

AIR STERILIZER

FIELD OF INVENTION

The invention relates generally to devices for the generation of negative ions and ozone for indoor air applications. More specifically, the invention concerns an air sterilizer to distribute negative ions and/or ozone to the surroundings to sterilize the surrounding air as well as the surface of objects in an enclosed indoor space.

BACKGROUND OF THE INVENTION

The consumer behavior has changed drastically the last decade with a shift of focus and demand for products related to health care. It is not surprising that sterilization devices which sterilize the surroundings and widely includes air sterilizers, ozonizers and ionizers are in high demand to fulfill the consumers' desire for healthier way of living. In general, ionizers are designed to generate negative ions and the ion modules are built in the devices for specific applications only while sterilizers are designed to generate a combination of negative ions and ozone for specific applications. These currently available devices in the market lack the capability and flexibility to perform different functions, such as the selective generation of ions, ozone, or a combination of ions and ozone.

The concept of an ionizer which is able to perform multiple functions of generating negative ions, ozone or a combination of ions and ozone with the usage of different types of electrode module has been thoroughly protected by the applicant's patent portfolio based on the applicant's originating PCT application no. PCT/SG2010/000416 with an international filing date of 29 October 2010 and published on 03 May 2012 as WO publication no. 2012/057704 A1. The patented invention relates to a key feature of the ease of replaceability and interchangeability of the electrode module(s) with the air ionizer to perform the required multiple functions as determined by the user.

The present invention was developed as an improved version of the earlier patented invention to incorporate additional features for providing a monitoring and alert mechanism to monitor and prompt the replacement of electrode modules used in an air sterilizer. The present invention has adopted the term, air sterilizer by virtue of choice to distinguish itself from the more commonly used term, air ionizer. This new feature provides an added capability to replace the electrode module or cartridge when needed or as it reaches its lifespan. The user is informed through a generated alert mechanism to prompt the replacement of the electrode module or cartridge. With this new feature, it allows the sterilization process to be performed efficiently to optimize the quality of the sterilization process. This also prevents possible downtime of the air sterilizer which possibly leads to inconvenience to the user in operating the said sterilizer.

EP patent no. 1,303,459 B1 discloses an ozone generator system in which a multitude of plate type ozone generators are arranged adjacent to each other in a block. Each ozone generator comprises a chamber, adapted for converting oxygen to ozone by a corona discharge, and each chamber is provided with an inlet for oxygen or an oxygen-rich gas and an outlet for ozone. Said ozone generators are arranged in a block module in which they are affixed by a block rack. Said block rack comprises an inlet port adapted for introduction of oxygen gas, and an outlet port adapted for discharge of ozone created through conversion within the generators comprised in the block module.

US patent no. 6,137,670 discloses a system and method for cleaning and/or replacing emitter points of a pin-type electrical ionizer. The electrical ionizer has a replaceable electrical ionizer cartridge including a support platter having a central air passage opening therethrough and at least two emitter points or pins supported by the support platter so as to extend into the opening. At least one electrical connector is supported by the support platter and is electrically connected to at least one of the emitter points. The electrical contact members define the positive and negative contact members, which are driven by DC voltage. When the emitter points become dirty or contaminated, the cartridge which includes the dirty emitter points secured to a support platter is removed as a unit from the electrical ionizer housing. The cartridge is then moved to a desired location, the points cleaned and the cartridge reinserted into the

housing. Installation of the cartridge (either the original cartridge with clean emitter points or new cartridge) requires time due to its complexity of the components.

There is an unfulfilled need for an air sterilizer to be able to cater to the needs of different users and environments, which is able to perform multiple functions, with greater standardization of hardware to simplify and reduce the cost of manufacture. In addition, it is imperative that the sterilizer is able to perform at its optimal condition at all times by incorporating a feature which allows the continuous monitoring of the parameters of the said sterilizer. The present invention was developed in consideration of this need.

SUMMARY OF THE INVENTION

In a first aspect, the invention provides an air sterilizer to distribute negative ions and/or ozone to the surroundings in a sterilization process, comprising:

- a casing;

- an electrode module;

- a module holder adapted to receive and retain said electrode module within the casing in a replaceable/interchangeable manner;

- a control unit for controlling and monitoring the operations of the electrode module; and

- a display means for displaying visual information for prompting a user to replace the electrode module;

- wherein the module holder receives the electrode module so as to connect the electrode module to a source of AC high voltage for the generation of negative ions and/or ozone;

- wherein the electrode module is one of a plurality of types for generating primarily negative ions, primarily ozone, or a combination of both negative ions and ozone;

- wherein the type of electrode module is identifiable by interaction between the electrode module and the sterilizer;

- wherein the control unit monitors the change in parameters of the electrode module and once the electrode module does not comply with a predetermined set of parameters, the control unit generates an alert to the display means to prompt the replacement of the electrode module;

- wherein the control unit is adapted with a counter to calculate and monitor the cumulative duration for which the air sterilizer is switched on and configures a predetermined maximum duration the air sterilizer is switched on to trigger in sending an alert to the display means to prompt the replacement of the electrode module;

wherein for a new sterilizer, a first electrode module with no fuse is inserted into the electrode module to initiate the sterilization process by switching on the air sterilizer; and

wherein after the end of the usage of the first electrode module, the first electrode module is replaced with a second electrode module equipped with a fuse, and so on, whereby the control unit detects the fuse in the second electrode module and once the sterilizer is switched on, the control unit sends a predetermined current to blow the fuse in the second electrode module and resets the counter to initiate the calculation and monitoring process of the duration the air sterilizer is switched on, whereby once the cumulative duration of the air sterilizer being switched on reaches the predetermined maximum of duration, the control unit triggers and send an alert to the display means to prompt the replacement of the second electrode module.

The invention provides a solution for an air sterilizer to perform multiple functions of a sterilization process by using different type of configuration of electrode modules to suit the needs of the user or environment in which the sterilizer is used. The term sterilization process used in this specification suitably encompasses the ionization process, the ozonation process and both combined processes of the air sterilizer for sterilizing the surrounding air and the surface of objects in an enclosed indoor space. The different types of sterilization process, either an ionization process or ozonation process or both combined processes, can be configured by using different types of electrode modules.

The replaceability and interchangeability of the electrode module provides an advantage where one sterilizer can cater to all different needs easily controlled by the user. The air sterilizer provides a holder to receive the electrode module. The compartment inside the holder is configured with clearance to receive the electrode module. The electrode module is easily insertable, for example slidable into the holder and a module cover may be used to retain the electrode module in the holder. The holder allows the electrode module to be connected to a source of AC high voltage for the generation of negative ions and/or ozone.

The air sterilizer further provides a feature of monitoring the usage and condition of the electrode module in use during the on-going sterilization process to generate an alert to prompt the replacement of the electrode module. Once the same electrode module has surpassed predetermined parameters, the air sterilizer generates an alert to prompt the replacement of the currently used electrode module with a new electrode module.

In this embodiment, the generation of alert to prompt the replacement of the electrode module is based on the monitoring of the duration for which the air sterilizer is switched on. The control unit is adapted with a counter for calculating and monitoring the duration for which the sterilizer is switched on. The air sterilizer is switched on for the first time once a new electrode module is inserted into the holder. The control unit has configured a pre-determined maximum duration for which the sterilizer is switched on before triggering and generating an alert to the display means to prompt the user to replace the currently used electrode module with a new electrode module. Once the air sterilizer has reached the pre-determined maximum duration, the control unit generates an alert to prompt the replacement of the currently used electrode module with a new electrode module. This new electrode module is equipped with a fuse. The new electrode module with a fuse is inserted into the air sterilizer to initiate the sterilization process. The control unit detects the fuse in the new electrode module and sends a predetermined current to blow the fuse in the new electrode module in order to reset the counter to restart the calculation of the duration for which the sterilizer is being switched on. Once the air sterilizer has reached the pre-determined maximum duration, the control unit generates an alert to prompt the replacement of the currently used electrode module with a new electrode module equipped with a fuse.

In another embodiment, the generation of alert to prompt the replacement of the electrode module is based on the monitoring of the current consumption of the electrode module by the control unit. The control unit monitors the current consumption of the electrode module during the on-going sterilization process. Once the electrode module draws current from the AC high voltage beyond the pre-determined maximum amount of drawn current from the electrode module, the control unit triggers and sends an alert to the display means to prompt the user to replace the currently used electrode module with a new electrode module.

In an embodiment, a control unit supplies DC voltage to a high voltage module. The high voltage module supplies AC voltage to the electrode module. The control unit controls the level of generation of negative ions and/or ozone by controlling the supply of power to the high voltage module.

In another embodiment, the air sterilizer has two module holders where each module receives a respective electrode module. Two electrode modules may be connected to a common high voltage module by inserting the electrode modules into respective module holders. The two module holders may be on either side of the high voltage module. The lifespan of the two electrode modules may be monitored individually or as a group of two electrode modules by the two monitoring configurations which are either based on the current consumption or the duration for which the sterilizer is switched on. Once either one or both the electrode modules reach the predetermined maximum parameter as configured by the control unit, an alert is generated and sent by the control unit to the display means to alert the user to initiate the replacement of either one or both the electrode modules.

In another embodiment, the air sterilizer has four module holders where each module holder receives a respective electrode module. The air sterilizer has two high voltage modules. A set of two electrode modules may be connected to each common high voltage module by sliding the electrode modules into respective module holders. The two module holders may be on either side of the high voltage module. The lifespan of the four electrode modules may be monitored individually or as a group of four electrode modules by the two monitoring configurations which are either based on the current consumption or the duration of the sterilizer is switched on. Once either one or all four electrode modules reach the predetermined maximum parameter as configured by the control unit, an alert is generated and sent by the control unit to the display means to alert the user to initiate the replacement of either one or all of the electrode modules.

Multiple electrode modules, i.e. not necessarily only two modules, may be connected to a common high voltage module, if desired. Alternatively, for multiple electrode modules, one module holder may be connected to one high voltage module, if desired.

The electrode module generally comprises an inner electrode, an outer electrode and a dielectric barrier sandwiched between the inner electrode and the outer electrode. The inner electrode has a continuous (i.e. non-apertured) overall surface and the outer

electrode provides a plurality of ion generating points for generation of negative ions and/or ozone. With the application of high AC voltage to the module, it allows the generation of negative ions and controlling of the generation of ozone. Using different types of electrode modules controls the multiple functions of the air sterilizer. There may be several different types of electrode modules, which are able to generate negative ions, ozone or combination of both. Suitably, there can be three types of electrode for generating negative ions, ozone and combination of negative ions and ozone. The needs of the user can be met by installing or changing different interchangeable electrode modules into the air sterilizer to obtain the desired effect.

The type of electrode module may be identified by electrical or mechanical interaction with the air sterilizer.

In one embodiment, the control unit may function to detect the type of electrode module by detecting the level of power consumption of the electrode module. Different types of electrode modules have different power usage requirements. The control unit is arranged to supply a range of high voltage, determined by the user, to the electrode module.

Alternatively, the control unit may detect the type of electrode module by sensing and detecting an identification code on the electrode module. The identification code may be stored in a memory chip, mounted on the electrode module. This identification code specifies the specific function of the electrode module. Alternatively, the identification code is a bar code or other optically detectable code which specifies the specific type and function of the electrode module. This bar code is located on the electrode module which allows the control unit to detect the type of the electrode module through an optical sensor or scanner.

The control unit may shut down voltage supply to an electrode module upon detecting that it requires a voltage higher than the range of supply of high voltage by the control unit.

Alternatively, the type of electrode is identified by the module holder being adapted to receive a specific type of electrode module as determined by the user. The compartments in the module holder are structurally adapted to selectively receive specific type of electrode module to prevent wrong type of electrode module from being fully inserted into the module holder. For this purpose, the electrode module and/or module holder may comprise structural elements that cooperate to determine whether or not a particular type of module may be fully inserted (and thereby connected) to a particular holder. An example of such elements are a pin and a receiving hole for the pin, each provided on one or other of the module and holder.

In another embodiment, the air sterilizer is equipped with a communication module for transmitting a remote signal to prompt or alert the user to facilitate the replacement of the used electrode module or electrode modules. The communication via a communication module between a user or a remote server and the air sterilizer also allows the flexibility of controlling the start and end of the operation of the air sterilizer.

In another embodiment, the communication module is wireless using a Wi-Fi signal or a cellular network to facilitate the communication between a user or a remote server and the air sterilizer.

In another embodiment, the user is able to switch on and off the air sterilizer using a mobile device connected to the air sterilizer through a wireless network.

In another embodiment, in the arrangement of which the air sterilizer is being rented to a user, the principal office has the flexibility to control the operations of the air sterilizer via a remote server communicating with the air sterilizer through a wireless network. The user can utilize the rented air sterilizer by paying directly to the principal office in exchange of hours of usage of the air sterilizer. Once the credit of hours of usage is reached, a signal is sent from the remote server to the air sterilizer to switch off the air sterilizer. The air sterilizer can only be switched on again by the principal office once the user has remitted additional payment in exchange of new hours of usage of the air sterilizer.

In another embodiment, the communication module is wireless using a Bluetooth® network to facilitate the communication between a user and the air sterilizer.

In another embodiment, the display means is provided at the outer surface of the casing so as to visually indicate and prompt the user to replace the electrode module. The display means may comprise of a monitor display, LED lights or any other equivalent illuminating mechanism suitably used.

In a further aspect, the present invention provides an air sterilizer to distribute negative ions and/or ozone to the surroundings, comprising:

- a casing;

- a module holder adapted to receive and retain an electrode module within the casing in a replaceable/interchangeable manner;

- a control unit for controlling and monitoring the operations of the electrode module; and

- a display means for displaying visual information for prompting a user to replace the electrode module;

- wherein the module holder receives the electrode module so as to connect the module to a source of AC high voltage for the generation of negative ions and/or ozone;

- wherein the electrode module is one of a plurality of types for generating primarily negative ions, primarily ozone, or a combination of both negative ions and ozone;

- wherein the type of electrode module is identifiable by interaction between the electrode module and the sterilizer; and

- wherein the control unit monitors the change in parameters of the electrode module and once the electrode module does not comply with a predetermined set of parameters, the control unit generates an alert to the display means to prompt the replacement of the electrode module.

The components in the air sterilizer are encased within a casing. The casing may be enclosed by a top cover having apertures for the release of ions/ozone.

The air sterilizer may also include a fan that is located so as to generate an air flow to circulate the generated negative ions and/or ozone to the surroundings. A timer controls the rate or duration for which air circulates through the casing.

The air sterilizer has the ability to perform multiple functions in accordance to the needs of the user. The electrode modules used in the air sterilizer can be readily removed and replaced with an electrode module which performs different functions or a new electrode module to replace the old module. The lifetime of the electrode modules, may be monitored individually or as a group of electrode modules by the two monitoring configurations which are either based on the current consumption or the duration for which the sterilizer is switched on. Once either one or all of the electrode modules reach the predetermined maximum parameter as configured by the control unit, an alert is generated and sent by the control unit to the display means to alert the user to initiate the replacement of either one or all of the electrode modules

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more clearly understood from the following description of the embodiments thereof, when taken in conjunction with the accompanying drawings. However, the embodiments and the drawings are given only for the purpose of illustration and explanation, and are not to be taken as limiting the scope of the present invention, the scope of which is to be determined by the appended claims.

In the accompanying drawings, like reference numerals are used to denote like parts throughout the several views. The features of the described embodiments are generic to all embodiments unless specifically stated otherwise or required by the context.

Fig. 1 is a perspective view of the construction of an air sterilizer of a first embodiment;

Fig. 2 shows a perspective view of the air sterilizer of Fig. 1 in its assembled state;

Fig. 3 is a perspective view of the construction of an air sterilizer of a second embodiment equipped with a counter;

Fig. 4 is a perspective view of the construction of an air sterilizer of a third embodiment;

Fig. 5 is a perspective view of the construction of an air sterilizer of a fourth embodiment;

Fig. 6 is a perspective view of a construction of a first embodiment of an electrode module;

Fig. 7 is a perspective view of a construction of a second embodiment of an electrode module;

Fig. 8 is a perspective view of an electrode module with an identification code;

Fig. 9 is a perspective view of a first embodiment of a holder configured to receive two types of electrode modules;

Fig. 10 is a perspective view of another embodiment with a different holder;

Fig. 11 is a perspective of another embodiment with a different holder;

Fig. 12 is a perspective view of a third embodiment of an electrode module;

Fig. 13 illustrates an air sterilizer which uses a communication module for wireless communication; and

Fig. 14 is a schematic block diagram of an air sterilizer.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Figures 1 and 2 illustrate, in perspective view, the first embodiment of an air sterilizer 10 with the components of an electrode module 11, a module holder 12, a high voltage module 13, a control unit 14, a power supply unit 15, a connector 16, and a display means 17 which are encased in a casing 18.

The casing 18 is made up of a rectangular casing 18a, module cover 18b, rectangular cover 18c and vented opening 18d. The rectangular casing 18a serves as a housing in which all the components are mounted or supported. The components on the rectangular casing 18a are enclosed by a rectangular cover 18c which has a vented opening 18d. A connector 16 in the form of a plug in this embodiment is mounted on the rear of the casing 18a. This connector 16 connects the air sterilizer 10 to an AC voltage power supply through a wall mounting bracket (as shown in Figure 4).

The AC voltage power supply is directed to the power supply unit 15. The power supply unit 15 converts the AC voltage to a DC voltage. The control unit 14 receives the DC voltage from the power supply unit 15 and supplies power to the high voltage module 13. The high voltage module 13 converts the DC voltage to AC voltage to supply power to the electrode module 11.

An electrode module 11 comprises an inner electrode, an outer electrode and a solid dielectric barrier sandwiched between the inner and outer electrode. The electrode module 11 is used to generate negative ions. The electrode module 11 has two terminals 11a at one side edge of the module 11. Each of the two ends of the electrode module 11 has one notch 11b. The module holder 12 is mounted to the casing 19. The module holder 12 has two terminals 12a which are connected to the high voltage module 13. The terminals 11a of the module 11 are connected to the high voltage module 13 automatically once the module 11 is installed in the holder 12. One end (as shown in Figure 6) of the inner electrode has an extended portion in the shape of a spring plate extension to be fitted to a modular casing of the module 11. Similarly, one end (as shown in Figure 6) of the outer electrode is made in the shape of a spring plate

extension. The compartment inside the module holder 12 is configured with clearance to receive the electrode module 11. The electrode module 11 is slidable into the module holder 12 for the terminals 11a of the module 11 to make electrical contact with the terminals 12a of the module holder 12. The module 11 is retained inside the holder 12 by a module cover 18b which is fastened to the holder 11 with a screw.

The high voltage module 13 supplies AC high voltage to the electrode module 11. Negative ions and/or ozone are released when the electrode module 11 receives high voltage. A fan 26 is located next to the electrode module 11 and module holder 12 so as to generate an air flow to circulate the generated negative ions and/or ozone to the surroundings. The negative ions and/or ozone exit through the vented opening 18d of the cover 18c to the atmosphere. The vented opening 18d is located directly over the module holder 12 inside the casing 18a.

The control unit 14 controls the level of generation of negative ions and/or ozone by controlling the high voltage module 13. The control unit 14 has a timer to control the ON/OFF setting of the high voltage module 13. The level of generation of negative ions and/or ozone can be controlled by the control unit 14 in the order of three settings of low, medium and high.

The control unit 14 controls and monitors the operations of the electrode module 11. In this embodiment, the generation of alert to prompt the replacement the electrode module 11 is based on the monitoring of the current consumption of the electrode module 11 by the control unit 14 during the on-going sterilization process. The control unit 14 monitors the current consumption of the electrode module 11 once the air sterilizer 10 has begun its sterilization process. The control unit 14 has configured a maximum current consumption drawn by the electrode module 11 before triggering an alert to the display means 17. The maximum current consumption is configured by the control unit 14 to be within a range of 400 milliamps to 450 milliamps. In this embodiment, the maximum current consumption is configured at 400 milliamps. After the sterilization process has started and continued after a period of time, the electrode module 11 exponentially consumes more current from the AC high voltage power. Once

the electrode module 11 consumes beyond the maximum current consumption of 400 milliamps for example, the control unit 14 triggers and generates a signal to the display means 17 to prompt the user to replace the currently used electrode module 11 with a new electrode module 11x.

The display means 17 is a set of LED lights provided at an outer surface of the cover 18c of the casing 18 so as to visually indicate and prompt the user to replace the electrode module. The LED lights of the display means 17 are lit up or blinking to visually indicate the electrode module 11 is required to be replaced. Once the electrode module 11 is replaced with a new electrode module 11x, the display means 17 is switched off.

Alternatively, in another embodiment, in the module holder 12, there is a locking mechanism which fits the two notches 11b on the electrode module 11 to further secure the module 11 in the holder 12. The electrode module 11 may be released from the module holder 12 by pushing the module 11 to release the notches 11b on the module 11 from the locking mechanism.

Figure 2 shows a perspective view of the air sterilizer 10 of Fig. 1 in its assembled state. An on-off switch and display means 17 for the air sterilizer 10 are located on the exterior of the cover 18c of the casing 18.

Figure 3 illustrates, in a perspective view, a second embodiment of an air sterilizer 20 which comprises all the components of the first embodiment with the addition of a counter 21 adapted into the control unit 14 for calculating and monitoring the duration for which the air sterilizer 20 is switched on. In this embodiment, the generation of alert to prompt the replacement the electrode module 11 is based on the monitoring of the cumulative duration for which the air sterilizer 20 is switched on.

This air sterilizer 20 is equipped with an electrode module 11 slotted into the module holder 12. The electrode module 11 is not equipped with an additional mini fuse. The control unit 14 detects there is no mini fuse in the electrode module 11, the control unit 14 starts the counting process when the air sterilizer 20 is switched on for the first

time. Concurrently, the control unit 14 sends a defined voltage supply, between 7 V to 10 V to the high voltage module 13 to start the sterilization process of the air sterilizer 20. The counter 21 monitors the total time of which the air sterilizer 20 is switched on and once the predetermined maximum duration for which the air sterilizer 20 is switched on is reached, the control unit 14 triggers and sends an alert to the display means 17 to prompt the replacement of the electrode module 11. The predetermined maximum duration for which the air sterilizer 20 is switched on is configured in the ranges of 8,000 hours to 8,500 hours. The LED lights of the display means 17 are lit up and blinking to visually indicate the electrode module 11 is required to be replaced. For example, the maximum duration is configured to be 8,500 hours. If the air sterilizer 20 has been switched on for more than 8,500 hours, the control unit 14 triggers and sends an alert to the display means 17 to prompt the replacement of the electrode module 11.

The old electrode module 11 is replaced with a new electrode module 11y which is equipped with a mini fuse built into the fuse board mounted in the electrode module 11y. The new electrode module 11y is slotted into the module holder 12. When the control unit 14 detects the presence of a mini fuse in the electrode module 11y, and when the air sterilizer 20 is switched on, the control unit 14 sends a defined current between the ranges of 65 milliamps to 75 milliamps to blow the mini fuse in the electrode module 11y to reset the counter 21 to reset the counting process of the total duration of which the air sterilizer 20 is switched on. Concurrently, when the mini fuse in the electrode module 11y is blown, the high voltage module 13 starts the sterilization process. The counter 21 monitors the total time of which the air sterilizer 20 is switched on and once the predetermined maximum duration for which the air sterilizer 20 is switched on for example, 8,500 hours is reached, the control unit 14 triggers and sends an alert to the display means 17 to prompt the replacement of the electrode module 11y with a new electrode module 11z which is equipped with a mini fuse.

Figure 4 illustrates, in a perspective view, a third embodiment of an air sterilizer 30 with the components of two electrode modules 31, two module holders 32, a high voltage module 33, a control unit 34, a power supply unit 35, a connector 16 and a display means 37 which are encased in a casing 38.

The casing 38 is made up of a rectangular casing 38a, module cover 38b, rectangular cover 38c and vented openings 38d. The rectangular casing 38a serves as a housing in which all the components are mounted or supported. The components are enclosed by a rectangular top cover 38c which has two sets of vented openings 38d. A connector 16 in the form of a plug in this embodiment is mounted on the rear of the rectangular casing 38a. The plug 16 connects the sterilizer 30 to an AC voltage power supply through a wall mounting bracket MB.

In this embodiment, two electrode modules 31 are used. One electrode module 31 is used to generate either only negative ions or combination of both negative ions and ozone. Another electrode module 31 is used to generate only ozone. Each electrode module 31 has two terminals 31a at one side edge of the module 31. Each of the two ends of the electrode module 31 has one notch 31b. Two module holders 32 are mounted to the casing 38. Each module holder 32 has two terminals 32a which are connected to a common high voltage module 33.

Each electrode module 31 is slidable into a respective module holder 32 for the terminals 31a of the module 31 to make electrical contact with the terminals 32a of the module holders 32. Each module 31 is retained inside the respective holders 32 by a respective module cover 38b which is fastened to the respective holder 32 with a screw.

A common high voltage module 33 supplies AC voltage to both electrode modules 31. The control unit 34 controls the supply of power to the high voltage module 33 to supply AC voltage to the electrode modules 31. The supply of AC voltage is dependent on the type of electrode module 31. The voltages supplied to the modules 31 through the respective module holders 32 may be the same for each module holder 32 or different, according to the types of module 31 that are intended to be installed.

Each electrode module 31 and module holder 32 are located to either side of the high voltage module 33. Negative ions and/or ozone are released when the electrode modules 31 receive high voltage. Two sets of fans 36 are located next to each two sets of electrode module 31 and module holder 32 so as to generate an air flow to circulate the generated negative ions and/or ozone to the surroundings. The negative ions and/or ozone exit through the vented openings 38d of the top cover 38c to the atmosphere. Two sets of vented openings 38d are each located directly over the respective module holders 32 inside the rectangular casing 38a.

Alternatively, a separate high voltage module 33 may be used to supply AC high voltage to each of the two electrode modules 31.

The control unit 34 has a timer to control the ON/OFF setting of the high voltage module 33. The level of generation of negative ions and/or ozone can be controlled by the control unit 34 in the order of three settings of low, medium and high.

The module cover 38b is removed to enable the old electrode module 31 to be slid out of the module holder 32 to be replaced with a new electrode module 31 or different type of electrode module 31.

Alternatively, in another embodiment, in each module holder 32, there is a locking mechanism which fits the two notches 31b on the electrode module 31 to further secure the module 31 in the holder 32. The electrode module 31 may be released from the module holder 32 by pushing the module 31 to release the notches 31b on the module 31 from the locking mechanism.

The third embodiment of the air sterilizer 30 is suitably used with both types of mechanisms for monitoring the usage and condition of the electrode modules 31 in use which are either based on the current consumption or the duration for which the sterilizer is switched on, to generate an alert to prompt the replacement of the electrode modules 31. Both monitoring mechanisms which are configured by the control unit 34 can be suitably adapted to either monitor the individual electrode module or as a group of electrode modules to trigger the replacement of the individual electrode module or as a group of electrode modules.

The air sterilizer 30 is suitably used with the first mechanism in which the generation of alerts to prompt the replacement of the two electrode modules 31 is based on the monitoring of the current consumption of the two electrode modules 31 during the on-going sterilization process. The control unit 34 monitors the current consumption of the two electrode modules 31 once the air sterilizer 30 has begun its sterilization process. The control unit 34 has configured a maximum current consumption drawn by each of the two electrode modules 31 before triggering an alert to the display means 37. The maximum current consumption is configured by the control unit 34 to be within a range of 400 milliamps to 450 milliamps. The maximum current consumption is configured at 400 milliamps. After the sterilization process has started and continued after a period of time, the electrode modules 31 exponentially consume more current from the AC high voltage power. Once any of the two electrode modules 31 consumes beyond the maximum current consumption of 400 milliamps for example, the control unit 34 triggers and generate a signal to the display means 37 to prompt the user to replace the specific electrode module 31 with a new electrode module 31x.

The display means 37 is a set of LED lights adapted on to outer surface of the cover 38c which is to visually indicate and prompt the user to replace the electrode modules. The display means 37 is a series of LED lights placed on top of the module holder 32. This display means 37 is lit up or blinking to visually indicate the electrode modules 31 are required to be replaced. Once the electrode modules 31 are replaced with new electrode modules 31x, the display means 37 is switched off. Alternatively, the display means 37 comprises two sets of LED lights placed on top of the two respective

module holders 32. This provide the flexibility to the control unit 34 for monitoring both of the electrode modules 31 individually and to facilitate the replacement of the specific and individual electrode module 31. The two sets of LED lights are adapted to visually indicate the specific electrode module of the two electrode modules 31 that is required to be replaced.

The air sterilizer 30 is also suitably used with the second mechanism in which the generation of alert to prompt the replacement the two electrode modules 31 is based on the monitoring of the cumulative duration for which the air sterilizer 30 is switched on. An additional counter (not shown) is adapted into the control unit 34 for calculating and monitoring the duration for which the air sterilizer 30 is switched on.

This air sterilizer 30 is equipped with two electrode modules 31 slotted into the respective module holders 32. These new electrode modules 31 are not equipped with additional mini fuses. The control unit 34 detects there are no mini fuses in both of the electrode modules 31, the control unit 34 starts the counting process when the air sterilizer 30 is switched on for the first time. Concurrently, the control unit 34 sends a defined voltage supply, between 7 V to 10 V to the high voltage module 33 to start the sterilization process of the air sterilizer 30. The counter (not shown) monitors the total time of which the air sterilizer 30 is switched on and once the predetermined maximum duration for which the air sterilizer 30 is switched on is reached, the control unit 34 triggers and sends an alert to the display means 37 to prompt the replacement of the two electrode modules 31. The predetermined maximum cumulative duration for which the air sterilizer 30 is switched on is configured in the ranges of 8,000 hours to 8,500 hours. The display means 37 is lit up and blinking to visually indicate the two electrode modules 31 are required to be replaced. For example, the maximum duration is configured to be 8,500 hours. If the air sterilizer 30 has been switched on for totally more than 8,500 hours, the control unit 34 triggers and sends an alert to the display means 37 to prompt the replacement of the two electrode modules 31.

The two old electrode modules 31 are replaced with two new electrode modules 31y which are equipped with mini fuses built into the fuse boards mounted in the

respective electrode modules 31y. The new electrode modules 31y are slotted into the respective module holders 32. When the control unit 34 detects the presence of mini fuses in the electrode modules 31y, and when the air sterilizer 30 is switched on, the control unit 34 sends a defined current between the ranges of 65 milliamps to 75 milliamps to blow the mini fuses in the electrode modules 31y to reset the counter (not shown) to reset the counting process of the total duration of which the air sterilizer 30 is switched on. Concurrently, when the mini fuses in the electrode modules 31y are blown, the high voltage module 33 starts the sterilization process. The counter (not shown) monitors the total time of which the air sterilizer 30 is switched on and once the predetermined maximum cumulative duration for which the air sterilizer 30 is switched on is reached, the control unit 34 triggers and sends an alert to the display means 37 to prompt the replacement of the electrode modules 31y with new electrode modules 31z which are equipped with mini fuses.

Figure 5 illustrates, in a perspective view, a fourth embodiment of an air sterilizer 40 with the components of two sets of two electrode modules 41, two module holders 42, and high voltage module 43 are controlled by a control unit 44, a power supply unit 45, a connector 16 and a display means 47 which are encased in a casing 48.

The casing 48 is made up of a rectangular casing 48a, module cover 48b, rectangular cover 48c and vented openings 48d. The rectangular casing 48a serves as a housing in which all the components are mounted or supported. The components are enclosed by a rectangular top cover 48c which has four sets of vented openings 48d. A connector 16 in the form of a plug in this embodiment is mounted on the rear of the rectangular casing 48a. The plug 16 connects the sterilizer 40 to an AC voltage power supply through a wall mounting bracket MB.

In this embodiment, a set of two electrode modules 41 and two module holders 42 are connected to either side of a common high voltage module 43. Each electrode module 41 has two terminals 41a at one side edge of the module 41. Each of the two sides of the module 41 has one notch 41b. Each module holder 42 has two terminals 42a which are connected to a common high voltage module 43. Negative ions and/or

ozone are released when the electrode modules 41 receive high voltages. Four sets of fans 46 are located next to each four sets of electrode module 41 and module holder 42 so as to generate an air flow to circulate the generated negative ions and/or ozone to the surroundings. The negative ions and/or ozone exit through the four vented openings 48d of the top cover 48c to the atmosphere. The four sets of vented openings 48d are each located directly over the respective module holders 42 inside the rectangular casing 48a.

Alternatively, a separate high voltage module 43 may be used to supply AC high voltage to each of the four electrode modules 41.

The control unit 44 has a timer to control the ON/OFF setting of the two high voltage modules 43. The level of generation of negative ions and/or ozone can be controlled by the control unit 44 in the order of three settings of low, medium and high. A high level of generation of negative ions and/or ozone requires the control unit 44 to control the two high voltage modules 43 to supply different AC voltages to the two sets of two electrode modules 41. The voltages supplied to the modules 41 through the respective module holders 42 may be the same for each module holder 42 or different, according to the types of module 41 that are intended to be installed.

Alternatively, in another embodiment, in each module holder 42, there is a locking mechanism which fits the two notches 41b on the electrode module 41 to further secure the module 41 in the holder 42. The electrode module 41 may be released from the module holder 42 by pushing the module 41 to release the notches 41b on the module 41 from the locking mechanism.

The fourth embodiment of the air sterilizer 40 is suitably used with both types of mechanisms for monitoring the usage and condition of the electrode modules 41 in use which are either based on the current consumption or the cumulative duration for which the sterilizer is switched on, to generate an alert to prompt the replacement of the electrode modules 41. Both monitoring mechanisms which are configured by the control unit 44 can be suitably adapted to either monitor the individual electrode module or as a

group of electrode modules to trigger the replacement of the individual electrode module or as a group of electrode modules.

The air sterilizer 40 is suitably used with the first mechanism in which the generation of alerts to prompt the replacement of the four electrode modules 41 is based on the monitoring of the current consumption of the four electrode modules 41 during the on-going sterilization process. The control unit 44 monitors the current consumption of the four electrode modules 41 once the air sterilizer 40 has begun its sterilization process. The control unit 44 has configured a maximum current consumption drawn by the four electrode modules 41 before triggering an alert to the display means 47. The maximum current consumption is configured by the control unit 44 to be within a range of 400 milliamps to 450 milliamps. The maximum current consumption is configured at 400 milliamps. After the sterilization process has started and continued after a period of time, the electrode modules 41 exponentially consume more current from the AC high voltage power. Once any of the four electrode modules 41 consumes beyond the maximum current consumption of 400 milliamps for example, the control unit 44 triggers and generate a signal to the display means 47 to prompt the user to replace the specific electrode module 41 with a new electrode module 41x.

The display means 47 is a set of LED lights adapted on to outer surface of the rectangular cover 48c which is to visually indicate and prompt the user to replace the electrode modules. The display means 47 is a series of LED lights placed on top of the module holder 42. This display means 47 is lit up or blinking to visually indicate the four electrode modules 41 are required to be replaced. Once the four electrode modules 41 are replaced with new electrode modules 41x, the display means 47 is switched off. Alternatively, the display means 47 comprises four sets of LED lights placed on top of four respective module holders 42. This provides the flexibility to the control unit 44 for monitoring the four electrode modules 431 individually and to facilitate the replacement of the specific and individual electrode modules 41. The four sets of LED lights are adapted to visually indicate the specific electrode module of the four electrode modules 41 that is required to be replaced.

The air sterilizer 40 is also suitably used with the second mechanism in which the generation of alert to prompt the replacement the four electrode modules 41 is based on the monitoring of the cumulative duration of which the air sterilizer 40 is switched on. An additional counter (not shown) is adapted in the control unit 44 for calculating and monitoring the duration for which the air sterilizer 40 is switched on.

This air sterilizer 40 is equipped with four new electrode modules 41 slotted into the respective module holders 42. These new electrode modules 41 are not equipped with additional mini fuses. The control unit 44 detects there are no mini fuses in all four electrode modules 41, the control unit 44 starts the counting process when the air sterilizer 40 is switched on for the first time. Concurrently, the control unit 44 sends a defined voltage supply, between 7 V to 10 V to the high voltage module 43 to start the sterilization process of the air sterilizer 40. The counter (not shown) monitors the total time for which the air sterilizer 40 is switched on and once the predetermined maximum duration for which the air sterilizer 40 is switched on is reached, the control unit 44 triggers and sends an alert to the display means 47 to prompt the replacement of the four electrode modules 41. The predetermined maximum duration for which the air sterilizer 40 is switched on is configured in the ranges of 8,000 hours to 8,500 hours. The display means 47 is lit up and blinking to visually indicate the four electrode modules 41 are required to be replaced. For example, the maximum duration is configured to be 8,500 hours. If the air sterilizer 40 has been switched on for more than 8,500 hours, the control unit 44 triggers and sends an alert to the display means 47 to prompt the replacement of the four electrode modules 41 with new electrode modules 41y.

The four used electrode modules 41 are replaced with four new electrode modules 41y which are equipped with mini fuses built into the fuse boards mounted in the respective electrode modules 41y. The new electrode modules 41y are slotted into the respective module holders 42. When the control unit 44 detects the presence of mini fuses in the electrode modules 41y, and when the air sterilizer 40 is switched on, the control unit 44 sends a defined current between the ranges of 65 milliamps to 75 milliamps to blow the mini fuses in the electrode modules 41y to reset the counter (not

shown) to reset the counting process of the total duration of which the air sterilizer 40 is switched on. Concurrently, when the mini fuses in the electrode modules 41y are blown, the high voltage module 43 starts the sterilization process. The counter (not shown) monitors the total time of which the air sterilizer 40 is switched on and once the predetermined maximum duration for which the air sterilizer 40 is switched on is reached, the control unit 44 triggers and sends an alert to the display means 47 to prompt the replacement of the electrode modules 41y with new electrode modules 41z which are equipped with mini fuses.

Figure 6 illustrates, in an exploded perspective view, an embodiment of the electrode module which may be used for all embodiments described in Figures 1 to 5. The electrode module comprises a planar configuration with the components of an inner electrode 51, an outer electrode 52 and a dielectric barrier 53 arranged in parallel which are encased in a modular frame-like casing 54, 55.

The inner electrode 51 has a continuous overall surface and the outer electrode 52 provides a plurality of ion generating points for generation of negative ions and/or ozone. One end of the inner electrode 51 has an extended portion in the shape of a spring plate extension to be fitted to the modular casing 54, 55. Similarly, one end of the outer electrode 52 is made in the shape of a shape of a spring plate extension.

The modular casing 54, 55 of a rectangular shape that includes two covers 54, 55 is used to encase the components of the electrode module. Two opposing ends of the modular casing 54, 55 have notches 54a. The notches on the casing 54, 55 of the electrode module allow the electrode module to be locked and released in and from the holder of the air sterilizer. The compartments inside the covers 54, 55 are configured with clearance to receive the electrode module components that are dielectric barrier 53, outer electrode 52 and inner electrode 51. The dielectric barrier 53 in this example is made of two dielectric plates is designed to be a relatively snug fit within frames defined by the inner structure of the covers 54, 55. On the other hand, the electrodes 51, 52 are undersized relative to the two dielectric plates 53. The electrodes 51, 52 are located centrally of the two dielectric plates 53.

The outer electrode 52 may have a plurality of apertures configured for example in the stars configuration, honeycomb configuration, sun-shaped configuration either in planar or in the form of 3-dimensional structures.

The cover 54 has a window-like opening 56 to expose the ion generating holes of the outer electrode 52. Screws 58 are used to secure the two covers 54, 55 of the casing to form an enclosure. Obviously, other means such as a snap-lock fit may be used to secure the casing covers 54, 55 together. In the case of the 3-dimensional star structure for the outer electrode 52 as represented in Figure 6, slits are first formed as a set of radial cuts of a circle. The 3-dimensional star structures are then formed by punching through the slits whereby the pointed edges of the star formed by sectors of the circle are protruded from the surface at an inclined angle. The pointed edges protrude outside of the surface area of the outer electrode 52 that faces the window 56 of the modular casing 54, 55.

The electrode module for all the embodiments described herein is inserted into the module holder in the direction where the window-like opening 56 which exposes the outer electrode 52 facing upward or outward of the modular casing 54, 55 for the release of negative ions and/or ozone through the outlets of the casing of the air sterilizer.

There may be several different types of electrode modules, which are able to generate negative ions, ozone or combination of both. Suitably, there can be three types of electrode for generating primarily negative ions, primarily ozone and combination of negative ions and ozone.

Figure 7 illustrates, in an exploded perspective view, an electrode module using a different outer electrode which has a 3-dimensional claw structure. This outer electrode arrangement is used to form an electrode module that generates a combination of negative ions and ozone.

The air sterilizer may identify the type of electrode module through electrical interaction. In all the embodiments described herein, the control unit may also be used to

detect the type of electrode module by detecting the level of power consumption of the electrode module once it is installed in the module holder. Different types of electrode module have different power usage requirements. The control unit may control the supply of power to the high voltage module to supply different AC voltages to one or more types of electrode module as determined by the user. For an air sterilizer which has more than one module holder, the control unit supplies different power to different outputs of module holders which receives the different types of electrode modules. For example, the electrode module that generates only negative ions may require power of 1.5 W. The electrode module that generates a combination of negative ions and ozone may require power of 2.0 W. The electrode module that generates ozone may require power of 5.0 W.

In a module holder which is configured to receive an electrode module that generates primarily negative ions, the control unit is configured to supply power of up to 1.5 W. For this module holder, the control unit is unable to supply sufficient power to different types of electrode module which require power of more than 1.5 W. The control unit shuts down the supply of voltage to the electrode module to indicate that a wrong type of electrode module is installed into the module holder.

In another module holder which is configured to receive either an electrode module that generates either negative ions or a combination of negative ions and ozone, the control unit is configured to supply power of up to 2.0 W. For this module holder, the control unit may supply power of up to 2.0 W to either one type of the electrode module, once it is inserted into the module holder. The control unit is unable to supply sufficient power to different types of electrode module which require power of more than 2.0 W. The control unit shuts down the supply of voltage to the electrode module to indicate that a wrong type of electrode module is installed into the module holder.

In another module holder which is configured to receive an electrode module that generates primarily ozone, the control unit is configured to supply power of up to 5.0 W. For this module holder, the control unit may supply power of up to 5.0 W to the electrode

module that generates ozone. However, the control unit may also provide sufficient power to different types of electrode module that requires power less than 5.0 W.

Alternatively to the electrode module in relation to Figures 6 and 7, Figure 8 illustrates an electrode module having a memory chip 59 on the surface of the modular casing, where a terminal of the memory chip 59 is in parallel to the terminals of the electrodes 51', 52'. A stored identification code in the memory chip 59 specifies the type of module. As an alternative to the power detection option, the control unit may instead detect the type of electrode module by sensing and detecting the memory chip 59 once the module is installed into the module holder, memory chip 59 is then connected to the control unit through the terminals of the memory chip 59. The control unit may detect the type of module through reading the memory chip 59.

As an alternative to the electrical detection of the type of electrode module, the air sterilizer may identify the type of electrode module through mechanical interaction. For this purpose, the module holder in all the embodiments described herein may be adapted to receive a specific type of electrode module as determined by the user. The module holder has one or more matching holes to receive a module pin of an electrode module. The position of the matching hole on the holder allows a specific electrode module as determined by the user, to be installed into the holder. A wrong type of electrode module is structurally prevented from being fully inserted into the module holder and so cannot become electrically connected to the control unit in the air sterilizer. Alternatively, the holder may instead be provided with a module pin to be inserted into the matching hole on the surface of the electrode module.

Figure 9 illustrates, in a perspective view of a module holder 82 configured to only receive two types of electrode module 81 that generates either negative ions or a combination of negative ions and ozone. The holder 82 is adapted with a module hole 82a at the bottom edge of the holder 82. The electrode module 81 has a module pin 81a on the modular casing, where module pin 81a is in parallel to the terminals of the electrodes 81', 82'. The relative position of the module pin 81a corresponds to the position of the module hole 82a formed in the holder 82.

Figure 10 illustrates, in a perspective view of another embodiment of a holder 92 configured to receive only an ozone electrode module 91 which generates only ozone. The holder 92 is adapted with a module hole 92a at the top edge of the holder 92. The electrode module 91 has a module pin 91a on the right surface of the modular casing, where module pin 91a is in parallel to the terminals of the electrodes 91', 92'. The relative position of the module pin 91a corresponds to the position of the module hole 92a formed in the holder 92.

Figure 11 illustrates, in a perspective view of another embodiment of a holder 102 configured to receive all three types of electrode module 101. The holder 102 is adapted with two module holes 102a at the top and bottom edges of the holder 102 to receive the three different types of electrode modules 101 which has a different location of its module pin 101a.

Figure 12 illustrates another embodiment of the electrode module with a cylindrical configuration which may be used for all embodiments described in Figures 1 to 5. Alternatively, this electrode module may also be used with another embodiment or air sterilizer which provide new module holders to accommodate this electrode module. The electrode module X1, X2, X3 comprises a cylindrical configuration with the components of an inner electrode XX and an outer electrode XW, XY, XZ arranged and encapsulated around the outer surface of the electrode XX separated by a cylindrical glass tube supported by a cartridge frame Y1, Y2, Y3. The outer electrode XW, XY, XZ provides a plurality of ion generating points for generation of negative ions and/or ozone.

The electrode module X1 which is used to generate ozone only comprises an inner electrode XX and an outer electrode XW which is steel wire fully wound around the outer surface of the inner electrode XX supported by a cartridge frame Y1.

The electrode module X2 which is used to generate negative ions only comprises an inner electrode XX and an outer electrode XY which is a plate provided with plurality of apertures wound and encapsulated around the inner electrode XX supported by a

cartridge frame Y2. The plurality of apertures on the plate of the outer electrode XY are configured either in planar form or in the form of 3-dimensional structures.

The electrode module X3 which is used to generate both the ozone and negative ions comprises an inner electrode XX and an outer electrode XZ which has a steel wire and a plate provided with plurality of apertures whereas both elements are wound around the outer surface of the inner electrode XX supported by a cartridge frame Y3. The plurality of apertures on the plate of the outer electrode XZ are configured either in planar form or in the form of 3-dimensional structures.

Figure 13 illustrates, an additional communication module (not shown) applicable in all embodiments of the air sterilizer which provides communication between a user, a server and the sterilizer. The communication module (not shown) which is adapted into a control unit of the air sterilizer comprises either a wireless module which or a Bluetooth® module. The wireless module utilizes a Wi-Fi-network or a cellular network which allows communication between the user, the server and the air sterilizer using communication devices such as smart phones, laptop and tablet.

The communication module (not shown) allows the flexibility of the user or a server to communicate with the air sterilizer which includes the generation of alert to the user or server to prompt the replacement of the electrode module. In addition, the communication module (not shown) allows the user or a server to switch on or off the air sterilizer remotely.

In the embodiment of an air sterilizer being rented to users, the principal office monitors and controls the usage of the air sterilizer by communicating with the air sterilizer through the server and the communication module in the air sterilizer. There is an exchange of payment between the user and the principal office for a predetermined number of credit hours of usage of the air sterilizer. Once the credit hours have been fully used, the principal office sends a remote signal through the server to the sterilizer to switch off the air sterilizer. The user is required to remit additional payment in exchange

of credit hours to use the air sterilizer. Once the payment has been remitted, the principal office sends a remote signal through the server to switch on the air sterilizer.

Figure 14 illustrates a schematic block diagram of an air sterilizer using power detection to detect the type of electrode module. The high AC voltage power supply is directed to the power supply unit 15. The power supply unit 15 converts the AC voltage to a DC voltage. The control unit 14 receives the DC voltage from the power supply unit 15. The control unit 14 is connected to the high voltage module 13. The high voltage module 13 converts the DC voltage to AC high voltage to supply power to the electrode module 11. In the control unit 14, a main control panel 14a controls the ON/STANDBY setting. The main control panel 14a is connected to a power detection unit 14b, a sterilizer control unit 14c and fan control unit 14d. The level of generation of negative ions and/or ozone may be controlled by the sterilizer control unit 14c in the order of three settings of low, medium and high. The power detection unit 14b detects the level of power consumption to determine the type of electrode module. The control unit 14 shuts down the supply of voltage to the electrode module to indicate that a wrong type of electrode module is installed into the module holder. The main control panel 14a is also connected to a fan control unit 14d which controls the ON/OFF setting of the fan 26.

The embodiments in accordance with the invention can use different types of electrode modules to suit the application of the user. Using inner and outer electrodes of, for example, different configurations, materials, and/or adjusting their relative dimensions, provides the flexibility to vary and control the output of ions and ozone depending on the application. The air sterilizer provides a flexibility to use different electrode modules interchangeably in accordance with different needs.

The invention may also be embodied in many ways other than those specifically described herein, without departing from the scope thereof.

CLAIMS

1. An air sterilizer to distribute negative ions and/or ozone to the surroundings in a sterilization process, comprising:

a casing;

an electrode module;

a module holder adapted to receive and retain said electrode module within the casing in a replaceable/interchangeable manner;

a control unit for controlling and monitoring the operations of the electrode module; and

a display means for displaying visual information for prompting a user to replace the electrode module;

wherein the module holder receives the electrode module so as to connect the electrode module to a source of AC high voltage for the generation of negative ions and/or ozone;

wherein the electrode module is one of a plurality of types for generating primarily negative ions, primarily ozone, or a combination of both negative ions and ozone;

wherein the type of electrode module is identifiable by interaction between the electrode module and the air sterilizer;

wherein the control unit monitors the change in parameters of the electrode module and once the electrode module does not comply with a predetermined set of parameters, the control unit generates an alert to the display means to prompt the replacement of the electrode module;

wherein the control unit is adapted with a counter to calculate and monitor the cumulative duration for which the air sterilizer is switched on and configures a predetermined maximum duration the air sterilizer is switched on to trigger in sending an alert to the display means to prompt the replacement of the electrode module;

wherein for a new air sterilizer, a first electrode module with no fuse is inserted into the module holder to initiate the sterilization process by switching on the sterilizer; and

wherein after the end of the usage of the first electrode module, the first electrode module is replaced with a second electrode module equipped with a fuse, and so on, whereby the control unit detects the fuse in the second electrode module and once the air sterilizer is switched on, the control unit sends a predetermined current to blow the fuse in the second electrode module and resets the counter to initiate the calculation and monitoring process of the duration the air sterilizer is switched on, whereby once the cumulative duration of the air sterilizer being switched on reaches the predetermined maximum of duration, the control unit triggers and send an alert to the display means to prompt the replacement of the second electrode module.

2. The air sterilizer according to Claim 1, wherein the control unit is adapted to detect the type of electrode module by detecting the power consumption of the electrode module.

3. The air sterilizer according to Claim 1, wherein the control unit is adapted to detect the type of electrode module by detecting an identification code of the electrode module.

4. The air sterilizer according to Claim 3, wherein the identification code is stored in a memory chip mounted on the electrode module.

5. The air sterilizer according to any of Claims 2 to 4, wherein the control unit is adapted to shut down the supply of voltage to the electrode module upon detecting that the type of electrode module is not suitable for use with the air sterilizer.

6. The air sterilizer according to any of the preceding claims, wherein the type of module is identifiable by physical interaction between the electrode module and the sterilizer.

7. The air sterilizer according to Claim 6, wherein the module holder is adapted to selectively receive at least one type of electrode module.

8. The air sterilizer according to Claim 6 or 7, wherein the module holder is adapted to block at least one type of electrode module which is not suitable for use with the air sterilizer from being fully inserted into the holder.

9. The air sterilizer according to any of Claims 6 to 8, wherein the electrode module comprises a modular casing;

wherein the structure of the modular casing defines the type of electrode module.

10. The air sterilizer according to any of the preceding claims, wherein the sterilizer comprises a plurality of said module holders each for receiving a respective said electrode module.

11. The air sterilizer according to any of the preceding claims, wherein the electrode module comprises terminals for making electrical contact with corresponding terminals in the module holder when the electrode module is mounted in the module holder.

12. The air sterilizer according to any of the preceding claims, wherein the sterilizer comprises a module cover fastenable to the casing to secure and retain the electrode module in the module holder.

13. The air sterilizer according to Claim 1, wherein the used second electrode module is replaced with a third electrode module equipped with a fuse to initiate the sterilization process by switching on the air sterilizer

14. The air sterilizer according to Claim 1, wherein the predetermined maximum duration the air sterilizer is switched on as configured by the control unit ranges from 8,000 hours to 8,500 hours.

15. The air sterilizer according to Claim 1, further comprising a communication module for transmitting a remote signal.

16. The air sterilizer according to Claim 15, wherein the communication module is wireless.

17. The air sterilizer according to Claim 16, wherein the wireless communication module uses a Wi-Fi network or a cellular network.

18. The air sterilizer according to any one of Claims 15 to 17 wherein the communication module automatically transmits a remote signal to a server or mobile terminal device.

19. The air sterilizer according to any one of Claims 15 to 18, wherein the communication module allows for communication between the server and the air sterilizer for starting or stopping the sterilization process in the air sterilizer.

20. The air sterilizer according to Claim 16, wherein the wireless communication module uses a Bluetooth® network.

21. The air sterilizer according to Claim 20, wherein the communication module automatically transmits a said remote signal to a server or mobile terminal device.

22. The air sterilizer according to any one of Claims 20 to 21, wherein the communication module allows for communication between the server and the air sterilizer for starting or stopping the sterilization process in the air sterilizer.

23. The air sterilizer according to Claim 1, wherein the display means is a monitor display or a series of LED Lights for visually indicating the alert to prompt the replacement of the electrode module by the user.