

METHOD FOR MONITORING SERVICE LIFE OF A WATER PURIFIER FILTER ELEMENT

Technical field

The application belongs to the technical field of water purifiers, in particular to a method for monitoring service life of a water purifier filter element.

Background

Water purifier is a kind of water treatment equipment that deeply filters and purifies the water according to the requirements of water use. Water purifier can effectively filter out rust, sandstone and colloid in water, adsorb residual chlorine, odor, abnormal color, pesticides and other chemicals in water, and remove impurities such as bacteria, germs, toxins and heavy metals in water. Its main working principle is to exert certain pressure on water, so that harmful substances in water can be blocked by various filtering materials, while pure water and beneficial mineral ions can pass normally. Its main working principle is that harmful substances in the water are intercepted by various filtering materials by applying certain pressure to the water, while water and beneficial mineral ions can pass through normally.

The core of a water purifier is its filter element. For example, in a household water purifier, KDF and activated carbon are generally contained in the filter element of the water purifier. The filter element is used to clean the polluted water to the state required by production and life. That is, to make the water reach a certain cleanliness, remove solid particles in the water, kill bacteria and filter out harmful chemical components.

As a consumable, the filter element of the water purifier needs to be replaced when it approaches its service life. In daily use, the life of the filter element of the water purifier is often judged according to the approximate estimation of the number of days it has been used and the stain condition of the filter element itself. This will lead to the situation that it seems that there are stains on the surface of the filter element, but it is replaced before the service life limit, or it seems that there are not many stains on the surface of the filter element, but in fact it has no filtering effect because it has exceeded the service life limit. Therefore, it is very necessary to use a monitoring system for the service life of the filter element together with the water purifier.

Summary

The purpose of the present application is to provide a method for monitoring service life of a water purifier filter element, so as to solve the problems described in the background above.

In order to achieve the above purpose, the technical solutions adopted by the application are as follows. A method for monitoring service life of a water purifier filter element is provided, the filter element is installed in a water purifier main body, and the water purifier main body is provided with a main PCB board; a data storage chip is arranged on the filter element, the main PCB board and the data storage chip are connected by electrical signals, and the main PCB board is electrically connected and controls a warning device; the method includes following steps:

S1) setting use stage of the filter element as a safe use stage, a first early warning stage, a second early warning stage, an End-of-Life stage and a scrapping stage, wherein each stage is experienced in sequence until the filter element is scrapped;

S2) when the filter element is at the safe use stage, the warning device controlled by the main PCB board does not respond;

when the filter element is at the first early warning stage, the main PCB board controls the warning device to enter a first response mode;

when the filter element is at the second early warning stage, the main PCB board controls the warning device to enter a second response mode;

when the filter element is at the End-of-Life stage, the main PCB board controls the warning device to enter a third response mode;

when the filter element is at the scrapping stage, the main PCB board controls the warning device to enter a fourth response mode, and meanwhile, the water purifier main body stops supplying water.

Preferably, the safe use stage, the first early warning stage, the second early warning stage, the End-of-Life stage and the scrapping stage are all determined according to service days and a filtered water volume of the filter element, and each stage is determined according to one of the conditions of the service days and the filtered water volume,

depending on which condition is reached first.

Preferably, the safe use stage is that the number of the service days of the filter element is between 0-290, or the filtered water volume of the filter element is 0-2900 liters;

the first early warning stage is that the number of the service days of the filter element is between 260-310, or the filtered water volume of the filter element is 2600-3100 liters;

the second early warning stage is that the number of the service days of the filter element is between 280-330, or the filtered water volume of the filter element is 2800-3300 liters;

the End-of-Life stage is that the number of the service days of the filter element is between 300-360, or the filtered water volume of the filter element is 3000-3600 liters;

the scrapping stage is that the number of the service days of the filter element is between 320-365, or the filtered water volume of the filter element is 3200-3600 liters; and

the interval end values of the service days and the filtered water volume of the safe use stage of the filter element are continuous with the interval start values of the service days and the filtered water volume of the first early warning stage; the interval end values of the service days and the filtered water volume of the first early warning stage of the filter element are continuous with the interval start values of the service days and the filtered water volume of the second early warning stage; the interval end values of the service days and the filtered water volume of the second early warning stage of the filter element are continuous with the interval start values of the service days and the filtered water volume of the End-of-Life stage; and the interval end values of the service days and the filtered water volume of the End-of-Life stage of the filter element are continuous with the interval start values of the service days and the filtered water volume of the scrapping stage.

Preferably, a timing unit is arranged on the main PCB board, the timing unit performs data statistics at a frequency of 5-1800 seconds, with 24 hours as one service day, and transmits the data to the data storage chip for recording.

Preferably, the water purifier main body is provided with a flow pump for determining the filtered water volume at a filter inlet or a filter outlet of the filter element,

the main PCB board is electrically connected and controls the flow pump; when the water purifier is used, the flow pump starts to work, and meanwhile, the timing unit records a working time of the flow pump, the filtered water volume running through the flow pump is obtained by multiplying a water flow rate of the flow pump and the working time of the flow pump; the main PCB board transmits the data of filtered water volume of each use of the flow pump to the data storage chip for recording, and keeps accumulating from 0.

Preferably, the main PCB board has a control identification chip, and the control identification chip is able to read the data in the data storage chip.

Preferably, the warning device is an indicator light, a buzzer, a display screen, an APP and/or a mini-program.

A method for determining authenticity of a filter element is provided, used for the method for monitoring service life of a filter element of any one of claims 1 to 7, wherein a first serial number for judging whether the filter element is genuine is stored in the data storage chip, and a control identification chip is arranged on the water purifier main body, and the first serial number in the data storage chip is read through electrical signal transmission between the control identification chip and the data storage chip.

Preferably, it includes following steps:

S01) before step S1 of the method for monitoring service life of a filter element, firstly, the control identification chip starts reading the first serial number on the data storage chip, and when the control identification chip cannot identify the first serial number on the data storage chip, the warning device on the water purifier body makes an alarm response.

Preferably, when the control identification chip cannot identify the first serial number on the data storage chip, the water purifier main body stops supplying water to the filter element.

Preferably, the data storage chip also stores a second serial number indicating the service days of the filter element and a third serial number indicating the filtered water volume of the filter element; when the data read by the control identification chip indicates "genuine", the second serial number indicating the service days of the filter element and the third serial number indicating the filtered water volume of the filter element are read

together, and then it proceeds to step S1 of the method for monitoring service life of a filter element.

The application has the following beneficial effects.

When the filter element is replaced and the method for monitoring service life of a filter element of the present application is used, the water purifier main body monitors the current service days of the filter element and the filtered water volume in real time, and determines which stage the service life of the filter element is in according to one of the conditions of the service days and the filtered water volume, depending on which condition is reached first. So that users can get relevant information in time and prepare for replacing the filter element in advance.

When using the method for monitoring service life of a filter element to identify the authenticity of the filter element, the control identification chip connected to the main PCB on the water purifier main body and the data storage chip on the filter element are electrically connected, and then the control identification chip will identify the first serial number in the data storage chip on the filter element. If the first serial number does not match or does not exist, it indicates that the filter element is not genuine, then water supply to the filter element would be refused, thus avoiding the use of inferior filter elements and ensuring the purification effect of the water purifier. Meanwhile, if the filter element is identified as genuine, the control identification chip will identify the second serial number and third serial number on the data storage chip on the filter element together so as to read the current service days and purified water volume of the water purifier, and then determine its current usage and remaining service life, so as to facilitate the main PCB board to classify the identified data into the corresponding use stage of the filter element, and control the indicator light or buzzer to respond accordingly.

Meanwhile, if the filter element is confirmed to be genuine, the monitoring of the service life of the filter element of the water purifier can be ensured to be accurate, thus ensuring that the warning issued is correct when the filter element reaches different warning conditions, and further reminding users to replace the filter element in time. In this way, it can avoid the situation that a large number of counterfeit products are fraudulently sold and the used genuine filter element still flows into the market because the life of the filter element in the existing water purifier on the market is monitored by recalculating the life of the replaced filter element.

Brief description of drawings

Fig. 1 is a decision table of response modes and execution conditions of an indicator light and an alarm device of the present application.

Fig. 2 is a flow chart of a water purifier for monitoring service life of a filter element of the present application.

Fig. 3 is a flow chart of the life monitoring of a filter element by water purifier main body, combined with the function of identifying authenticity of the filter element.

Detailed description of disclosed embodiments

The preferred embodiments of this application will be described in detail with the attached drawings, so that the advantages and features of this application would be more easily understood by those skilled in the art, and the protection scope of this application would be defined more clearly

Embodiments

The application relates to a method for monitoring service life of a water purifier filter element, which specifically includes the following contents.

A water purifier, including a water purifier main body and a filter element arranged in the water purifier main body, the water purifier main body can control whether water is supplied to the filter element, and a warning device is arranged on the water purifier main body, and the warning device is one or any combination of an indicator light, a buzzer, a display screen, an APP and/or a min-program, etc. In this embodiment, the warning device realizes the warning function of the water purifier filter element at different stages by using the combined functions of the indicator light and the alarm device. A main PCB board for controlling the indicator light and the alarm device is installed in the water purifier, a chip fixing bracket is fixed on the filter element, and a data storage chip is detachably connected in the chip fixing bracket. By detachably connecting the data storage chip and the chip fixing bracket, the situation that the data storage chip needs to be scrapped together with the filter element shell due to damage can be avoided, and a data connector is arranged on the data storage chip. The water purifier main body is provided with a main PCB board

connection socket which is connected with a power supply, a control identification chip is connected with the main PCB board, and a data transmission line which can be connected with the data connector on the data storage chip is fixed on the main PCB board. In addition, on the main PCB board, the usage data of the water purifier is connected to a master data storage relay server through network by fixing a wireless radio frequency module or connecting a network cable. The manufacturer can store and monitor the filter element data used by all users by building a data processing station, and the user can know the current usage status and service life of the water purifier filter element through an app or mini-program compatible with the water purifier.

The application also provides a method for determining authenticity of a filter element, which is used in combination with the water purifier with the above structure. Specifically, a data storage chip on the filter element stores a first serial number for judging whether the filter element is genuine or not, a second serial number indicating the service life of the filter element and a third serial number indicating the filtered water volume of the filter element, and a control identification chip on the main body of the water purifier reads the first serial number in the data storage chip through a data line.

When the filter element is identified as genuine, the service days and filtered water volume of the filter element recorded by the second serial number and the third serial number are then identified. When the data read by the control identification chip is not genuine, the water purifier main body stops supplying water to the filter element and makes an alarm response through an alarm device.

Referring to Figs. 1 and 3, a method for monitoring service life of a water purifier filter element is used in combination with a method for determining authenticity of a filter element, which specifically includes the following steps:

S1: after replacing the filter element, reset the main PCB board by APP or mini-program, or manually reset the main PCB board by setting a reset module on the water purifier main body, and set the data of filtered water volume and service days of the filter element to zero.

S2: the control identification chip on the water purifier main body reads the first serial number on the data storage chip on the filter element through data connection to determine whether the filter element is genuine.

S3: if the filter element is genuine, a system corresponding to the above method for monitoring service life of the filter element starts to run, and meanwhile, the data of the second serial number and the third serial number on the data storage chip are identified to determine the current filtered water volume and service days of the filter element.

S4: setting use stage of the filter element as a safe use stage, a first early warning stage, a second early warning stage, an End-of-Life stage and a scrapping stage, wherein each stage is experienced in sequence until the filter element is scrapped.

S5: when the filter element is at the safe use stage, the indicator light and the alarm device on the main body of the water purifier do not respond.

when the filter element is at the first early warning stage, the indicator light makes a first response mode, and the alarm device enters a first response mode;

when the filter element is at the second early warning stage, the indicator light makes a second response mode, and the alarm device enters a second response mode;

when the filter element is at the End-of-Life stage, the indicator light makes a third response mode, and the alarm device enters a third response mode;

when the filter element is at the scrapping stage, the indicator light makes a fourth response mode, and the water purifier main body stops supplying water.

When the filter element is at the first early warning stage, the second early warning stage, the End-of-Life stage and the scrapping stage, the specific response modes of the indicator light and the alarm device are as follows. The service life stages of the filter element are distinguished according to different levels of urgency. In this case, during the first early warning stage, the second early warning stage and the End-of-Life stage, the response modes of the indicator light and the alarm device are divided into the case of using the water purifier for water filtration and the case of not using the water purifier for water filtration.

Case of using the water purifier for water filtration:

1. Set the early warning conditions of the first early warning stage as follows: the number of service days of the filter element is between 286-296 or the filtered water volume of the filter element is between 2860-2969 liters. When either of the conditions of

the service days and filtered water volume of the filter element read by the control identification chip reaches the range of the first early warning stage, the indicator light will be green, and it will flash 3 times every 60 minutes, with each flashing being on for 1 second and off for 0.5 seconds. Meanwhile, the alarm device will give an alarm reminder for once every 60 minutes.

2. Set the early warning conditions of the second early warning stage as follows: the number of service days of the filter element is between 297-299 or the filtered water volume of the filter element is between 2970-2999 liters. When either of the conditions of the service days and filtered water volume of the filter element read by the control identification chip reaches the range of the second early warning stage, the indicator light will be green, and it will flash five times every 60 minutes, with each flashing being on for 1 second and off for 0.5 seconds. Meanwhile, the alarm device will give an alarm reminder for three times every 60 minutes.

Case of not using the water purifier for water filtration:

1. The early warning conditions of the first early warning stage are consistent with that of the first early warning stage when the water purifier is used for water purification. When either of the condition of the service days and filtered water volume of the filter element read by the control identification chip first reach the range of the first early warning stage, the indicator light and the alarm device will be triggered to respond. In this case, the indicator light will remain green, and the alarm device will give an alarm every time the water purifier is being used.

2. The early warning conditions of the second early warning stage are consistent with that of the second early warning stage when the water purifier is used for water purification. When either of the condition of the service days and filtered water volume of the filter element read by the control identification chip first reach the range of the second early warning stage, the indicator light and the alarm device will be triggered to respond. In this case, the indicator light will remain green, and a short alarm will be given for three times every time the water purifier is being used.

When the filter element enters the End-of-Life stage, the early warning conditions of the End-of-Life stage are set as follows: the number of service days of the filter element is between 300-330 or the filtered water volume of the filter element is 3000-3300 liters.

When either of the conditions of the service days and filtered water volume of the filter element read by the control identification chip reaches the range of the End-of-Life stage, the indicator light will be red, and it will flash 10 times every 60 minutes, with each flashing being on for 1 second and off for 0.5 seconds. Meanwhile, the alarm device will give an alarm reminder for three times every 60 minutes, and each alarm reminder rings three times continuously.

When the filter element enters the scrapping stage, the early warning conditions of the scrapping stage are set as follows: the number of service days reaches 331 days or the filtered water volume reaches 3,301 liters or more. When either of the conditions of the service days and filtered water volume of the filter element read by the control identification chip reaches the range of the scrapping stage, the indicator light and the alarm device will be triggered to respond. In this case, the indicator light remains red and stops flashing. Meanwhile, the water purifier main body stops supplying water.

Apparently, in other embodiments, it may not be used in combination with the method for determining authenticity of the filter element. In this case, just omit some steps of S2 and/or S3 in the above process, and then start (see Fig. 2).

In the above water purifier, a timing unit is arranged on the main PCB, and the timing unit performs data statistics every 5 seconds, with 24 hours as one service day, and transmits the data to the data storage chip for recording (it should be noted that chips are also used for recording data in some domestic household products, but the general data recording frequency is about 5-10 minutes. If this frequency recording is used in this water purifier product, for example, when the filter element is replaced, there will be a waiting time for initial data recording, which will undoubtedly reduce the user experience. Therefore, the control identification chip and data storage chip in this product should be of high quality to meet the needs of the product), and it is recorded in the data storage chip in hexadecimal format (apparently, other recording methods may also be used, the same below). The water purifier main body is provided with a flow pump for counting the filtered water volume at a filter inlet or a filter outlet of the filter element, when the water purifier is used, the flow pump starts to work, and meanwhile, the timing unit records a working time of the flow pump, the filtered water volume running through the flow pump is obtained by multiplying a water flow rate of the flow pump and the working time of the flow pump, and the filtered water volume data recorded by the flow pump at each use is recorded into the data storage chip in the filter element in hexadecimal format. The main

PCB board transmits the data of filtered water volume of each use of the flow pump to the data storage chip for recording, and keeps accumulating from 0. Moreover, the data of the filtered water volume of the flow pump is transmitted to the data storage chip at a frequency of 5 seconds/time. With the short transmission frequency interval, the problem of inaccurate recording of the filtered water volume caused by external factors such as power failure can be avoided to the greatest extent. It should be noted that the data of the filtered water volume of the flow pump recorded at the frequency of 5 seconds/time mentioned above is not fixed at each use. And apparently, the frequencies of 10 seconds/time and 20 seconds/time may also be used, which is set by the manufacturer according to the demand. In addition, when the counted filtered water volume reaches 10L, a summary and separate numerical value is recorded on the data storage chip and accumulated, and the numerical value will be transmitted to the control identification chip. After being identified by the control identification chip, the numerical value will be displayed on the data processing station and the client, and the control identification chip will process the filtered water in units of 10L, which can reduce the calculation amount of the control identification chip, thus reducing the use requirements of the chip and effectively reducing the cost. Furthermore, an electromagnetic valve is connected to the water inlet of the filter element, and the electromagnetic valve is connected with the main PCB board and controls whether water is supplied to the filter element through the main PCB board.

The above are merely the preferred embodiments of this application, and are not intended to limit the protection scope of the application. Any equivalent structural transformation made by using the description and attached drawings of this application, or directly or indirectly used in other related technical fields, is equally included in the patent protection scope of this application.

Claims

1. A method for monitoring service life of a water purifier filter element, wherein the filter element is installed in a water purifier main body, and the water purifier main body is provided with a main PCB board; a data storage chip is arranged on the filter element, the main PCB board and the data storage chip are connected by electrical signals, and the main PCB board is electrically connected and controls a warning device; the method comprises following steps:

S1) setting use stage of the filter element as a safe use stage, a first early warning stage, a second early warning stage, an End-of-Life stage and a scrapping stage, wherein each stage is experienced in sequence until the filter element is scrapped;

S2) when the filter element is at the safe use stage, the warning device controlled by the main PCB board does not respond;

when the filter element is at the first early warning stage, the main PCB board controls the warning device to enter a first response mode;

when the filter element is at the second early warning stage, the main PCB board controls the warning device to enter a second response mode;

when the filter element is at the End-of-Life stage, the main PCB board controls the warning device to enter a third response mode; and

when the filter element is at the scrapping stage, the main PCB board controls the warning device to enter a fourth response mode, and meanwhile, the water purifier main body stops supplying water.

2. The method for monitoring service life of a water purifier filter element of claim 1, wherein the safe use stage, the first early warning stage, the second early warning stage, the End-of-Life stage and the scrapping stage are all determined according to service days and a filtered water volume of the filter element, and each stage is determined according to one of the conditions of the service days and the filtered water volume, depending on which condition is reached first.

3. The method for monitoring service life of a water purifier filter element of claim 2, wherein

the safe use stage is that the number of the service days of the filter element is between 0-290, or the filtered water volume of the filter element is 0-2900 liters;

the first early warning stage is that the number of the service days of the filter element is between 260-310, or the filtered water volume of the filter element is 2600-3100 liters;

the second early warning stage is that the number of the service days of the filter element is between 280-330, or the filtered water volume of the filter element is 2800-3300 liters;

the End-of-Life stage is that the number of the service days of the filter element is between 300-360, or the filtered water volume of the filter element is 3000-3600 liters;

the scrapping stage is that the number of the service days of the filter element is between 320-365, or the filtered water volume of the filter element is 3200-3600 liters; and

the interval end values of the service days and the filtered water volume of the safe use stage of the filter element are continuous with the interval start values of the service days and the filtered water volume of the first early warning stage; the interval end values of the service days and the filtered water volume of the first early warning stage of the filter element are continuous with the interval start values of the service days and the filtered water volume of the second early warning stage; the interval end values of the service days and the filtered water volume of the second early warning stage of the filter element are continuous with the interval start values of the service days and the filtered water volume of the End-of-Life stage; and the interval end values of the service days and the filtered water volume of the End-of-Life stage of the filter element are continuous with the interval start values of the service days and the filtered water volume of the scrapping stage.

4. The method for monitoring service life of a water purifier filter element of claim 3, wherein a timing unit is arranged on the main PCB board, the timing unit performs data statistics at a frequency of 5-1800 seconds, with 24 hours as one service day, and transmits the data to the data storage chip for recording.

5. The method for monitoring service life of a water purifier filter element of claim 4, wherein the water purifier main body is provided with a flow pump for determining the

filtered water volume at a filter inlet or a filter outlet of the filter element, the main PCB board is electrically connected and controls the flow pump; when the water purifier is used, the flow pump starts to work, and meanwhile, the timing unit records a working time of the flow pump, the filtered water volume running through the flow pump is obtained by multiplying a water flow rate of the flow pump and the working time of the flow pump; the main PCB board transmits the data of filtered water volume of each use of the flow pump to the data storage chip for recording, and keeps accumulating from 0.

6. The method for monitoring service life of a water purifier filter element of claim 1, wherein the main PCB board has a control identification chip, and the control identification chip is able to read the data in the data storage chip.

7. The method for monitoring service life of a water purifier filter element of claim 3, wherein the warning device is an indicator light, a buzzer, a display screen, an APP and/or a mini-program.

8. A method for determining authenticity of a filter element, used for the method for monitoring service life of a filter element of any one of claims 1 to 7, wherein a first serial number for judging whether the filter element is genuine is stored in the data storage chip, and a control identification chip is arranged on the water purifier main body, and the first serial number in the data storage chip is read through electrical signal transmission between the control identification chip and the data storage chip.

9. The method for determining authenticity of a water purifier filter element of claim 8, comprising following steps:

S01) before step S1 of the method for monitoring service life of a filter element, firstly, the control identification chip starts reading the first serial number on the data storage chip, and when the control identification chip cannot identify the first serial number on the data storage chip, the warning device on the water purifier body makes an alarm response.

10. The method for determining authenticity of a water purifier filter element of claim 8, wherein when the control identification chip cannot identify the first serial number on the data storage chip, the water purifier main body stops supplying water to the filter element.

11. The method for determining authenticity of a water purifier filter element of

claim 8, wherein the data storage chip also stores a second serial number indicating the service days of the filter element and a third serial number indicating the filtered water volume of the filter element; when the data read by the control identification chip indicates "genuine", the second serial number indicating the service days of the filter element and the third serial number indicating the filtered water volume of the filter element are read together, and then it proceeds to step S1 of the method for monitoring service life of a filter element.