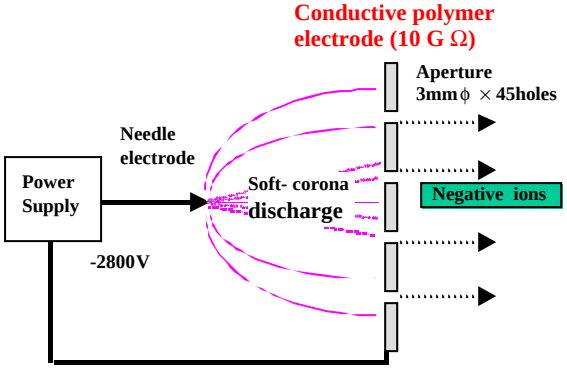

Fig. 1 Structure of negative ion generator.

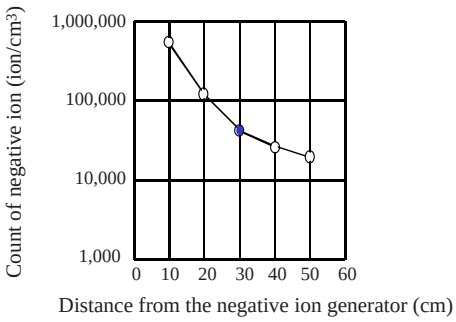

Fig. 2 Characteristic of ion count.

Fig. 3 Negative ion generator. (Patent pending) Brand name: IONVEIL