

Air Purification System Base on Dynamic Life Record and Replacement Reminding Method of Filter Screen

Technical Field

[0001] The present invention belongs to the technical field of air purification devices, and particularly relates to an air purification system based on dynamic life record and a replacement reminding method of a filter screen.

Background

[0002] A conventional life monitoring method of a filter screen of an air purifier is to determine the life by accumulatively computing the use time of equipment, but it ignores the influence of the concentration of particulate matters on the life loss of the air purifier. Therefore, a variety of methods have been designed on the market to determine the actual service life of the filter screen based on the change of certain performance indicators of the filter screen after filtering the particulate matters, for example, a Chinese utility model patent with the publication number of CN205825251U discloses an air purifier, including: a case, and a filtering module, a fan and a control device which are arranged in the case; the control device is connected to an alarm device; the case internally includes a mounting base on which a weight sensor is arranged; and the filtering module is mounted on the mounting base and presses the weight sensor, and the weight sensor is used for weighing the filtering module. In this solution, the weight of the filtering module is monitored in real time, thus the use condition of the filtering module can be accurately monitored; and a user can be informed through the alarm device, so that whether the service life of the filtering module is reached can be conveniently judged.

[0003] In the above disclosed patent, it is to utilize the change of the weight performance of the filter screen after absorbing the particulate matters to monitor the life of the filter screen. Definitely, in other reference documents, including the case solution of utilizing the change of the performances such as the color change of the filter screen to monitor the life of the filter screen, its underlying logic is to monitor the life of the filter screen through the relationship between the change of certain performances of the filter screen and the service life of the filter screen after absorbing the particulate matters.

[0004] The solutions above can effectively monitor the actual life of the filter screen, but in the actual use of a purifier product, there is no reasonable solution for properly reminding the user to replace the filter screen of which the life almost ends. A conventional indicator for determining the life of the filter screen is to determine according to the CCMs in the "Air Purifier" (GB/T 18801-2015), that is, the total amount of the particulate matters filtered by the filter screen when the purification efficiency of the air purifier decays to 50% (in EU standard, it is the total amount of the particulate matters filtered by the filter screen when the filtration efficiency decays to 85%). When the filter screen performance is insufficient but it can still continue to be used, a threshold is usually set for the reminding method for the need to replace the filter screen. When the indicator for monitoring the life of the filter screen reaches the threshold, the alarm device will make a corresponding reminder. Usually, the threshold is before the actual life end value of the filter screen so that the user has a prepare time for replacing the filter screen. In addition, the alarm device will also be implement corresponding reminding methods to inform the user that the current filter can no longer be used when the life of the filter screen ends. However, this reminding method has a problem that cannot be ignored, that is, during actual use, since the concentration of the particulate matters in the air is not fixed, the actual remaining life of the filter screen is also not fixed. In areas with serious air pollution, the remaining life of the filter screen will be consumed quickly. In a high-quality air environment, the remaining life of the filter will last for a long time. In conventional reminding methods, the user needs to face a countdown of unclear time. This uncertain future will psychologically put pressure on customers, forcing them to purchase new filter screens in advance or replace them directly.

[0005] In the actual production, the CCM of the purifier equipment is actually a range value (in national standard, the range of particulate matters is listed as p1-p4 grades), and by the influence of raw materials, equipment, etc., it is impossible to guarantee the CCM that can be achieved every day by every production line and even every product. In order to ensure product quality, when the CCM of the product is within the range of each grade specified in the national standard, the purification efficiency of the purifier is usually set to be greater than 50% by the manufacturer. At present, the overall purification efficiency of the purifiers of the more mainstream brand is generally kept between 52%-54% when the CCMs of the purifiers are within the range of each grade specified in the national standard.

[0006] Therefore, we have designed a reminding solution for the replacement of the filter screen at the end of life. When the user uses the purifier product, and the factory default service life of the filter screen ends, the purifier will continue to work using the allowance of the purification capacity of the filter screen and remind the user to replace the filter screen, which will not cause psychological pressure to the user, and can further improve the purification capacity of the filter while meeting the standard.

Summary

[0007] An object of the present invention is to provide an air purification system based on dynamic life record and a replacement reminding method of a filter screen to solve the problem proposed in the Background above.

[0008] In order to achieve above object, one technical solution in the present invention is that: a replacement reminding method of a filter screen of an air purification system includes: determining a factory default life end index prompt threshold of the filter screen, the factory default life end index prompt threshold of the filter screen being before an actual life end index threshold of the filter screen of a purifier, the factory default life end index prompt threshold of the filter screen of the filter being an index numerical value when the filter screen reaches the set total amount of filtering particulate matters, and the filtering efficiency of the purifier being greater than 50% when the filter screen reaches the set total amount of filtering particulate matters; when the life index of the filter screen reaches an actual life end index prompt threshold of the filter screen and the factory default life end index prompt threshold of the filter screen, CCMs of the purifier are in the same level; the reminding method specifically includes the following steps:

[0009] S1, when the life index of the filter screen reaches the factory default life end index prompt thread of the filter screen, switching the life of the filter screen into static countdown, the duration of the static countdown meeting that the filtering efficiency of the purifier is not less than 50% at the time of countdown completion; and

[0010] S2, after the static countdown ends, stopping running the purifier.

[0011] Preferably, after the static countdown is started, the purifier enters an equipment performance protection period, and in the state, the rotating speed of a purifier unit needs to be adjusted to be less than 600 r/min.

[0012] Preferably, a reminding device is arranged on the purifier, and the reminding device includes at least two response modes of an initial response mode when the factory default life end index of the filter screen reaches the prompt threshold and an end response mode when the static countdown ends.

[0013] Preferably, an alarm device includes one or more of an indicator lamp, a loudspeaker alarm, a purifier external display screen and an app.

[0014] Preferably, a timing device used for recording the service time of the purifier is arranged on the purifier.

[0015] An air purification system based on dynamic life record utilizes the replacement reminding method of the filter screen above and specifically includes: an air purifier and the filter screen; a main control board and a monitoring device used for detecting the current service life of the filter screen are arranged on the air purifier; the main control board is electrically connected to the monitoring device; and the filter screen has related life end index used for being detected by the monitoring device.

[0016] Preferably, a pressure detection sensor is arranged at a position where the purifier screen is located; data of the pressure detection sensor of the air purifier under the same level and the use time of the purifier are collected to form a database; the life of a filter element of the air purifier is determined through the current value of the pressure detection sensor; and the life end index is the pressure value of the position where the filter screen is located.

[0017] Preferably, a light source is arranged in the air purifier and can be emitted out through the filter screen; the use time of the air purifier under the same condition and the brightness of the light source emitted out through the filter screen are collected to form the database; the life of the filter element of the air purifier is determined through the current brightness of the light source emitted out through the filter screen; and the life end index is the brightness of the light source penetrating through the filter screen.

[0018] Preferably, a particulate matter concentration recognition sensor is arranged at an air inlet of the purifier; a set concentration range of the air purifier is set, and the set concentration range is a reference comparison value; the actual total use time of the purifier when the particulate matters are in different concentration ranges is collected, thus obtaining a time function relationship between the total use time of the purifier at different concentration relative the purifier within a set concentration range; the total use time of the purifier within the set concentration range is set to be a fixed value; the detection frequency of the concentration of the particulate matters at the air inlet of the purifier is set; the use time of the purifier under single detection frequency within the set concentration range is obtained according to the time of the single detection frequency and the time function relationship between the total use time of the purifier at different concentration relative the purifier within the set concentration range; the remaining life of the filter element of the air purifier is determined according to an accumulated difference value of the total use time of the purifier within the set concentration range and the use time of the purifier under single detection frequency within the set concentration range; the life end index of the filter screen is the remaining work time of the filter screen under the total use time of the purifier within the set concentration range.

[0019] The present invention has the beneficial effects that in the air purification system based on the dynamic life record, the underlying layer logic is that the concentration of the particulate matters in the current air environment is different, so the end time of the service life of the purifier is not clear, resulting in the problems that after the customer purchases a new filter screen, the currently used filter screen does not reach the end life in a long time, the customer also wants to replace the filter screen after the life of the filter screen ends, and then the filter screen is prone to being forgotten or damaged due to improper storage after being placed for a long time, or the currently used filter screen is accelerated to expire while the purchased filter screen is not delivered to the customer, and the customer has no filter screen to replace. Moreover, the uncertain future will bring the customer a sense of pressure psychologically, and forces the customer to replace the filter screen before the factory default use performance of the filter screen ends.

[0020] According to the present invention, in the replacement reminding method of the filter screen of the air purification system, the allowance which is additionally set by a conventional production factory in order to ensure that the product meets the standard is utilized, and in the

actual use, reminding to replace the filter screen will be started when the factory default index prompt threshold of life of the filter screen is reached. The reminding method is static countdown, so the psychological expectation is provided to the customer, and the filter screen can be temporarily replaced. Moreover, the service life of the filter screen reaches the factory default life, after purchasing the new filter screen, the customer can replace it directly without waiting until the static countdown ends and the purifier stops running because its performance is still within the effective use standard range, continued use will not affect the air purification effect or cause anti-pollution.

Brief Description of Figures

[0021] FIG. 1 is a flowchart of a working principle of a replacement reminding method of a filter screen of an air purifier according to the present invention; and

[0022] FIG. 2 is a flowchart of a response process and method of a reminding device according to an embodiment of the present invention.

Detailed Description

[0023] The preferred embodiments of the present invention are described in detail below in conjunction with the accompanying drawings so that the advantages and features of the present invention can be more easily understood by those skilled in the art, thereby making a clearer and more definite definition of the protection scope of the present invention.

[0024] An air purification system based on the dynamic life record includes an air purifier and a filter screen; the air purifier is provided with a main control board and a monitoring device used for detecting the current service life of the filter screen; the main control board is electrically connected to the monitoring device; and the filter screen has related life termination indexes used for being detected by the monitoring device.

[0025] Embodiment 1:

[0026] An air purification system based on dynamic life record is that, a particulate matter concentration recognition sensor is arranged at an air inlet of a purifier; a set concentration range of the air purifier is set, and the set concentration range is a reference comparison value; the actual

total use time of the purifier when the particulate matters are in different concentration ranges is collected; the actual total use time of the purifier within the particulate matter concentration range can be determined and obtained through the concentration intermediate value of the particulate matters within each concentration range, and thus a linear function relationship between the total use time of the purifier at different concentrations relative to the purifier within the set concentration range; the total use time of the purifier within the set concentration range is set to be a fixed value; the detection frequency of the concentration of the particulate matters at the air inlet of the purifier is set; the use time of the purifier under single detection frequency within the set concentration range is obtained according to the time of the single detection frequency and the linear function relationship between the total use time of the purifier at different conditions relative the purifier within a set concentration range; the remaining life of a filter element of the air purifier is determined according to the accumulated difference value between the total use time of the purifier within the set concentration range and the total use time of the purifier under single detection frequency within the set concentration range; a life end index of the filter screen is the remaining work time of the filter screen under the total use time of the purifier within the set concentration range; and therefore, the total use time of the purifier within the set concentration range can be obtained when the factory default life of the filter screen and the actual life of the filter screen end;

[0027] a replacement reminding method of a filter screen of the air purification system is used in the air purification system above. The replacement reminding method of the filter screen of the air purification system includes: determining a factory default life end index prompt threshold of the filter screen, the factory default life end index prompt threshold of the filter screen being before an actual life end index threshold of the filter screen of a purifier, the factory default life end index prompt threshold of the filter screen of the filter being an index numerical value when the filter screen reaches the set total amount of filtering particulate matters, and the filtering efficiency of the purifier being greater than 50% when the filter screen reaches the set total amount of filtering particulate matters, wherein when the life index of the filter screen reaches an actual life end index prompt threshold of the filter screen and the factory default life end index prompt threshold of the filter screen, CCMs of the purifier are in the same level; the reminding method specifically includes the following steps:

[0028] S1, when the life index of the filter screen reaches the factory default life end index prompt thread of the filter screen, switching the life of the filter screen into static countdown, the duration of the static countdown meeting that the filtering efficiency of the purifier is not less than 50% at the time of countdown completion; and

[0029] S2, after the static countdown ends, stopping running the purifier.

[0030] After the static countdown is started, the purifier enters an equipment performance protection period, and in the state, the rotating speed of a purifier unit needs to be adjusted to be less than 600 r/min.

[0031] Specifically, it is assumed that the index value of the total amount of filtering particulate matters when the factory default life of the filter screen ends is 6,000 mg, and the index value of the total amount of filtering particulate matters when the actual life of the filter screen ends is 6,200 mg, so that the total use time of the purifier within the set concentration range can be obtained when the factory default life of the filter screen and the actual life of the filter screen end; it is assumed that the total use time of the purifier within the set concentration range when the factory default life of the filter screen ends is 8,640 h, the total use time of the purifier within the set concentration range when the actual life of the filter screen ends is 9,360 h, thus the life of the filter screen can be 30 d when switching into static countdown; a timing device used for recording the use time of the air purifier and a reminding device are arranged on the air purifier; the reminding device includes at least two response modes of an initial response mode when reaching the factory default index prompt threshold of life of the filter screen and an end response mode when the static countdown ends; an alarm device includes one or more of an LED indicator lamp, a loudspeaker alarm, a purifier external display screen and an app; in this embodiment, the LED indicator lamp is singly used, and its specific alarm mode is as follows:

[0032] S01, when the filter screen reaches the delivery default life (namely, the remaining life of the filter screen is zero), starting the reminding device and entering the initial response mode, meanwhile, starting the timing device to implement timing, the LED indicator lamp slowly flickering once every three minutes, and the purifier unit keeping running at the lowest gear speed;

[0033] S02, after the filter screen reaches the factory default life, continuously running the air purifier for 30 days, enabling the purifier to enter the end response mode, and stopping running the purifier.

[0034] In order to ensure that the purification efficiency of the purifier is still in the state of meeting the requirements of the national standard or other standards when the alarm device enters the end response mode, the media value of the current area air purification (concentration of the particulate matters) in the last year can be acquired, thus the maximum duration from the time that the alarm device starts to give an alarm to the time that the alarm device enters the end response mode can be computed according to the value of the allowance of the filtering capacity of the filter screen.

[0035] In addition, in the alarm mode above, because the filter screen is seriously blocked when the alarm device enters the initial response mode, the purification capacity of the purifier is actually very weak; relative to the purification capacity of a healthy purifier, if the air entering the purifier needs to be purified and discharged, a larger acting force needs to be applied to the air in the purifier undoubtedly to enable the air to pass through the filter screen, but a unit will bear a larger counter-acting force; and if the unit continuously runs at a high speed, the abrasion of the unit will be undoubtedly increased, the service life of the unit will shortened, and the loss outweighs the gain, so the purifier unit needs to keep running at the lowest gear speed, and the rotating speed of the purifier unit at the lowest gear speed needs to be adjusted to be less than 600 r/min.

[0036] Embodiment 2:

[0037] In this embodiment, a user is still reminded to replace a filter screen when the life of the filter screen ends by the replacement reminding method of the filter screen of the air purification system in the Embodiment 1. Different from the Embodiment 1, the life end index of the air purification system based on the dynamic life record in this embodiment is the air pressure value of the position where the filter screen is located, specifically, an air pressure detection sensor is arranged at the position where the filter screen is located, data of the air pressure detection sensor under the same condition and the use time of the purifier are collected through experiments to form a database, the life of a filter element of the air purifier is determined through the current value of the air pressure detection sensor, the a function relationship between the life of the filter screen

and the brightness of a light source is obtained by computing the average value of the filter screen at different times in the database, or selecting the median value or the mode value, and therefore, the brightness of a light source can be obtained when the factory default life of the filter screen and the actual life of the filter screen end. The specific countdown time is subjected to analog computing by referring to the total use time of the purifier within the set concentration range in the Embodiment 1.

[0038] Embodiment 3:

[0039] In this embodiment, a user is also reminded to replace a filter screen when the service life of the filter screen ends by the replacement reminding method of the filter screen of the air purification system in the Embodiment 1. Different from the Embodiment 1 and the Embodiment 2, the life end index of the air purification system based on the dynamic life record in this embodiment is the brightness of a light source emitted out through the filter screen; the light source is arranged in an air purifier according to the air pressure value of the position where the filter screen is located; the light source can be emitted out through the filter screen; the use time of the air purifier under the same condition and the brightness of the light source emitted out through the filter screen are collected to form a database; the life of a filter element of the air purifier is determined through the brightness of the light source emitted out through the filter screen at present; and the specific countdown time is subjected to analog computing by referring to the total use time of the purifier within the set concentration range in the Embodiment 1.

[0040] The above is only an embodiment of the present invention, and does not limit the patent scope of the present invention, and all equivalent structural transformations made by using the contents of the description and drawings of the present invention, or directly or indirectly applied in other related technical fields, are similarly included in the patent protection scope of the present invention.

CLAIMS

What is claimed is:

1. A replacement reminding method of a filter screen of an air purification system, comprising: determining a factory default life end index prompt threshold of the filter screen, the factory default life end index prompt threshold of the filter screen being before an actual life end index threshold of the filter screen of a purifier, the factory default life end index prompt threshold of the filter screen of the filter being an index numerical value when the filter screen reaches the set total amount of filtering particulate matters, and the filtering efficiency of the purifier being greater than 50% when the filter screen reaches the set total amount of filtering particulate matters, wherein when the life index of the filter screen reaches an actual life end index prompt threshold of the filter screen and the factory default life end index prompt threshold of the filter screen, CCMs of the purifier are in the same level; the reminding method specifically comprises the following steps:

S1, when the life index of the filter screen reaches the factory default life end index prompt threshold of the filter screen, switching the life of the filter screen into static countdown, the duration of the static countdown meeting that the filtering efficiency of the purifier is not less than 50% at the time of countdown completion; and

S2, after the static countdown ends, stopping running the purifier.

2. The replacement reminding method of the filter screen of the air purification system according to claim 1, wherein after the static countdown is started, the purifier enters an equipment performance protection period, and in the state, the rotating speed of a purifier unit needs to be adjusted to be less than 600 r/min.

3. The replacement reminding method of the filter screen of the air purification system according to claim 2, wherein a reminding device is arranged on the purifier, and the reminding device comprises at least two response modes of an initial response mode when the factory default life end index of the filter screen reaches the prompt threshold and an end response mode when the static countdown ends.

4. The replacement reminding method of the filter screen of the air purification system according to claim 2, wherein the reminding device comprises one or more of an indicator lamp, a loudspeaker alarm, a purifier external display screen and an app.

5. The replacement reminding method of the filter screen of the air purification system according to claim 3, wherein a timing device used for recording the service time of the purifier is arranged on the purifier.

6. An air purification system based on dynamic life record, utilizing the replacement reminding method of the filter screen of the air purification system according to any one of claims 1 to 5, and comprising: an air purifier and the filter screen, wherein a main control board and a monitoring device used for detecting the current service life of the filter screen are arranged on the air purifier; the main control board is electrically connected to the monitoring device; and the filter screen has related life end index used for being detected by the monitoring device.

7. The air purification system based on the dynamic life record according to claim 6, wherein a pressure detection sensor is arranged at an air outlet of the purifier; data of the pressure detection sensor of the air purifier under the same condition and the use time of the purifier are collected to form a database; the life of a filter element of the air purifier is determined through the current value of the pressure detection sensor; the life end index is the pressure value of the position where the filter screen is located; the average value of the filter screen at different times in the database is computed, or a media value or mode value is selected, thus obtaining a function relationship between the life of the filter screen and the brightness of a light source; and therefore, the brightness of the light source can be obtained when the factory default life of the filter screen and the actual life of the filter screen end.

8. The air purification system based on the dynamic life record according to claim 6, wherein the light source is arranged in the air purifier and can be emitted out through the filter screen; the use time of the air purifier under the same condition and the brightness of the light source emitted out through the filter screen are collected to form the database; the life of the filter element of the air purifier is determined through the current brightness of the light source emitted out through the filter screen; the life end index is the brightness of the light source penetrating through the filter screen; the average value of the filter screen at different times in the database is computed, or the

media value or mode value is selected, thus obtaining the function relationship between the life of the filter screen and the brightness of the light source; and therefore, the brightness of the light source can be obtained when the factory default life of the filter screen and the actual life of the filter screen end.

9. The air purification system based on the dynamic life record according to claim 6, wherein a particulate matter concentration recognition sensor is arranged at an air inlet of the purifier; a set concentration range of the air purifier is set, and the set concentration range is a reference comparison value; the actual total use time of the purifier when the particulate matters are in different concentration ranges under the same condition is collected, thus obtaining the function relationship between the total use time of the purifier at different concentration relative to the purifier within the set concentration range; the total use time of the purifier within the set concentration range is set to be a fixed value; the detection frequency of the concentration of the particulate matters at the air inlet of the purifier is set; the use time of the purifier under single detection frequency within the set concentration range is obtained according to the time under the single detection frequency and the function relationship between the total use time of the purifier at different concentration relative to the purifier within the set concentration range; the remaining life of the filter element of the air purifier is determined according to an accumulated difference value of the total use time of the purifier within the set concentration range and the use time of the purifier under single detection frequency within the set concentration range; the life end index of the filter screen is the remaining work time of the filter screen under the total use time of the purifier within the set concentration range; and therefore, the total use time of the purifier within the set concentration range can be obtained when the factory default life of the filter screen and the actual life of the filter screen end.