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(54) **A WASHING MACHINE HAVING AN IMPROVED NANOFILTRATION SYSTEM AND METHOD THEREOF**

WASCHMASCHINE MIT EINEM VERBESSERTEN NANOFILTRATIONSSYSTEM UND VERFAHREN DAFÜR

MACHINE À LAVER À SYSTÈME DE NANOFILTRATION AMÉLIORÉ ET PROCÉDÉ ASSOCIÉ

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Description

[0001] The present invention pertains to a washing machine having an improved nanofiltration system and method of nanofiltration for a washing machine.

[0002] Washing processes are known for their effectiveness to be heavily dependent on the quality characteristics of the water used for washing; in particular, the hardness of the water, ie. the concentration of calcium and magnesium ions contained therein, leads to a couple of drawbacks. The presence of said calcium and magnesium ions in the wash water inhibits the action of surfactant substances contained in the detergents. In practice, considering all other conditions similar, the harder the water, the larger the amount of detergent that needs to be added into it so as to ensure an equally acceptable washing results.

[0003] A nanofiltration system typically softens water to be processed in the washing machine. Such systems being commercially available in the form of special membranes, they substantially contribute to the washing results mentioned above.

[0004] A prominent prior art reference in the field of the present invention may be referred to as WO 2011/076720, disclosing a washing machine having a suds container. A washing drum, a water inlet system and a suds discharge system having a suds pump, a program control, a desalination device for generating desalinated water, and a rinse water store are provided. The washing machine comprises a soft water tank connected to the water inlet system by means of the desalination device.

[0005] The present invention, on the other hand, provides a nanofiltration system according to which nanofiltration process is repeated in cycles such that the system always store softened water and is hence able to supply softened water more efficeintly.

[0006] The present invention provides an improved nanofiltration method and system as defined in the characterizing portion of Claim 1.

[0007] Primary object of the present invention is to realize a washing machine having an improved nanofiltration system and method thereof that is a more efficient filtration is obtained.

[0008] The present invention proposes a washing machine comprising a water tank receiving water from a public network. A pump is installed to circulate water between the water tank and a tub in which laundry is washed. In between, a nanofiltration membrane is present to soften network water received from said water tank.

[0009] Therefore, water is being softened before feeding into the tub. Said nanofiltration membrane has two outlets, a first main feed line leading to said tub and a second feed-back line leading to said water tank. Therefore, water in said water tank is continuously treated and softened at least partially and at least part of the water present in said tank at any time is already circulated through said nanofiltration membrane. This provides a more efficient continuous processing.

[0010] Said water tank comprises a pressure sensor and a microcontroller monitors water level in said tank by said pressure sensor. This is used in determining amount of water present in said tank. Water is not taken any more into the tank when a certain flow rate is ensured for effluent water. Certain stages of a washing program may not necessitate driving said pump and accordingly pressure in said water tank may be sufficient for circulating water into said tub. This is overseen by said microcontroller.

[0011] Said water tank comprises a first temperature sensor and said main feed line comprises a second temperature sensor. Said microcontroller accordingly monitors temperature change by means of said temperature sensors and water in said water tank is accordingly heated until a certain temperature is reached in said main feed line.

[0012] Said water tank comprises a first conductivity sensor and said main feed line comprises a second conductivity sensor. Said microcontroller monitors conductivity change by means of said conductivity sensors and informs when said nanofiltration membrane is underperforming. This is crucial as such membranes requires regular cleaning and regeneration.

[0013] Accompanying drawing is given solely for the purpose of exemplifying a nanofiltration system and method whose advantages were outlined above and will be explained hereinafter in brief.

[0014] The drawings are not meant to delimit the scope of protection as identified in the claims nor should they be referred to alone in an effort to interpret the scope identified in said claims without recourse to the technical disclosure in the description of the present invention.

[0015] Fig. 1 demonstrates a principle diagram of a nanofiltration system according to the present invention.

[0016] Referring now to the figure outlined above, the present invention proposes a nanofiltration system and method for a washing machine as defined in Claim 1.

[0017] The following numerals are assigned to different parts demonstrated in the drawings:

1. Water tank
2. Pump
3. Nanofiltration membrane
4. Tub
5. Main feed line
6. Feed-back line

[0018] The present invention proposes a washing machine comprising a water tank (1) for receiving water from a public network and a pump (2) that is circulating water from said water tank to a tub (5), in which laundry is treated. Water circulation typically provides that water from said water tank (1) is circulated through a nanofiltration membrane (3) and fed into said tub (4) where washing process is carried out.

[0019] Said nanofiltration membrane (3) which softens public network water stored in said water tank (1) before feeding into said tub (4) is associated with two separate lines (5, 6).

[0020] Said nanofiltration membrane (3) comprises a first main feed line (5) through which water is fed into said tub (4) and a second feed-back line (6) through which water is returned back to said water tank (1). This has the effect that water present in said water tank is at any time at least partially treated by said nanofiltration membrane (3) such that a more efficient continuous processing is obtained when said pump (2) is operated to circulate water from said water tank (1) to said nanofiltration membrane (3).

[0021] Said water tank (1) comprises a pressure sensor (P) such that a microcontroller monitors water level in said tank (1) and determines amount of water to be received therein for obtaining a certain flow rate value for effluent water. Therefore, as it is important that a certain flow rate should be ensured for continuous processing, pump drive power can be saved during certain stages in a washing program, depending on the flow rate and amount of water. Hydrostatic pressure level sensors, being readily available in the market, are submersible or externally mounted pressure sensors suitable for measuring the level of liquids in deep tanks or water in reservoirs.

[0022] Said water tank (1) comprises a first temperature sensor (T) and said main feed line (5) comprises a second temperature sensor (T) such that a microcontroller monitors temperature change by means of said temperature sensors (T) and heats water in said water tank (1) until a certain temperature value is read by said second temperature sensor (T). Therefore according to the correlation between two sets of values, said microcontroller can determine in a more accurate manner the required temperature in said water tank (1) to obtain a desired washing temperature in said main feed line (5).

[0023] Said water tank (1) comprises a first conductivity sensor (C) and said main feed line (5) comprises a second conductivity sensor (C) such that a microcontroller monitors conductivity change by means of said conductivity sensors (C) and evaluates operational performance of said nanofiltration membrane (3). This is important as ion holding capacity of said nanofiltration membrane (3) must regularly be controlled. In case a predefined value of conductivity cannot be provided by said nanofiltration membrane (3), then an appropriate error code can be produced by said microcontroller and maintenance service can be performed.

[0024] Conductivity sensors, which are also commercially available, simply measure how well a solution conducts a current. The more ions present in the solution, the higher the conductivity.

[0025] In different embodiments of the present invention, temperature sensors (T) and conductivity sensors (C) are placed into the tub (4).

[0026] The present invention proposes a method for treating washing water of a washing machine comprising the steps of (a) storing water in a water tank (1), (b) circulating water through a nanofiltration membrane (3), (c) circulating part of water by a main feed line (5) into a washing tub (4) of said washing machine and (d) circulating part of water circulated through said nanofiltration membrane (3) back to said water tank (1) by a feed-back line (6).

[0027] Said step of circulating water through said nanofiltration membrane (3) is selectively carried out by a pump (2). Said step of circulating water through said nanofiltration membrane (3) further comprises the steps of measuring pressure in said water tank (1) and selectively operating said pump (2) based on measured pressure value in said water tank (1).

[0028] Said method for treating washing water of a washing machine further comprises the step of comparing temperature in said water tank (1) with temperature in said main feed line (5) and heating water in said main tank (1) until a certain temperature in said main feed line (5) is achieved.

Claims

1. A washing machine comprising a water tank (1) for receiving water from a public network, a pump (2) circulating water from said water tank to a tub (4) in which laundry is treated, a nanofiltration membrane (3) for softening public network water stored in said water tank (1) before feeding into said tub (4) **characterized in that** said nanofiltration membrane (3) comprises a first main feed line (5) through which water is fed into said tub (4) and a second feed-back line (6) through which water is returned to said water tank (1) whereby water in said water tank (1) is at least partially treated by said nanofiltration membrane (3) such that a more efficient continuous processing is obtained.

2. A washing machine as set forth in Claim 1 wherein said water tank (1) comprises a pressure sensor (P) such that a microcontroller monitors water level in said tank (1) and determines amount of water to be received therein for obtaining a certain flow rate value for effluent water.

3. A washing machine as set forth in Claim 1 or 2 wherein said water tank (1) comprises a first temperature sensor (T) and said main feed line (5) comprises a second temperature sensor (T) such that a microcontroller monitors temperature change by means of said temperature sensors (T) and heats water in said water tank (1) until a certain temperature value is read by said second temperature sensor (T).

4. A washing machine as set forth in Claim 1, 2 or 3 wherein said water tank (1) comprises a first con-

ductivity sensor (C) and said main feed line (5) comprises a second conductivity sensor (C) such that a microcontroller monitors conductivity change by means of said conductivity sensors (C) and evaluates operational performance of said nanofiltration membrane (3).

5. Method for treating washing water of a washing machine comprising the steps of (a) storing water in a water tank (1), (b) circulating water through a nanofiltration membrane (3), (c) circulating part of water by a main feed line (5) into a washing tub (4) of said washing machine and (d) circulating part of water circulated through said nanofiltration membrane (3) back to said water tank (1) by a feed-back line (6).

6. Method for treating washing water of a washing machine as set forth in Claim 5 wherein said step of circulating water through said nanofiltration membrane (3) is selectively carried out by a pump (2).

7. Method for treating washing water of a washing machine as set forth in Claim 6 wherein said step of circulating water through said nanofiltration membrane (3) further comprises the steps of measuring pressure in said water tank (1) and selectively operating said pump (2) based on measured pressure value in said water tank (1).

8. Method for treating washing water of a washing machine as set forth in Claim 5 wherein said method further comprises the step of comparing temperature in said water tank (1) with temperature in said main feed line (5) and heating water in said main tank (1) until a certain temperature in said main feed line (5) is achieved.

Patentansprüche

1. Waschmaschine, umfassend einen Wassertank (1) zum Aufnehmen von Wasser von einem öffentlichen Versorgungsnetz, eine Pumpe (2), die Wasser aus dem Wassertank an einen Waschbehälter (4) zirkulieren lässt, in dem Wäsche behandelt wird, eine Nanofiltrierungsmembran (3) zum Erweichen des Wassers des öffentlichen Versorgungsnetzes, das im Wassertank (1) gelagert wird, bevor es dem Waschbehälter (4) zugeleitet wird, **dadurch gekennzeichnet, dass** die Nanofiltrierungsmembran (3) eine erste Hauptzuführleitung (5), durch die Wasser in den Waschbehälter (4) geleitet wird, und eine zweite Rückführleitung (6), durch die an den Wassertank (1) zurückgeleitet wird, umfasst, wobei Wasser in dem Wassertank (1) wenigstens teilweise von der Nanofiltrierungsmembran (3) behandelt wird, derart, dass eine effizientere kontinuierliche Verarbeitung erzielt wird.

2. Waschmaschine nach Anspruch 1, wobei der Wassertank (1) einen Drucksensor (P) umfasst, derart, dass ein Mikrocontroller den Wasserpegel in dem Tank (1) überwacht und die Menge an darin aufzunehmendem Wasser bestimmt, um einen bestimmten Durchflusswert für das ausfließende Wasser zu erreichen.

3. Waschmaschine nach Anspruch 1 oder 2 wobei der Wassertank (1) einen ersten Temperatursensor (T) umfasst und die Hauptzuführleitung (5) einen zweiten Temperatursensor (T) umfasst, derart, dass ein Mikrocontroller eine Temperaturänderung mithilfe der Temperatursensoren (T) überwacht und Wasser in dem Wassertank (1) erwärmt, bis der zweite Temperatursensor (T) eine bestimmte Temperatur misst.

4. Waschmaschine nach Anspruch 1, 2 oder 3 wobei der Wassertank (1) einen ersten Leitfähigkeitssensor (C) umfasst und die Hauptzuführleitung (5) einen zweiten Leitfähigkeitssensor (C) umfasst, derart, dass ein Mikrocontroller eine Leitfähigkeitsänderung mithilfe der Leitfähigkeitssensoren (C) überwacht und die Betriebsleistung der Nanofiltrierungsmembran (3) beurteilt.

5. Verfahren zum Behandeln von Waschwasser einer Waschmaschine, folgende Schritte umfassend: (a) Speichern von Wasser in einem Wassertank (1), (b) Zirkulieren von Wasser durch eine Nanofiltrierungsmembran (3), (c) Zirkulieren eines Teils des Wassers über eine Hauptzuführleitung (5) in einen Waschbehälter (4) der Waschmaschine und (d) Zirkulieren eines Teils des Wassers, das durch die Nanofiltriemngsmembran (3) zirkuliert wird, zurück an den Wassertank (1) durch eine Rückführleitung (6).

6. Verfahren zum Behandeln von Waschwasser einer Waschmaschine nach Anspruch 5, wobei der Schritt des Zirkulierens des Wassers durch die Nanofiltrierungsmembran (3) selektiv von einer Pumpe (2) ausgeführt wird.

7. Verfahren zum Behandeln von Waschwasser einer Waschmaschine nach Anspruch 6, wobei der Schritt des Zirkulierens des Wassers durch die Nanofiltrierungsmembran (3) ferner die Schritte des Messens von Druck im Wassertank (1) und selektives Betreiben der Pumpe (2) auf Grundlage des gemessenen Drucks im Wassertank (1) umfasst.

8. Verfahren zum Behandeln von Waschwasser einer Waschmaschine nach Anspruch 5, wobei das Verfahren ferner den Schritt des Vergleichens der Temperatur im Wassertank (1) mit der Temperatur in der Hauptzuführleitung (5) und des Erwärmens des Wassers im Haupttank (1) umfasst, bis eine bestimmte Temperatur in der Hauptzuführleitung (5)

erreicht wird.

Revendications

1. Un lave-linge comprenant un réservoir d'eau (1) pour recevoir l'eau d'un réseau public, une pompe (2) qui faire circuler l'eau à partir dudit réservoir d'eau à la cuve (4) dans laquelle le linge est traité, une membrane de nanofiltration (3) pour adoucir l'eau du réseau public stockée dans ledit réservoir d'eau (1) avant d'être alimentée dans ladite cuve (4) **caractérisé en ce que** ladite membrane de nanofiltration (3) comprend une première ligne d'alimentation principale (5) à travers laquelle l'eau est alimentée dans ladite cuve (4) et une deuxième ligne de retour (6) à travers laquelle l'eau est renvoyée audit réservoir d'eau (1), donc l'eau dans ledit réservoir d'eau (1) est traitée au moins partiellement par ladite membrane de nanofiltration (3) de telle sorte qu'un traitement continu plus efficace est obtenu.

2. Un lave-linge selon la Revendication 1, où ledit réservoir d'eau (1) comprend un capteur de pression (P) de telle sorte qu'un microcontrôleur surveille le niveau de l'eau dans ledit réservoir (1) et détermine la quantité d'eau à y être reçue pour obtenir une certaine valeur de débit pour l'eau effluente.

3. Un lave-linge selon la Revendication 1 ou 2, où ledit réservoir d'eau (1) comprend un premier capteur de température (T) et ladite ligne d'alimentation principale (5) comprend un deuxième capteur de température (T) de telle sorte qu'un microcontrôleur surveille le changement de température par l'intermédiaire desdits capteurs de température (T) et chauffe l'eau dans ledit réservoir d'eau (1) jusqu'à une certaine valeur de température est mesurée par ledit deuxième capteur de température (T).

4. Un lave-linge selon la Revendication 1, 2 ou 3 où ledit réservoir d'eau (1) comprend un premier capteur de conductivité (C) et ladite ligne d'alimentation principale (5) comprend un deuxième capteur de conductivité (C) de telle sorte qu'un microcontrôleur surveille le changement de conductivité par l'intermédiaire desdits capteurs de conductivité (C) et évalue la performance de fonctionnement de ladite membrane de nanofiltration (3).

5. Procédé pour traiter l'eau de lavage d'un lave-linge comprenant les étapes de (a) stocker l'eau dans un réservoir d'eau (1), (b) faire circuler l'eau à travers une membrane de nanofiltration (3), (c) faire circuler une partie de l'eau par une ligne d'alimentation principale (5) dans une cuve de lavage (4) dudit lave-linge et (d) retourner une partie de l'eau circulée à travers ladite membrane de nanofiltration (3) audit réservoir d'eau (1) par une ligne de retour (6).

6. Procédé pour traiter l'eau de lavage d'un lave-linge selon la Revendication 5 où ladite étape de faire circuler l'eau à travers ladite membrane de nanofiltration (3) est effectuée de manière sélective par une pompe (2).

7. Procédé pour traiter l'eau de lavage d'un lave-linge selon la Revendication 6 où ladite étape de faire circuler l'eau à travers ladite membrane de nanofiltration (3) comprend en outre les étapes de mesurer la pression dans ledit réservoir d'eau (1) et de faire fonctionner de manière sélective ladite pompe (2) en fonction de la valeur de pression mesurée dans ledit réservoir d'eau (1).

8. Procédé pour traiter l'eau de lavage d'un lave-linge selon la Revendication 5 où ledit procédé comprend en outre l'étape de comparer la température dans ledit réservoir d'eau (1) avec la température dans ladite ligne d'alimentation principale (5) et de chauffer l'eau dans ledit réservoir d'eau (1) jusqu'à ce qu'une certaine température dans ladite ligne d'alimentation principale (5) est atteinte.

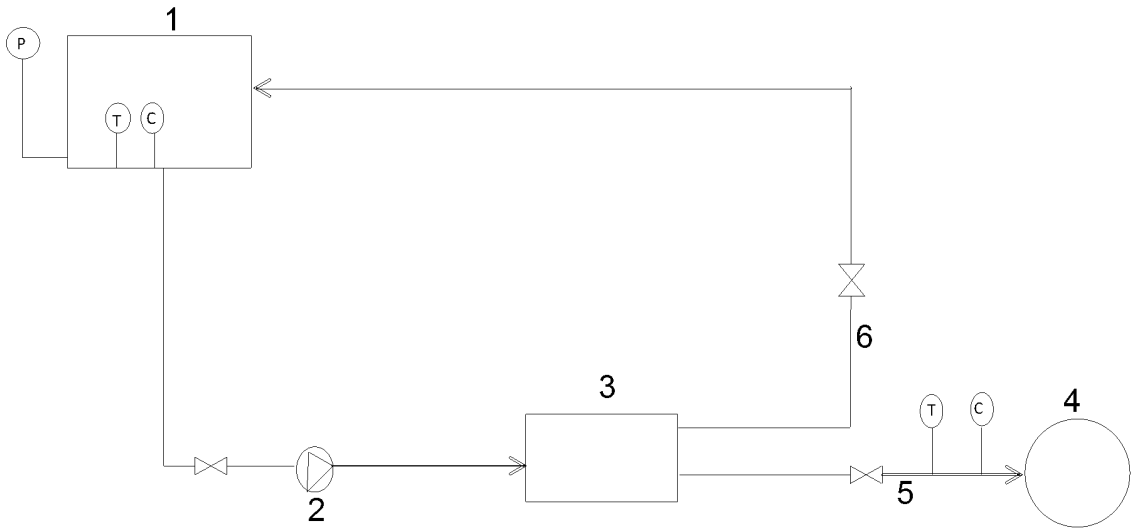

Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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