

TITLE OF INVENTION

AUTHENTICATING WATER PURIFIER FILTER AND METHOD TO DETERMINE THE LIFE SPAN OF THE WATER FILTER

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BACKGROUND OF THE INVENTION

A. Field of The Invention

10 The present invention relates to a water purifier, and in particular, by employing circuitry and a meter to verify authenticity of the water purifier filter and method for checking the life span of the water purifier filter.

B. Background Art

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Water filters available in the market suffer from the drawback that they are cumbersome to use and to replace after a period of time of usage since there is no way to find out the efficacy of the filter and the life span of the filters, and whether it is time to get a change in the filter in order to obtain purified water. Currently, the available practise to determine the lifespan of a filter in a water purifier is by recording the number of days, or number of litres, or monitoring slow flowrate or blockages, and/or visual checking for brown stains. In these practises, the water purifier unit and the filter work independently and there is no communications between the filter and the water purifier. The filter usage data is stored in the water purifier and not in the filter itself, and this means that the exhausted filter may be a brand new filter when it is used on another water purifier. This will allow the user to reset filter to continue using the exhausted filter even though the exhausted filter is inefficient. As a result, based on current filter lifespan monitoring methods, the filter usage monitoring is not accurate nor complete. This brings a risk of compromising the filter's performance and defeated the purposed of having one in the water purifier. The prolong-continual usage of exhausted filter may lead to poor chlorine removal, poor sediments removal, poor VOC removal, poor microorganism removal, and contaminants breeding due to exhausted anti-bacteria properties.

Filters used in water purifiers are manufactured by companies producing the purifiers in consideration of physical and chemical properties suitable for the environment of the purifiers. The filters are consumable in the water purifier and are in general supplied with by the water purifiers companies for each model of the water purifier. Thus, it is important to have the right

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filters for the purifiers since the water purifier is generally developed together with the filters used, and there is also a limited period or life span of the filters for that particular water purifier. Good quality water from the water purifier affects the health of an user and is directly influenced by the quality of filters, and there are numerous of less effective filters available in the market which provides poor quality purified water as compared to the genuine filters that manufactured by the water purifier companies. Therefore, a method is needed in which the filters can be verified as to the authenticity, and the method can remind the user for replacing the filter to solve the problem and monitor the actual condition of the filter more accurately.

Despite the development of genuine filters with optimum conditions for water purifiers by the water purifier company, non-genuine filters are on widely sold in the market, and a number of users often buy and use non-genuine filters. In the case of such a non-genuine filter, not only the quality of the water is poor, the filter is deteriorated rapidly which has bad impact on the quality of the water purifier. It is a common sense that most of the inexpensive non-genuine filters are poor in quality, leading to the failure of expensive water purifiers. Therefore, there is a great demand for genuine filters for use in water purifier, and it is important to develop method to easily identify non-genuine whose use is inappropriate, and a method of effectively limiting its use.

US Patent No. 8348146B1 entitled "System and method for determining product authenticity" relates to system and method for determining product authenticity including a code assembly having a plurality of preferably three displayed companion codes visually observable on the product and purportedly associated therewith. A communication device is structured to input at least one of the displayed companion codes and transmitted to a remote processor facility. A database accessible by the processor facility includes a plurality of preferably three correct companion codes correctly associated with the product wherein receipt of the displayed companion codes from the communication device will facilitate access by the processor facility of the database and the plurality of correct companion codes associated with the product, wherein product authenticity is determined by a transmission of a predetermined one of the displayed companion codes back to the communication device for comparison with the one other of the displayed companion codes not transmitted to the processor facility.

China Patent No. CN 106778963B, entitled "Anti-counterfeiting device and method for filter screen" relates to a filter screen anti-counterfeiting device, wherein a filter assembly is arranged on the outer wall of an air purifier, a filter screen is arranged in the filter assembly, an electronic tag is arranged on the filter screen, the electronic tag is provided with a plurality of data sectors capable of performing data sector attribute operation and anti-counterfeiting

identification, a card reader system for identifying and operating the electronic tag is arranged on the air purifier, and a control panel is arranged at the upper part of the air purifier and used for controlling the air purifier and the card reader system to work through data transmission lines respectively after the card reader system reads and identifies the attributes of each data sector in the electronic tag. The invention also discloses a filter screen anti-counterfeiting method, which is characterized in that the data sectors in the electronic tag are sequenced and combined, the authenticity is judged by identifying the sequencing and combining, and the data sectors can be additionally provided with passwords, so that the anti-cracking safety capability is improved.

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China Patent Application No. CN 104496055A entitled "Anti-counterfeiting water purifying device based on filter element recognition" discloses a device comprising a filter element assembly, a booster pump and a filter membrane assembly, wherein a water inlet and a water outlet of the filter element assembly are respectively connected with a water supply pipe and the booster pump; a water outlet of the booster pump is connected with a water inlet of the filter membrane assembly; identity recognizing chips which are matched with an identity recognizer mounted on the water purifying device are arranged on the filter element assembly and the filter membrane assembly; the identity recognizing chips are respectively mounted and located on filter elements of the filter element assembly and the filter membrane assembly; the booster pump is connected with the identity recognizer, so that the identity recognizer outputs a control signal to drive the booster pump to work only after the identity recognizing chips are successfully matched with the identity recognizer; only the original filter element equipped with the identity recognizing chip can be matched with the water purifying device; therefore, the filter element anti-counterfeiting function can be achieved, the counterfeit and shoddy products can be effectively avoided, and the quality of filter element products and the sanitation of filtered water in drinking can be ensured.

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China Utility Model Application CN207294221U entitled "A kind of water purifier multichannel anti-counterfeiting system" discloses an anti-counterfeiting system including water purifier body and filter core, the water purifier body are equipped with control panel and at least one filter core mounting hole ; The control panel is equipped with RFID radio frequency chips and microcontroller ; The RFID radio frequency chips are equipped with the signalling channel identical with filter core installation hole number, and each signalling channel is connected with antenna ; The end of the filter core is equipped with RFID tag, and anti-counterfeiting identification code is stored in the RFID tag ; The antenna is used to launch the anti-counterfeiting identification code that the radiofrequency signal that the RFID radio frequency

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chips are sent is passed back with the reception RFID tag, the microcontroller is used to switch turning on and off for the signalling channel, while judges whether the anti-counterfeiting identification code that RFID tag is passed back is correct.

- 5 Accordingly, the present invention has been proposed to solve the conventional problems as described above, and an object of the present invention is to provide a water filter installed with a filter chip that can detect a non-genuine of the water filter and also to check the lifespan of the filter used in the water purifier.

10 **BRIEF SUMMARY OF THE INVENTION**

These and other features, aspects and advantages of the present invention will become better understood with reference to the following drawings, description and claims.

- 15 A main object of the present invention is to provide authenticity of water purifier filter and method to determine the life span of the water filter, wherein real time accurate monitoring of filter lifespan is determined to ensure the quality of filtration of water within the water purifier. A further object of the present invention is to provide authenticity of water purifier filter and method to determine the life span of the water filter by employing a flow meter to measure the
20 volume of water being filtered and a timer to keep track of the duration of filter usage.

- Another main object of the present invention is that in a water purifier filter for authenticating and for determining lifespan of the filter, the filter being positioned within a water purifier, comprising a filter chip inserted into a slot provided on the filter, characterized in that the filter
25 includes the filter chip having a memory containing information of the filter; a main PCB unit including a temporary memory, a flow meter or a pump or valve working time times flow rate, to determine the number of litres, and a lifespan counter, and a power supply unit, wherein the filter chip stores information of the corresponding filter with respect to usage data including number of days of using the filter, and the number of litres being filtered by the filter for
30 determining authenticity of the filter, the temporary memory containing information of the filter after the filter is activated, communication with the filter chip is by accessing the filter usage data in the memory of the filter chip and use the detected filter information to verify the authenticity of the filter, and by comparing the filter information usage in the temporary memory of the main PCB unit, result of the authenticating is notified to the user via a wifiapp together
35 with beeping sound via a speaker or on a LED display for the user to replace with a new filter based on filter usage data, and the power supply unit is used to activate the operation of the main PCB unit to trigger the operation of the filter of the water purifier.

A further main object of the present invention is to provide a method of authenticating a filter of a water purifier, characterized in that the method comprises a first step of acquiring filter information of the filter; determining whether the filter is genuine using the filter information; and proceeding the filter to a normal operation of the water purifier when the filter is determined to be genuine.

Yet still another object of the present invention is to provide a method of authenticity of water purifier filter and method to determine the life span of the water filter, wherein a 3-way interactive communication between a water purifier and the filter incorporated to the water purifier by means of a filter chip which stores and transmits usage data to the water purifier unit.

Yet another object of the present invention is to provide a method of authenticity of water purifier filter and method to determine the life span of the water filter, wherein any exhausted and compromised filter prompted are replaced timely.

Still another object of the present invention is to provide a method of authenticity of water purifier filter and method to determine the life span of the water filter, wherein a progressive alarm system is provided to the water purifier to allow the user with ample time to prepare for filter replacement through APP message prompt and the physical unit alarm.

Yet a further object of the present invention is to provide a method of authenticity of water purifier filter and method to determine the life span of the water filter, which provides the ease of ordering the filter replacement through the APP.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

A fuller understanding of the nature and objects of the present invention will become apparent upon consideration of the following detailed description, taken in connection with the accompanying drawings, wherein:

FIG. 1 is a logic diagram flow for authenticating a water purifier filter according to an exemplary embodiment of the present invention.

FIG. 2 is a block diagram of an apparatus for authenticating a water purifier filter according to an exemplary embodiment of the present invention.

FIG. 3 is a flowchart illustrating an operation of detecting a water purifier filter in a method for authenticating a water purifier filter according to an exemplary embodiment of the present invention.

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FIG. 4 is a flowchart illustrating a water purifier control operation in a method for checking lifespan of a water purifier filter according to an exemplary embodiment of the present invention.

10 DETAILED DESCRIPTION OF THE INVENTION

The following detailed description is of the best currently contemplated modes of carrying out exemplary embodiments of the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention, since
15 the scope of the invention is best defined by the appended claims.

Referring to FIG. 1, broadly, there is shown a logic diagram flow for authenticating a water purifier filter in accordance with the present invention. In accordance with the preferred embodiment of the present invention, the authenticating of a water purifier filter involves a filter
20 (110), a Filter Progressive Alarm System having a filter progressive alarm and a user, which shows a 3-way interactive communication.

The filter (110) and the Filter Progressive Alarm System form the 3-way interactive communication in accordance with the present invention. In general, as shown in FIG. 1,
25 when a power on button located on the water purifier turns on, the information on the filter chip will be read and the filter usage data on the filter chip is used for authenticating the genuineness of the filter used in the water purifier. If the filter is not a genuine product, a faulty notification will be displayed and the operation of filtering will stop. If the filter is a genuine product the usage data will be displayed with LED color in respect to the water filtered capacity
30 and the day of using of the filter.

FIG. 2 is a schematical view of an assembly for authenticating water purifier filter and for checking the life span of water purifier filters in accordance with the present invention. As shown therein, the water purifier (610) comprises a filter (110) mounted thereto. On the filter
35 (110), there is provided a filter chip (130) which contains a microprocessor (131), for storing filter usage data. The filter usage data includes information on the number of days used of the filter (110) and the number of litre of water being filtered. The filter chip (130) is connected

to a PCB unit (200) in communication linkage with a temporary memory (142), a flow meter (144) and a lifespan counter (146). A power unit (190) is mounted to the water purifier to control the operation of the PCB unit (200). In another preferred embodiment, instead of the flow meter (144) a mean such as a pump and a valve with calculated flowrate can be employed
 5 to measure the number of litre of water over a period of time.

In accordance with the present invention, the PCB unit (200) and the filter chip (130) on the filter (110) are driven by the power unit (190) which triggers the operation of the filter chip (130) that is inserted to the filter (110) of the water purifier (610). The filter information detected
 10 and recorded by the filter chip (130) is used for determining the authenticity of the filter (110) and the life span of the filter (100). The information shall be the accumulated volume of water being filtered or the number of litres of water being filtered and the number of days of use of the filter (110); these data are being used to determine the life span of the filter (110). An App (300) (shown in Fig. 3) is used to notify the user whether or not a new filter replacement is
 15 required by using the accumulated capacity of the filtered water and the number of days of the usage of the filter (110).

The main PCB unit (200) functions to check whether the filter (110) for the water purifier is genuine when an operation event occurs by at least one of filter replacement. In accordance
 20 with the present invention, the PCB unit (200) can include a microprocessor (145) which functions in authenticity of the filter (110).

Referring again to the flowchart depicted in FIG.1, when the power on located on the water purifier (610) is turned on, the microprocessor within the PCB unit (200) functions to check the
 25 filter (110) with respect to chip value of the filter chip (130). If the chip value of the filter is correct, the microprocessors (131, 145) will proceed to check the usage data of the filter (110), such as the capacity of the filtered water and the number of days of using the filter (110). The checking process repeats in every 5 seconds. The filter value will be updated when the capacity or day changes. On the filter (110), a filter LED color will be changed based on a
 30 specific capacity or day. If the chip value of the filter chip (130) is checked and found false, a fault notification will be triggered and the filter (110) will stop its operation. The filter chip (130) stores usage data including number of days of the usage of the filter (110) and the number of litres of water being filtered.

FIG. 3 is a block diagram of an assembly for authenticating a water purifier filter (110) or filter lifespan checking using a filter chip (130) according to an exemplary embodiment of the
 35 present invention.

As shown in FIG. 3, the water purifier filter authenticating system according to an exemplary embodiment of the present invention includes a filter chip (130) with a first microprocessor (131), a memory (140) mounted onto the filter (110), a main PCB unit (200) containing a temporary memory (142), a flow meter (144), a second microprocessor (145), and a lifespan counter (146), and a power unit (190) linked with the main PCB unit (200). An alert unit (230), a speaker (250) and a display (270) are linked with the PCB unit (200) of the water purifier (610). The authenticating system is further provided with a wifiapp (300) which is used for immediate message communication with the user. The power unit (190) may be a power supply of which the current supply can be cut off by a control signal of the main PCB unit (200).

The filter chip (130) communicates with the main PCB unit (200) to obtain filter information of the filter (110). The main PCB unit (200) controls the overall operation of the water purifier (610) and provides communication signal among the filter chip (130), the temporary memory (142), the flow meter (144), and the lifespan counter (146), and the power unit (190) is used to activate the communication of the main PCB unit (200) and the chip (110). The alert unit (230) will send out a warning sound through the speaker (250) or outputs warning information or warning guide message through the display unit (270) and a message by WIFIAPPS (300) on the results of the authenticating of the filter (110).

The main PCB unit (200) controls the operation of any one of the normal operation of the water purifier (610). The main PCB unit (130), based on a comparison of the filter information acquired by the temporary memory (142) and the filter information stored in the memory (140) of the filter chip (130), provides instructions of the subsequent process of the filter lifespan and authenticating of the filter. The memory (140) stores the required filter information for operating normal function of the filter according to an embodiment of the present invention, and the filter information may be stored in binary numbers. The condition for the controlling of the operation of the water purifier is based on whether the filter (110) is genuine or fake. The genuineness of the filter (110) is based on the obtained filter information.

The alert unit (230) outputs a control signal for generating a warning set according to the non-genuine of the filter (110) under the control of the main PCB unit (200). The alert unit (230) outputs a warning sound through the speaker (250) or outputs warning information or warning guide message through the display unit (270). The display unit (270) displays information of an operation state of the water purifier (610), and displays warning information.

FIG. 4 is a flowchart illustrating an operation of checking lifespan of a water purifier filter according to an exemplary embodiment of the present invention. The method of authenticating a water purifier filter and of checking lifespan of the filter is explained hereinafter.

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In a first step (310) of the method of authenticating or checking of lifespan of the filter (110), it is the acquiring of filter information of the filter (110) when the verification of the filter (110) is requested. After the step of filter information verification, the next step shall be the determination of the genuineness of the filter step (320). At this step (330), it is to determine whether the filter (110) is genuine by employing the filter information in the filter memory (140) and the temporary memory (142). In the determination or checking step (330), if it is determined that the filter (110) is genuine, a third step (370) for controlling the normal operation of the water purifier is then proceeded; and if the filter (110) is fake or nongenuine, an operation restriction step (390) is introduced to the filter (110). After the authenticity step of (330) and if the filter (100) is found to be genuine, the filter lifespan is carried out, which is indicated as step (350). If the filter (100) is found non genuine product, then a beeping sound and a LED flashing alarm (380) is triggered, which is then proceeded to the operation restriction (390) step. In other words, the genuine authentication method of the water purifier filter using the filter chip (130) includes the fourth step (390) of limiting the operation of the water purifier when the filter (110) is determined to be non-genuine.

The fifth step is to be performed to check the lifespan of the filter (110) and to proceed with a replacement of the filter (110), and when the replacement time of the filter (110) is checked, the replacement time is determined by integrating the filter use flow rate and volume of the filtered water recorded/stored in the filter chip (130). In the preferred embodiment, in the fifth step (350) if the number of days of use of the filter is more than 44 days or the number of litres is 431 litres remaining, the filter (110) proceeds to normal operation as indicated as reference (370). If the number of days of use is less than 43 days or the number of litres is 430 litres remaining, the filter progressive alarm (360) within a filter progressive system will be triggered. If the filter progressive alarm (360) is triggered, an operation with a filter alarm reminder and an App reminder is sent to the user, as indicated by numeral (372). If the filter progressive alarm (360) is not triggered, then App reminder (382) is triggered, to cause a beeping and a LED flashing alarm indicated by step referenced 380, which in turn, triggers Operation Restriction referenced as numeral 390. In other words, once the filter progressive alarm (360) is triggered, the App reminder (360) is activated to pro-actively inform the user on the filter lifespan which is running due soon. the App reminder (382) is working hand in hand with the

filter progressive alarm (360) and is not functioned as a secondary back-up in the event the filter progressive alarm (360) is not being triggered.

5 The lifespan checking at the step referenced 350 will determine the filter (110) be used as normal operation (370) or be alerted to an operation restriction referenced as 390. At operation restriction (390), the filter (110) be either replaced by a new one or the filter (110) is stopped in operation.

10 Although the present invention has been described with reference to the preferred embodiment, the present invention is not necessarily limited to the preferred embodiment, and various modifications can be made without departing from the present invention. Therefore, the embodiment disclosed in the present invention is not intended to limit the scope of the present invention. The protection scope of the present invention should be interpreted by the claims, and all technical ideas within the scope equivalent thereto should be construed as
15 being included in the scope of the present invention.

CLAIMS

1. In a water purifier filter (110) for authenticating and for determining lifespan of the filter (110), the filter (110) being positioned within a water purifier (210), comprising a filter chip (130) inserted into a slot provided on the filter (110), characterized in that the filter (110) includes the filter chip (130) having a memory (140) containing information of the filter (110); a main PCB unit (200) including a temporary memory (142), a flow meter (144) or a pump or valve working time times flow rate, to determine the number of litres, and a lifespan counter (146), and a power supply unit (190), wherein the filter chip (130) stores information of the corresponding filter (110) with respect to usage data including number of days of using the filter (110), and the number of litres being filtered by the filter (110) for determining authenticity of the filter (110), the temporary memory (142) containing information of the filter (142) after the filter (110) is activated, communication with the filter chip (130) is by accessing the filter usage data in the memory (140) of the filter chip and use the detected filter information to verify the authenticity of the filter (110), and by comparing the filter information usage in the temporary memory of the main PCB unit (200), result of the authenticating is notified to the user via a wifiapp (300) together with beeping sound via a speaker (250) or on a LED display (270) for the user to replace with a new filter based on filter usage data, and the power supply unit (190) is used to activate the operation of the main PCB unit (200) to trigger the operation of the filter (110) of the water purifier (210).
2. The method according to claim 1, characterized in that the main PCB unit (200) communicates with the filter chip (130) to access to the usage data stored in the filter chip (130) so as to authenticating the filter (110).
3. The method according to claim 1, characterized in that the main PCB unit (200) is used for checking the authentication of the filter (110) when the filter (110) is in operation.
4. The method according to claim 1, characterized in that the filter chip (130) includes a microprocessor (131).
5. The method according to claim 1, characterized in that the filter information on the filter chip (130) is in the form binary numbers.
6. The method according to any one of claims 1 to 5, characterized in that the power supply unit (190) is able to block power supplying to the water purifier (110) so as to stop the function of the filter (110) if the filter (110) is found not genuine or a fake filter.

7. The method according to claim 1, characterized in that the alert alarm (230) for processing a warning signal output according to the non-genuine of the filter (110) under the control of the main PCB unit (200).

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8. The method according to claim 7, wherein the alert alarm (230), under the control of the main PCB unit (200), outputs a sound the speaker (250), and warning information via the display (270), and/or a reminding message via a wifiApp.

10 9. In a method of authenticating a filter (110) of a water purifier (610), characterized in that the method comprises a first step of acquiring filter information of the filter (110); determining whether the filter (110) is genuine using the filter information; and proceeding the filter (110) to a normal operation of the water purifier when the filter (110) is determined to be genuine.

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10. The method of authenticating a filter (110) of a water purifier (610) as set forth in claim 9, characterized in that when the filter (110) is detected to be genuine, the lifespan of the filter (110) is then checked.

20 11. The method of authenticating a filter (110) of a water purifier (610) as set forth in claim 9, characterized in that determining whether the filter (110) is genuine by comparing obtained filter information with prestored filter information, if the filter information are matched, the water purifier (610) is proceeded to normal operation.

25 12. The method of authenticating a filter (110) of a water purifier (610) as set forth in claim 9, characterized in that performing the checking of number of days and number of litres of the filter (110) so as to access the time to proceed with the replacement of a new filter (100).

13. The method of authenticating a filter (110) of a water purifier (610) as set forth in claim 30 9, characterized in that a notification of the replacement time via the alert alarm (230) is being sent to the user.

14. The method of authenticating a filter (110) of a water purifier (610) as set forth in claim 35 9, characterized in that a step (390) of limiting the operation of the water purifier (610) is activated when the filter (110) is determined to be non-genuine or fake.

15. The method as set forth in claim 1, characterized in that a filter progressive alarm system with a filter progressive alarm is employed in by a user to establish a 3-way interactive communication among the filter (110), the water purifier unit (610) and the user of the water purifier (610).

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16. The method of authenticating a filter (110) of a water purifier (610) as set forth in claim 9, characterized in that a filter progressive alarm system with a filter progressive alarm (360) is employed in by a user to establish a 3-way interactive communication among the filter (110), the water purifier unit (610) and the user of the water purifier (610).

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17. The method of authenticating a filter (110) of a water purifier (610) as set forth in claim 9 or 16, characterized in that if the filter progressive alarm (360) is not triggered, then App reminder (382) is triggered to cause a beeping and a LED flashing alarm (380), which in turn, triggers Operation Restriction (390).

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18. The method of authenticating a filter (110) of a water purifier (610) as set forth in claim 9 or 16, characterized in that if the filter progressive alarm (360) is triggered, the App reminder (382) is activated to pro-actively inform the user about the filter lifespan running due soon.

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