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**DEVICE FOR PRODUCING NEGATIVELY
CHARGED NANOPARTICLES AND A
METHOD FOR THE SAME**

CROSS-REFERENCE TO OTHER
APPLICATIONS

This Application is a National Phase of International Application No. PCT/CN02/00328, filed on May 13, 2002, which claims priority from P.R. China Patent Application No. 01120188.6, filed on Jul. 11, 2001.

FIELD OF THE INVENTION

The present invention relates to a device and method for producing nanoparticles, specifically to a device and method for producing novel negatively charged nanoparticles by combining two particles and electric charges in bioclimatology and physics, which are unrelated with each other, to be used in fields of medicine, home appliance, aseptic engineering, freshness preservation engineering, bioengineering, and the like.

BACKGROUND OF THE INVENTION

In bioclimatology, the state of air environmental condition is called by scientific workers as the aerosol state. Molecule cluster, liquid and solid particles dispersed in air as aerosols are mostly nanoparticles.

Nanoparticles exhibit small-scale effect, surface and interfacial effect and quantum-scale effect, and have large specific surface area and big number of atoms on the surface. Surface effect and interfacial effect are intensified with decreasing particle size. The big specific surface area and the big number of atoms on the surface increase the activity of the nanoparticle greatly. Due to the small-scale effect and surface effect, nanoparticles of different size also cause variation of surface electron spin conformation and electron energy spectra distribution. Quantum-scale effect of nanoparticles results in discrete energy level. The interval between energy levels changes with the changes of the nanoparticle sizes. Nanoparticles in aerosol are composed of different particles with different sizes. Because of the above-mentioned properties, nanoparticles greatly enhanced the ability to combine with electrons of different energy levels to form a very wide energy band of electron affinity.

The problem is what kind of electron-emitting electrode can be used to achieve a strong enough electric field with narrowing potential barrier on the electrode surface. Due to the tunnel effect in quantum mechanics, electrons will penetrate and escape from the tunnel as field electron emission. How to increase the emission current density is a problem under research.

In the 1960s, electrically charged aerosol centers were established in Texas and other states in the US. By ejecting pressurized gas the atomized physiological saline and electrons were emitted at the same time in the same direction at an electric potential of 26 kV-60 kV on an ejector to form electrically charged aerosol. Such aerosol was used to cure respiratory disease. It was effective in curing bronchitis and asthma, infection of the upper respiratory tract, emphysema, laryngitis, and pharyngitis. Besides the ejector, auxiliary equipments of gas pump, and liquid transport system were required. Atomized saline particles were mostly not nanoparticles. Even under the action of 26 kV-60 kV electric field, electrically charged aerosol could only travel a distance of about 1.8 m and disappeared beyond that distance. Such

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electrically charged aerosol was not able to directly participate in the electric metabolism at the tissue-cell-molecule level, so the biological effect and sterilizing effect were less promising.

DISCLOSURE OF THE INVENTION

The object of the present invention is to adopt an electron supermicroemitter at a micron-level or sub micron-level to provide very high emitter current density. When the electrode surface has a strong enough electric field, the potential barrier of electrode will narrow and electrons on the electrode will penetrate and escape from the tunnel because of tunnel effect in quantum mechanics to form field emission electrons, which can provide a very high emission current density.

The present invention is to combine the physical characteristics of nanoparticles and the tunnel effect in quantum mechanics. When the electrons 'e' emitted by the electron emitting electrode collide with the particles in aerosol, the electrons can adjust the energy and adhere to the nanoparticles 'Nm' with a broad energy band of electron affinity to form new negatively charged nanoparticles 'N⁻m', that is to realize: $e+Nm \rightarrow N^{-}m$.

Generally, there exist a few particles with different electric charges in air. Particles with and without electric charge can attract with each other and coalesce, resulting in combination of opposite charges and fall-off in large particles with the electric charge disappearing upon contact with ground. The negatively charged nanoparticles produced by the present invention appear in a large amount in a certain scope with same electric charges repelling each other. Scientists of bioclimatology and physics all think that such state of system is more stable.

Such novel particles produced by using the physical characteristics and tunnel effect in quantum mechanics of nanoparticles inevitably leads to exclusively negatively charged nanoparticles without the presence of any other compounds or impurities.

The device for producing negatively charged nanoparticles of the present invention comprises a power supply, a casing, a controller and an electrode with only one potential, that is, an electron supermicroemitter, wherein, the power supply connects with the electron supermicroemitter and the controller respectively, and the potential of the electron supermicroemitter to the ground is controlled in the range of -2 kV to -29 kV.

The said electron supermicroemitters are those with an electrode of an emitting body having a dimension at a micron level or sub-micron level. The material for preparing the said electron supermicroemitter of the present invention is platinum, gold, rhenium, iridium, tungsten or carbon fiber or their combination, or alloys with platinum, gold, rhenium, iridium and/or tungsten as the main components. The shape of the electrode could be any one or combination of the shapes selected from the group consisting of disk, cylinder, saw teeth, needle, sharp-ended, sphere, spheroid, arc, ring, bar, etc. The electron supermicroemitter could be a single electrode or multiple electrodes. The dimension of the electron supermicroemitter is ≤ 100 micron.

The method for producing negatively charged nanoparticles according to the present invention is as follows. The negatively charged nanoparticles producing device constructed by connecting the power supply with the electron supermicroemitter and the controller respectively is used. The potential of the nanoparticles in air and the electron supermicroemitter to the ground, under the action of the power supply and the controller, are controlled in the range of