

Air Purifier and Method for Calculating Life of Used Filter Cartridge, and Anti-Counterfeiting Method for Used Filter Cartridge

Technical Field

[0001] The disclosure belongs to the technical field of air purifying equipment and particularly relates to an air purifier and a method for calculating life of a used filter cartridge, and an anti-counterfeiting method for the used filter cartridge.

Background

[0002] In recent years, continuous hazy weather has bothered people a lot. To improve the air quality of a living environment, an air purifier has also become prevailed. A working principle of an existing air purifier is to suck air into the air purifier, filter the air through a filter cartridge in the air purifier, isolate dust and impurities in the air on the filter cartridge, and then exhaust the filtered air, so as to achieve an air purifying purpose. However, with increase of the dust and impurities adsorbed to the filter cartridge, the purifying effect of the air purifier will be weakened, and in this case, the filter cartridge needs to be replaced periodically to restore the effect of the air purifier.

[0003] For the existing air purifier, a use condition of the filter cartridge will be recorded, such that a user is reminded at expiration of the service life of the filter cartridge. However, a situation that the purifier equipment will identify the used filter cartridge which is re-installed in some purifier equipment as a new filter cartridge to re-calculate its service life easily occurs.

Summary

[0004] An object of the disclosure is to provide an air purifier and method for calculating life of a used filter cartridge and an anti-counterfeiting method for the used filter cartridge to solve the problem proposed in the background art.

[0005] To achieve the above object, the disclosure uses the following technical solution: an air purifier includes a purifier main body and a filter cartridge detachably therewith, where the purifier main body is provided with a master control and identifying chip, an information chip is fixed to the filter cartridge and records usage days and/residual life of the filter cartridge, the information chip and the master control and identifying chip intercommunicate with each other in data by way of wireless communication or wired communication, and a data communication

interval between the information chip and the master control and identifying chip is 2-300 s/time.

[0006] Preferably, the air purifier is further provided with a life prompt module and a timing apparatus intercommunicating with the master control and identifying chip, the master control and identifying chip is provided with a problem that controls the life prompt module to response and sets a terminating index prompt threshold for a factory set life of the filter cartridge, the terminating index prompt threshold for the factory set life of the filter cartridge is previous to an actual life terminating index threshold of the filter cartridge of the purifier, in a case that the filter cartridge is at the terminating index prompt threshold for the factory set life of the filter cartridge, the filter cartridge can be subjected to scrap disposition, and in a case that the filter cartridge is at the actual life terminating index threshold of the filter cartridge, the filter cartridge enters a fully scrapped state, and can no longer be used; and an implementation of the life prompt module includes the following steps:

[0007] S1: in a case that the life of the filter cartridge reaches the terminating index prompt threshold for the factory set life of the filter cartridge, the life prompt module entering a first response status, and meanwhile, recording, by the master control and identifying chip, the life of the filter cartridge in a countdown manner;

[0008] S2: after continuously operating for a fixed duration T_c , the purifier entering a performance protection status, and the life prompt module entering a second respond status, wherein in the performance protection status, an operating speed of a purifier unit is less than 600 r/m; and

[0009] S3: continuously operating the purifier for a fixed duration T_d after the operating duration reaches T_c , the filter cartridge entering a scrapped status, and moreover, the life prompt module entering a third respond status.

[0010] Preferably, the life prompt module includes one or more of an indicator light, a loudspeaker alarm, an external display screen of the purifier, and an app mini program.

[0011] Preferably, the information chip further includes a genuine product identification number for identifying whether the filter cartridge is genuine or fake, and in a case that the master control and identifying chip cannot read the genuine product identification number on the information chip, the purifier refuses to operate.

[0012] A method for calculating life of a used filter cartridge of an air purifier, used in the air purifier, specifically includes the following steps:

[0013] S4: setting a reference value a_r of a concentration of particulate matters passing through the purifier within unit time, setting a quantity of the particulate matters capable of being adsorbed by the purifier to the maximum extent as Q to obtain a usable duration of the filter cartridge in a case that the particulate matters are at the reference value concentration a_r in the condition of the quantity Q of the particulate matters capable of being adsorbed by the purifier, setting the duration as a standard total duration, and obtaining a residual usable duration of the filter cartridge through $T_v = T - T_r$, where T is the standard total duration, T_r is a duration consumed by the filter cartridge within the unit time at the reference value a_r of the concentration of the particulate matters, and setting T_r as a reference duration and T_v as the residual usable duration of the filter cartridge;

[0014] S5: setting a plurality of particulate concentration ranges $a_1, a_2..a_n$ end to end, calculating a relation between service life of the filter cartridge in a case that the particulate matter concentration is in the ranges of $a_1, a_2..a_n$ and service life of the filter cartridge in a case that the particulate matter concentration is in the range of a_r through an equation $T_i = W_i * T_r$, where T_i is a reference duration consumed in a case that the particulate matter concentration is at a_i , and W_i is a weight coefficient in a case that the particulate matters are at the concentration a_i and a relative reference value concentration a_r , W_i is one of $W_1, W_2, W_3..W_n$, and the $W_1, W_2, W_3..W_n$ are in one-to-one correspondence to $a_1, a_2...a_n$; and

[0015] S6: acquiring a particulate matter concentration C_{sn} at an air inlet of the purifier before purification in a current environment, judging the particulate matter range a_i of the C_{sn} , and calculating the standard total duration consumed in the current air environment within the unit time according to the weight coefficient W_i of the current concentration.

[0016] Preferably, a PM2.5 sensor connected to the master control and identifying chip by way of wireless communication or wired communication is arranged at the air inlet of the air purifier.

[0017] Preferably, the residual life recorded in the information chip is a sum of the residual usable duration T_v of the filter cartridge or the standard duration where the filter cartridge has been used.

[0018] Preferably, in a case that the life of the filter cartridge is before the terminating index prompt threshold for the factory set life of the filter cartridge, the master control and identifying chip performs one or more of identifying, recording or data transmitting work of the life of the filter cartridge through steps S4-S6.

[0019] Preferably, the terminating index prompt threshold for the factory set life of the filter cartridge, the continuous operating fixed duration T_c and the continuous operating fixed duration T_d are defined by double conditions: the usage days and the consumed standard total duration; the usage days are actual usage days after the filter cartridge is installed in the purifier; the usage days and the consumed standard total duration each have set a specific prompt value at three time nodes: the terminating index prompt threshold for the factory set life of the filter cartridge, the continuous operating fixed duration T_c and the continuous operating fixed duration T_d ; and in a case that any of the usage days and the consumed standard total duration is met preferably at the three time nodes, the operating status of the purifier at the time nodes is executed.

[0020] An anti-counterfeiting method for a used filter cartridge of an air purifier, applied to the air purifier, specifically includes the following methods:

[0021] Method I:

[0022] SA01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

[0023] SA02: identifying, by a master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that the filter cartridge is used, if the ID information is corrected, operating the purifier; and

[0024] if the ID information is incorrect, the purifier refuses to operate;

[0025] Method II:

[0026] SB01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

[0027] SB02: identifying, by the master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that a new filter cartridge is used, where if the

ID information is corrected and has no encrypted value, a special encrypted value is calculated and respectively recorded to nonvolatile storage areas of the information chip and the master control and identifying chip, and furthermore, the purifier operates and reads information stored in the information chip; and

[0028] identifying, by the master control and identifying chip, the dedicated ID of the information chip in a case that the filter cartridge is used, where if the ID information is corrected and has an encrypted value, whether the encrypted value is consistent is identified and checked, if the encrypted value is consistent, the purifier operates and reads the information stored in the information chip, and if the encrypted value is inconsistent, the purifier refuses to operate; and

[0029] Method III:

[0030] SC01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

[0031] SC02: identifying, by the master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that a new filter cartridge is used, where if the ID information is corrected and has no encrypted value, a special encrypted value is calculated and respectively recorded to nonvolatile storage areas of the information chip and the master control and identifying chip, and furthermore, the purifier operates and reads information stored in the information chip; and

[0032] identifying, by the master control and identifying chip, the dedicated ID of the information chip in a case that the filter cartridge is used, where if the ID information is corrected and has an encrypted value, whether the encrypted value is consistent is identified and checked, if the encrypted value is consistent, the purifier operates and reads the information stored in the information chip, and if the encrypted value is inconsistent, the purifier refuses to operate.

[0033] The disclosure has the following beneficial effects: the disclosure provides a method for determining life of a filter cartridge of an air purifier. In the method, by setting the reference value ar of the concentration of the particulate matters, in a case that the quantity Q of the particulate matters capable of being adsorbed by the filter cartridge is determined, a standard total duration T can be obtained; the particulate matter concentration range can be divided into

$a_1, a_2 \dots a_n$ in sequence according to a purifying capacity of the purifier; the relation on the service life of the filter cartridge in a case that the particulate matter concentration range is $a_1, a_2 \dots a_n$ and the reference value of the concentration of the particulate matters is a_r can be obtained by way of sample experiments, so as to deduce the consumed standard total duration within the unit time at the concentration ranges $a_1, a_2 \dots a_n$ in a case that the relative particulate matter concentration is at the reference value a_r ;

[0034] in the above way, the life of the filter cartridge can be recorded dynamically; in a case of a small amount of particulate matters in air, the usage days of the filter cartridge will be prolonged; in a case that the content of the particulate matters in air is high, the usage days of the filter cartridge are shortened; in this way, the service life of the filter cartridge can be fully utilized without a waste condition that the filter cartridge still has a very good filtering capacity but is scrapped while the air quality is kept in an excellent status for a long time in a case of a static life record or a condition that the filter cartridge has been unable to filter but the user still continuously uses the filter cartridge unknowingly in a case that the air quality is comparatively severe for a long time; besides, by selecting a proper range of the reference value a_r of the concentration of the particulate matters, for example, a substantial median range of the content of the particulate matters in air in a certain city on a year-on-year basis, the standard total duration T and realistic time can be synchronized basically.

[0035] The disclosure further provides a solution of a purifier for determining life of a filter cartridge. The solution quotes the method for determining life of a filter cartridge in the above content. In the solution, the particulate matter concentration in current air to be purified is identified by the PM2.5 sensor, and the standard total duration consumed within the unit time is calculated through the calculated particulate matter concentration;

[0036] moreover, the purifier in the solution is provided with the life prompt module to remind that the service life of the filter cartridge will be terminated; the information chip is installed on the filter cartridge to record data needed to be recorded such as the usage days of the filter cartridge and the residual usable duration T_v of the purifier, and the genuine product identification number is set on the information chip to prevent use of forged and fake products on the market.

Brief Description of Figures

[0037] FIG. 1 is a flowchart of a method for determining life of a filter cartridge of an air purifier in the disclosure; and

[0038] FIG. 2 is an operating logic diagram of purifier equipment in the disclosure.

Detailed Description

[0039] The preferred embodiment of the disclosure is described in detail below in combination with drawings to make advantages and features of the disclosure more easily understood by those skilled in the art, so that the protection scope of the disclosure is more clearly and specifically defined.

[0040] Embodiment:

[0041] Referring to FIG. 1, the air purifier and method for calculating life of a used filter cartridge, and an anti-counterfeiting method for the used filter cartridge include an air purifier, a method for calculating life of a used filter cartridge of the air purifier, and an anti-counterfeiting method for the filter cartridge.

[0042] Specifically, an air purifier includes a purifier main body and a filter cartridge detachably therewith, where the purifier main body is provided with a master control and identifying chip, an information chip is fixed to the filter cartridge and records usage days and/residual life of the filter cartridge, the information chip and the master control and identifying chip intercommunicate with each other in data by way of wireless communication or wired communication, and a data communication interval between the information chip and the master control and identifying chip is 2-300 s/time.

[0043] The air purifier is further provided with a life prompt module and a timing apparatus intercommunicating with the master control and identifying chip, the master control and identifying chip is provided with a problem that controls the life prompt module to response and sets a terminating index prompt threshold for a factory set life of the filter cartridge, the terminating index prompt threshold for the factory set life of the filter cartridge is previous to an actual life terminating index threshold of the filter cartridge of the purifier, in a case that the filter cartridge is at the terminating index prompt threshold for the factory set life of the filter cartridge, the filter cartridge can be subjected to scrap disposition, and in a case that the filter cartridge is at the actual life terminating index threshold of the filter cartridge, the filter

cartridge enters a fully scrapped state, and can no longer be used; and an implementation of the life prompt module includes the following steps:

[0044] S1: in a case that the life of the filter cartridge reaches the terminating index prompt threshold for the factory set life of the filter cartridge, the life prompt module entering a first response status, and meanwhile, recording, by the master control and identifying chip, the life of the filter cartridge in a countdown manner;

[0045] S2: after continuously operating for a fixed duration T_c , the purifier entering a performance protection status, and the life prompt module entering a second respond status, where in the performance protection status, an operating speed of a purifier unit is less than 600 r/m; it is to be noted that there is a special condition, i.e., T_c is 0, that is to say, the purifier will enter the performance protection status in a case that the life of the filter cartridge reaches the terminating index prompt threshold for the factory set life of the filter cartridge; and

[0046] S3: continuously operating the purifier for a fixed duration T_d after the operating duration reaches T_c , the filter cartridge entering a scrapped status, and moreover, the life prompt module entering a third respond status.

[0047] A method for calculating life of a used filter cartridge of an air purifier, applied to the air purifier, includes the following steps:

[0048] S4: setting a reference value a_r of a concentration of particulate matters passing through the purifier within unit time, setting a quantity of the particulate matters capable of being adsorbed by the purifier to the maximum extent as Q to obtain a usable duration of the filter cartridge in a case that the particulate matters are at the reference value concentration a_r in the condition of the quantity Q of the particulate matters capable of being adsorbed by the purifier, setting the duration as a standard total duration, and obtaining a residual usable duration of the filter cartridge through $T_v = T - T_r$, wherein T is the standard total duration, T_r is a duration consumed by the filter cartridge within the unit time at the reference value a_r of the concentration of the particulate matters, and setting T_r as a reference duration and T_v as the residual usable duration of the filter cartridge;

[0049] S5: setting a plurality of particulate concentration ranges $a_1, a_2..a_n$ end to end, calculating a relation between service life of the filter cartridge in a case that the particulate matter concentration is in the ranges of $a_1, a_2..a_n$ and service life of the filter cartridge in a case

that the particulate matter concentration is in the range of a_r through an equation $T_1 = W_i * T_r$, wherein T_1 is a reference duration consumed in a case that the particulate matter concentration is at a_i , and W_i is a weight coefficient in a case that the particulate matters are at the concentration a_i and a relative reference value concentration a_r , W_i is one of $W_1, W_2, W_3 \dots W_n$, and the $W_1, W_2, W_3 \dots W_n$ are in one-to-one correspondence to $a_1, a_2 \dots a_n$; and

[0050] S6: acquiring a particulate matter concentration C_{sn} at an air inlet of the purifier before purification in a current environment, judging the particulate matter range a_i of the C_{sn} , and calculating the standard total duration consumed in the current air environment within the unit time according to the weight coefficient W_i of the current concentration.

[0051] The weight coefficient W_i is an influence set generated by other influence factors, specifically including a rotating speed of the purifier, humidity of air, a temperature and an air pressure of the air and the like. When W_i is calculated, proper influence factors are selected as calculating indexes of the weight coefficient W_i to calculate and acquire the weight coefficient by a variable control method according to a service environment of the audience. The method for obtaining the weight coefficient W_i calculated corresponding to the life of the filter cartridge in a case that the particulate matter concentration range is $a_1, a_2 \dots a_n$ can include the following steps:

[0052] S41: a_n including at least two value ranges a_1 and a_2 , W_n being provided with at least two values W_1 and W_2 corresponding to a_n , the rotating speed of the purifier including at least one fixed value v_1 , and obtaining a maximum life set of the filter cartridge under conditions of different air temperatures, different air humidity or different air pressures by way of controlling a single variable in a case that the particulate matter concentration range is a_1 and the rotating speed of the purifier is v_1 ;

[0053] S42: obtaining a weighted average of the life of the filter cartridge within the concentration range a_1 by a method of weighted mean, and setting a weighted weight W_1 for calculating the life of the filter cartridge as 1 in a case that the particulate matter concentration is in the range a_1 at the moment by taking the life of the filter cartridge in this case as a control group;

[0054] S43: obtaining the maximum life of the filter cartridge in a case that the particulate matter concentrations are in different ranges under different conditions by way of controlling the single variable in a case that the particulate matter concentrations are respectively $a_2, a_3 \dots a_n$;

[0055] S44: selecting the maximum life set of the filter cartridge when the purifier is in the conditions of different rotating speeds, different air temperatures, different air humidity or different air pressures in a case that the particulate matter concentrations are respectively a_2 , a_3 ... a_n , obtaining the weighted average of the life of the filter cartridge in the different particulate matter concentration ranges by the method of weighted mean, and using the weighted average of the life of the filter cartridge in the particulate matter concentration ranges as experimental group data; and

[0056] S45: performing a division operation on the weighted average of the life of the filter cartridge in the control group and the weighted average of the life of the filter cartridge in the experimental group to obtain numerical values of the weighted weight W_1 for calculating the life of the filter cartridge at different rotating speeds and in different particulate matter concentration ranges.

[0057] When the above experiment is performed, in the process of obtaining the control group and the experimental group by the variable control method, the controlled variables are sampled by way of stratified sampling or systematic sampling, thereby, not only guaranteeing effectiveness and universality of the data, but also reducing the number of experiments greatly. Moreover, settings of the weights at different rotating speeds of the purifier, different air temperatures, different air humidity or different air pressures can refer to the following methods:

[0058] it is assumed that the rotating speeds of the purifier include two numerical values v_1 and v_2 , the air temperatures include three numerical values t_1 , t_2 , and t_3 , the humidity intervals include three intervals h_1 , h_2 , and h_3 , and the air pressure intervals include three intervals p_1 , p_2 , and p_3 ; and

[0059] life data of a plurality of groups of air purifiers is obtained by way of controlling the single variable, and for example, by taking the life data of the air purifier with the rotating speed set as v_1 , the air temperature set as t_1 , the humidity set as h_1 , and the air pressure set as p_1 as the control group, control group data of the life of the plurality of groups of air purifiers is obtained by respectively controlling variations of different conditions, and weights in different conditions can be obtained by analyzing a variation trend of the life.

[0060] Referring to table 1, assuming that the life data of the air purifier in a case that each variable is in an interval I is L_1 , other variables are in the interval I ; the life data of the air purifier of each variable in each interval is obtained by controlling the variation of the single

variable; by controlling a variable degree of the life data of the air purifier, the weights of each variable in different intervals can be obtained; therefore, the weight values of the obtained life data of the purifier in a case that the variables are in different intervals can be obtained; for example, assuming that the air temperature interval, the air humidity interval, and the air pressure interval are I, and the rotating speed interval of the air purifier is II, the life data of the air purifier is L2 and the life decrement of the air purifier is L1-L2; and assuming that the air humidity interval, the rotating speed interval of the air purifier, and the air pressure interval are I, and the air temperature interval is II, the life data of the air purifier is L3 and the life decrement of the air purifier is L1-L3, by parity of reasoning; and

[0061] moreover, through $\frac{L1-L2}{(L1-L2)+(L1-L3)} \times L2 + \frac{L1-L3}{(L1-L2)+(L1-L3)} \times L3$, the weighted average can be obtained in a case that the life data is L2 and L3.

[0062] Table 1

Variable	Interval	Life data/day	Interval	Life data/day	Interval	Life data/day
Rotating speed interval of purifier	I	L1	II	L2		
Air temperature interval	I	L1	II	L3	III	L6
Air humidity interval	I	L1	II	L4	III	L7
Air pressure interval	I	L1	II	L5	III	L8

[0063] For example, the rotating speed of the purifier can be set at 450 r/m and 850 r/m, the air temperature includes three intervals 0-15°C, 16-30°C, and 30-50°C, the humidity includes three intervals 30-50%, 50-70%, and 70-90%, and the select range of the air pressure includes three intervals 700-850 hPa, 850-950 hPa, and 950-1050 hPa;

[0064] the life data of the plurality of groups of air purifiers is obtained by way of controlling the single variable, and for example, by taking the life data of the air purifier with the rotating speed set as 450 r/m, the air temperature set as 0-15°C, the humidity set as 30-50%, and the air pressure set as 700-850 hPa as the control group, control group data of the life of the plurality of groups of air purifiers is obtained by respectively controlling variations of different

conditions, and weights in different conditions can be obtained by analyzing a variation trend of the life.

[0065] Referring to table 2 and table 1, assuming that the life data of the air purifier in a case that each variable is in an interval I is $100x$ (x is a coefficient, which can be any value), assuming that the air temperature interval, the air humidity interval, and the air pressure interval are I, and the rotating speed interval of the air purifier is II, the life data of the air purifier is $65x$ and the life decrement of the air purifier $35x$, and assuming that the air humidity interval, the rotating speed interval of the air purifier, and the air pressure interval are I, and the air temperature interval is II, the life data of the air purifier is $85x$ and the life decrement of the air purifier is $15x$; and

[0066] moreover, through $\frac{35x}{35x+15x} \times 35x + \frac{15x}{35x+15x} \times 15x$, the weighted average is $29x$ in a case that the life data is L2 and L3.

[0067] Table 2

Variable	Interval	Life data/day	Interval	Life data/day	Interval	Life data/day
Rotating speed interval of purifier	I	$100x$	II	$65x$		
Air temperature interval	I	$100x$	II	$85x$	III	$75x$
Air humidity interval	I	$100x$	II	$80x$	III	$75x$
Air pressure interval	I	$100x$	II	$95x$	III	$93x$

[0068] When the above experiment is performed, the select range of the air temperature is $0-50^{\circ}\text{C}$, the select range of the air humidity is $30-90\%$, the air pressure range is $700-1050\text{ hPa}$, and the range values of the above factors cover most environmental parameters through which the purifier can work, so that the universality of the weight coefficient W_n for calculating the life of the filter cartridge can be ensured and obtained. By taking the air purifier product of this

company as an example, in the product, the particulate matter concentration range a_n is divided into four layers, and specific data is shown in table 1 through the above experimental steps:

[0069] Table 1

Air quality index	Particulate matter concentration a_n (i.e., PM2.5 concentration)	Weight coefficient W_n for calculating life of filter cartridge	Life T_1 consumed within unit calculating time
Excellent	2-15	1	1s=1s
Good	16-55	6/5	5s=6s
Average	56-150	7/5	5s=7s
Poor	151-999	8/5	5s=8s

[0070] In table 1, the rotating speeds of the purifier are fixed and all are at the lowest tap position. In a case that the air quality is excellent, the weight coefficient W_1 for calculating life of the filter cartridge is 1. Therefore, the life consumed within the unit calculating time is the actual use duration. In a case that the air quality is good, the weight coefficient W_2 for calculating life of the filter cartridge is 6/5, and the actual use duration of the filter cartridge is 5/6 of the life consumed within the unit calculating time. Since the purifying capacity of the air purifier has the maximum value, in a case that the particulate matter concentration range a_4 of the last layer is set, the purifying capacity of the purifier within the unit time is a head end value of a_4 or a substantial range of the purifying capacity in a_4 is determined according to a raising proportion of the particulate matter concentration within each range. In a case that the particulate matter concentration reaches the extreme of the purifying capacity, the purifying efficiency of the purifier cannot be affected even if the particulate matter concentration is high. Therefore, a tail end value of the particulate matter concentration range a_4 designed by the product is theoretically infinite. In a case that the air quality index is in other ranges, the standard total duration T consumed within the unit calculating time is counted and recorded according to the above table. Moreover, in a case that the standard total duration T of the filter cartridge is determined, the standard total duration T consumed within the unit calculating time each time is subtracted from the standard total duration T of the filter cartridge to obtain the residual usable duration T_v of the filter cartridge.

[0071] The life prompt module includes one or more of an indicator light, a loudspeaker alarm, an external display screen of the purifier, and an app mini program. In the embodiment, an LED indicator light and a buzzer alarm are used. In the embodiment, the terminating index prompt threshold for the factory set life of the filter cartridge, the continuous operating fixed duration T_c , and the continuous operating fixed duration T_d are defined by double conditions: the usage days and the consumed standard total duration; the usage days are actual usage days after the filter cartridge is installed in the purifier; the usage days and the consumed standard total duration each have set a specific prompt value at three time nodes: the terminating index prompt threshold for the factory set life of the filter cartridge, the continuous operating fixed duration T_c , and the continuous operating fixed duration T_d ; and in a case that any of the usage days and the consumed standard total duration is met preferably at the three time nodes, the operating status of the purifier at the time nodes is executed. The standard total duration T in the embodiment is set as 9720 hours, the standard usage days are set as 760 days, and a specific alarm mode is as follows:

[0072] S01, in a case that the filter cartridge reaches the terminating index prompt threshold for the factory set life, the life prompt module is started and enters a first response status. In the embodiment, the first response status includes two response modes. In a case that when the terminating index prompt threshold for the factory set life is the consumed standard total duration which reaches any selected value within an interval of 8664-8904 hours or the standard usage days reaches any selected value of 716-726 days, the first response mode is performed in this case; in this case, the LED indicator light flickers three times per 60 minutes, and the following statuses are continued in each flicker: a white light is on for 1 second and off for 0.5 second, lasting for many times; moreover, in the first response mode, the buzzer alarm performs alarm prompt once every 60 minutes;

[0073] in a case that the consumed standard total duration reaches any selected value within an interval of 8905-8999 hours or the standard usage days reaches any selected value of 727-730 days, the second response mode is performed in this case; in this case, the LED indicator light flickers five times per 60 minutes, and the following statuses are continued in each flicker: the white light is on for 1 second and off for 0.5 second, lasting for many times; moreover, in the first response mode, the buzzer alarm performs alarm prompt three times every 60 minutes;

[0074] S02, after the purifier continuously operates for the fixed duration T_c , the purifier is reminded to enter the second response status, the consumed standard total duration is set to

reach any selected value within an interval of 9000-9719 hours or the standard usage days reaches any selected value of 731-760 days in the second response status, and in this case, the second response mode is performed; in this case, the LED indicator light is shown as a red light, and in this case, in the second response mode, the buzzer alarm performs alarm prompt three times every 60 minutes, each alarm sounds three times at an interval briefly, and moreover, an engine unit is forced to enter a low speed operating status (for example, the engine unit enters a first-gear operating status);

[0075] S03, after the purifier continuously operates for the fixed duration T_c , the purifier enters a third response status and stops operating, the consumed standard total duration is set to reach 9720 hours or the standard usage days reaches 761 days in the third response status; in this case, the LED indicator light is shown as the red light, and moreover, in the third response mode, the buzzer alarm performs alarm prompt three times every 60 minutes, each alarm sounds three times at an interval briefly, and in this case, to protect the purifier and ensure the use interests of the user (in this case, the purifier has no filtering effect basically or completely), the air purifier is forced to stop operating till the filter cartridge is replaced with a new filter cartridge;

[0076] in the above corresponding statuses, the consumed standard total duration is synchronized according to the standard time (the magnitude of concentration is no longer discussed).

[0077] To ensure that the purifying efficiency of the purifier still meets the requirements of national standard or other standards in a case that the alarm device enters the third response status, an operation is performed according to the residual value of the filtering capacity of the filter cartridge by acquiring a median value of the air quality (particulate matter concentration) in the current region in the previous year to further obtain the maximum duration in a mode where the alarm device starts to alarm and then terminates response, so as to set the start time of the second response mode of the air purifier in proportion or according to settings.

[0078] Besides, in the above alarm mode, since the filter cartridge has been blocked severely when the alarm device enters the first response status, the purifying capacity of the purifier has been actually weak already. Compared with the purifier with good purifying capacity, it is undoubtedly needed to apply a larger action force to air inside the purifier to purify and discharge air entering the purifier to make the air pass through the filter cartridge. Thus, the

unit will bear a larger counter-acting force. If the unit is continuously operated at a high speed, the wear of the unit is undoubtedly increased, the service life of the unit is shortened, and the loss outweighs the gain. Therefore, the second response mode is set to alleviate the wear of the unit.

[0079] In the embodiment, main reasons for the two indexes: the set terminating index prompt threshold for the factory set life of the filter cartridge and the actual life terminating index of the filter cartridge are as follows: the life expiration time of the filter cartridge cannot be determined by recording the life of the filter cartridge by means of the dynamic life recording method; if the air quality is in the good status for a long time, the life shown by the filter cartridge will be very long; however, when the air quality changes suddenly, the life shown by the filter cartridge may be short suddenly, and thus, the client is not prepared well mentally, which will bring mental oppressing sensation to the client; besides, in production of conventional manufacturers, the life of the filter cartridge is usually calculated by way of countdown, and as a result, whether the filter cartridge has a very strong residual filtering capacity or has been scrapped cannot be ensured; therefore, in the solution, the terminating index prompt threshold for the factory set life of the filter cartridge can be set between annotated range values of the total quantity of filterable particulate matters of the filter cartridge (the conventional total quantity of filterable particulate matters of the filter cartridge is an estimate range of the total quantity of filterable particulate matters of the filter cartridge), for example, an initial value of the annotated range. A terminating value of the annotated range of the total quantity of filterable particulate matters of the filter cartridge is taken as the actual life terminating index of the filter cartridge. Thus, by means of the method provided by the present invention, in a case that the filter cartridge reaches the terminating index prompt threshold for the factory set life of the filter cartridge, the filter cartridge can be subjected to scrap disposition. However, the filter cartridge still has the purifying capacity for a period of time.

[0080] An information chip is fixed to the filter cartridge and records the usage days of the filter cartridge, and the sum of the residual usable duration T_v of the filter cartridge or the standard duration where the filter cartridge has been used, and the information chip and the master control and identifying chip intercommunicate with each other in data by way of wired communication. Of course, the information chip and the master control and identifying chip can intercommunicate with each other in data by way of wired communication through technologies such as NFC or RFID. The data communication interval between the information

chip and the master control and identifying chip is 2-300 s/time, such as 5 s/time, 10 s/time, and 300 s/time. Moreover, the information chip further includes the genuine product identification number for identifying whether the filter cartridge is genuine or fake, and in a case that the master control and identifying chip cannot read the genuine product identification number on the information chip, the purifier refuses to operate to prevent use of the forged and fake products on the market. In the embodiment, data communication between the information chip and the master control and identifying chip can also be achieved by way of wired communication, for example, a connecting wire for data communication is fixed to the master control and identifying chip, a plug/jack is fixed to the end portion of the connecting wire, and moreover, a plug/jack matching the plug/jack on the connecting wire of the master control and identifying chip can be arranged on the information chip to achieve data intercommunication by connecting the plug and the jack. The anti-counterfeiting method for the filter cartridge includes the following steps:

[0081] Method I:

[0082] SA01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

[0083] SA02: identifying, by a master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that the filter cartridge is used, if the ID information is corrected, operating the purifier; and

[0084] if the ID information is incorrect, the purifier refuses to operate;

[0085] Method II:

[0086] SB01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

[0087] SB02: identifying, by the master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that a new filter cartridge is used, wherein if the ID information is corrected and has no encrypted value, a special encrypted value is calculated and respectively recorded to nonvolatile storage areas of the information chip and the master control and identifying chip, and furthermore, the purifier operates and reads information stored in the information chip; and

[0088] identifying, by the master control and identifying chip, the dedicated ID of the information chip in a case that the filter cartridge is used, where if the ID information is corrected and has an encrypted value, whether the encrypted value is consistent is identified and checked, if the encrypted value is consistent, the purifier operates and reads the information stored in the information chip, and if the encrypted value is inconsistent, the purifier refuses to operate; and

[0089] Method III:

[0090] SC01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

[0091] SC02: identifying, by the master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that a new filter cartridge is used, where if the ID information is corrected and has no encrypted value, a special encrypted value is calculated and respectively recorded to nonvolatile storage areas of the information chip and the master control and identifying chip, and furthermore, the purifier operates and reads information stored in the information chip; and

[0092] identifying, by the master control and identifying chip, the dedicated ID of the information chip in a case that the filter cartridge is used, where if the ID information is corrected and has an encrypted value, whether the encrypted value is consistent is identified and checked, if the encrypted value is consistent, the purifier operates and reads the information stored in the information chip, and if the encrypted value is inconsistent, the purifier refuses to operate.

[0093] A working process and a working principle are as follows:

[0094] In a case that the purifier product provided by the present invention is used, after the filter cartridge is installed on the purifier, the master control and identifying chip first reads the genuine product identification number in the information chip on the filter cartridge by way of wireless communication or wired communication; if the genuine product identification number cannot be identified or the genuine product identification number is incorrect, the purifier refuses to operate; moreover, the purifier also can send a special signal through the life prompt module to make the user know the condition; the main purpose of setting the genuine product identification number is to prevent benefits of the user from being invaded as sham products

are used; in a case that the master control and identifying chip identifies the correct genuine product identification number, it means that the filter cartridge is the genuine product, the purifier is normally started to operate, and moreover, the master control and identifying chip identifies and records the residual usable duration T_v of the purifier in the information chip about the particulate matter concentration parameter ar of the filter cartridge to record related data continuously; in the using process of the purifier, the life of the filter cartridge is monitored and recorded continuously, and the information chip on the filter cartridge records the service life termination of the filter cartridge till the service life of the filter cartridge reaches the terminating index prompt threshold for the factory set life of the filter cartridge. Moreover, the master control and identifying chip which identifies the signal controls the life prompt module to response to the life countdown and wait for replacing the filter cartridge with a new filter cartridge or stop operation of the purifier at the termination of the countdown.

[0095] The above is merely embodiments of the disclosure and does not hence limit the patent range of the disclosure. Equivalent structures made by means of the contents of the description and drawings of the disclosure are applied to other related technical fields directly or indirectly, which is, in a similar way, comprised in the protection scope of the patent of the disclosure.

Claims

What is claimed is:

1. An air purifier, comprising a purifier main body and a filter cartridge detachably therewith, wherein the purifier main body is provided with a master control and identifying chip, an information chip is fixed to the filter cartridge and records usage days and/residual life of the filter cartridge, the information chip and the master control and identifying chip intercommunicate with each other in data by way of wireless communication or wired communication, and a data communication interval between the information chip and the master control and identifying chip is 2-300 s/time.

2. The air purifier according to claim 1, wherein the air purifier is further provided with a life prompt module and a timing apparatus intercommunicating with the master control and identifying chip, the master control and identifying chip is provided with a problem that controls the life prompt module to response and sets a terminating index prompt threshold for a factory set life of the filter cartridge, the terminating index prompt threshold for the factory set life of the filter cartridge is previous to an actual life terminating index threshold of the filter cartridge of the purifier, in a case that the filter cartridge is at the terminating index prompt threshold for the factory set life of the filter cartridge, the filter cartridge can be subjected to scrap disposition, and in a case that the filter cartridge is at the actual life terminating index threshold of the filter cartridge, the filter cartridge enters a fully scrapped state, and can no longer be used; and an implementation of the life prompt module comprises the following steps:

S1: in a case that the life of the filter cartridge reaches the terminating index prompt threshold for the factory set life of the filter cartridge, the life prompt module entering a first response status, and meanwhile, recording, by the master control and identifying chip, the life of the filter cartridge in a countdown manner;

S2: after continuously operating for a fixed duration T_c , the purifier entering a performance protection status, and the life prompt module entering a second respond status, wherein in the performance protection status, an operating speed of a purifier unit is less than 600 r/m; and

S3: continuously operating the purifier for a fixed duration T_d after the operating duration reaches T_c , the filter cartridge entering a scrapped status, and moreover, the life prompt module entering a third respond status.

3. The air purifier according to claim 2, wherein the life prompt module comprises one or more of an indicator light, a loudspeaker alarm, an external display screen of the purifier, and an app mini program.

4. The air purifier according to claim 2, wherein the information chip further comprises a genuine product identification number for identifying whether the filter cartridge is genuine or fake, and in a case that the master control and identifying chip cannot read the genuine product identification number on the information chip, the purifier refuses to operate.

5. A method for calculating life of a used filter cartridge of an air purifier, used in the air purifier according to any one of claims 2-4, comprising the following steps:

S4: setting a reference value a_r of a concentration of particulate matters passing through the purifier within unit time, setting a quantity of the particulate matters capable of being adsorbed by the purifier to the maximum extent as Q to obtain a usable duration of the filter cartridge in a case that the particulate matters are at the reference value concentration a_r in the condition of the quantity Q of the particulate matters capable of being adsorbed by the purifier, setting the duration as a standard total duration, and obtaining a residual usable duration of the filter cartridge through $T_v = T - T_r$, wherein T is the standard total duration, T_r is a duration consumed by the filter cartridge within the unit time at the reference value a_r of the concentration of the particulate matters, and setting T_r as a reference duration and T_v as the residual usable duration of the filter cartridge;

S5: setting a plurality of particulate concentration ranges $a_1, a_2 \dots a_n$ end to end, calculating a relation between service life of the filter cartridge in a case that the particulate matter concentration is in the ranges of $a_1, a_2 \dots a_n$ and service life of the filter cartridge in a case that the particulate matter concentration is in the range of a_r through an equation $T_1 = W_i * T_r$, wherein T_1 is a reference duration consumed in a case that the particulate matter concentration is at a_i , and W_i is a weight coefficient in a case that the particulate matters are at the concentration a_i and a relative reference value concentration a_r , W_i is one of $W_1, W_2, W_3 \dots W_n$, and the $W_1, W_2, W_3 \dots W_n$ are in one-to-one correspondence to $a_1, a_2 \dots a_n$; and

S6: acquiring a particulate matter concentration C_{sn} at an air inlet of the purifier before purification in a current environment, judging the particulate matter range a_i of the C_{sn} , and calculating the standard total duration consumed in the current air environment within the unit time according to the weight coefficient W_i of the current concentration.

6. The method for calculating life of a used filter cartridge of an air purifier according to claim 5, wherein a PM2.5 sensor connected to the master control and identifying chip by way of wireless communication or wired communication is arranged at the air inlet of the air purifier.

7. The method for calculating life of a used filter cartridge of an air purifier according to claim 6, wherein the residual life recorded in the information chip is a sum of the residual usable duration T_v of the filter cartridge or the standard total duration where the filter cartridge has been used.

8. The method for calculating life of a used filter cartridge of an air purifier according to claim 6, wherein in a case that the life of the filter cartridge is before the terminating index prompt threshold for the factory set life of the filter cartridge, the master control and identifying chip performs one or more of identifying, recording or data transmitting work of the life of the filter cartridge through steps S4-S6.

9. The method for calculating life of a used filter cartridge of an air purifier according to claim 8, wherein the terminating index prompt threshold for the factory set life of the filter cartridge, the continuous operating fixed duration T_c , and the continuous operating fixed duration T_d are defined by double conditions: the usage days and the consumed standard total duration; the usage days are actual usage days after the filter cartridge is installed in the purifier; the usage days and the consumed standard total duration each have set a specific prompt value at three time nodes: the terminating index prompt threshold for the factory set life of the filter cartridge, the continuous operating fixed duration T_c , and the continuous operating fixed duration T_d ; and in a case that any of the usage days and the consumed standard total duration is met preferably at the three time nodes, the operating status of the purifier at the time nodes is executed.

10. An anti-counterfeiting method for a used filter cartridge of an air purifier, applied to the air purifier according to claim 4, comprising the following methods:

Method I:

SA01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

SA02: identifying, by a master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that the filter cartridge is used, wherein if the ID information is corrected, the purifier operates; and

if the ID information is incorrect, the purifier refuses to operate;

Method II:

SB01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

SB02: identifying, by the master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that a new filter cartridge is used, wherein if the ID information is corrected and has no encrypted value, a special encrypted value is calculated and respectively recorded to nonvolatile storage areas of the information chip and the master control and identifying chip, and furthermore, the purifier operates and reads information stored in the information chip; and

identifying, by the master control and identifying chip, the dedicated ID of the information chip in a case that the filter cartridge is used, wherein if the ID information is corrected and has an encrypted value, whether the encrypted value is consistent is identified and checked, if the encrypted value is consistent, the purifier operates and reads the information stored in the information chip, and if the encrypted value is inconsistent, the purifier refuses to operate; and

Method III:

SC01: endowing an information chip with a dedicated ID when the filter cartridge leaves factory, the dedicated ID in each information chip is consistent; and

SC02: identifying, by the master control and identifying chip on the purifier, the dedicated ID of the information chip in a case that a new filter cartridge is used, wherein if the ID information is corrected and has no encrypted value, a special encrypted value is calculated and respectively recorded to nonvolatile storage areas of the information chip and the master

control and identifying chip, and furthermore, the purifier operates and reads information stored in the information chip; and

identifying, by the master control and identifying chip, the dedicated ID of the information chip in a case that the filter cartridge is used, wherein if the ID information is corrected and has an encrypted value, whether the encrypted value is consistent is identified and checked, if the encrypted value is consistent, the purifier operates and reads the information stored in the information chip, and if the encrypted value is inconsistent, the purifier refuses to operate.