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(54) **Title**: A TABLET COMPOSITION FOR AN AUTOMATIC SHUT OFF MECHANISM

(57) **Abstract**: The present invention relates to a tablet composition for an automatic shut off mechanism for use in a water purification device and a process for preparing the tablet composition. The present inventors have developed a tablet composition for an automatic shut off mechanism with any type of water purification device having various means to provide microbiological purity. It has been found that the tablet composition provides for dissolution of the tablet after predetermined amount of water has passed through the purifier and can be manipulated to a range of 500 to 10000 litres and provides a flow rate of purified water from 50 to 300 ml/minute. It has been further found that the tablet composition of the present invention is non-corrosive and can be effectively used with any auto shut off mechanism including a magnetic auto shut off mechanism. Yet another advantage of the tablet composition of the present invention is that it provides as an end of life indicator for any consumable component used in the water purification device.



A TABLET COMPOSITION FOR AN AUTOMATIC SHUT OFF MECHANISM

Field of the invention

The present invention relates to a tablet composition for an automatic shut off
5 mechanism for use in a water purification device and a process for preparing the tablet composition.

Background of the invention

Many people live in countries where there is severe shortage of hygienic potable water.
10 These areas are generally small villages that do not have municipal drinking water treatment system. People in these areas depend on ground water sources like wells, ponds and rivers for fulfilling their daily water requirement. Often these ground water sources are contaminated by sewage, industrial effluents and agricultural by-products. Hence people need to treat the water themselves before consuming it. Generally the
15 household water purification device is a gravity fed unit.

Water purification device generally has a consumable component such as a filter or a microbial interception unit that requires replacement at regular intervals. The types of filter generally used in the water purification device are sediment filter, a micro-filter, activated carbon block and membrane filters. Filters have pores of known size which
20 traps and removes insoluble impurities, contaminants, microorganisms and odours from the water to be purified. Over repeated usage the trapped impurities forms sediment and the filter pores get saturated with the impurities, this makes the filter non-functional and thereby needs replacement. A microbial interception unit removes the microorganisms in water and may be a membrane or a biocide dosing unit. Microbial
25 interception unit also requires replacement at regular intervals. For example, when the biocide is exhausted in a biocide dosing unit, the unit needs replacement.

It is known to provide such water purification device having consumable components with an indicator which monitors the extent of utilization of the consumable component and also provides an indication as to when the consumable component should be

replaced. A variety of indicators is known in the art and these indicators may be a visual indicator, a timer device or a counting device.

WO05095284A1 (2005, Unilever) discloses various configurations of an end of life indicator for a biocide. The present inventors during extensive trials with such devices
5 in rural and far flung areas have found that consumers, many of whom are illiterate, continue to use the water purification device for their drinking water needs even after the end of life indicator indicates that the biocide has been consumed. This is potentially dangerous as the consumers are under the false impression that the water they are consuming is safe and reliable. Hence there was a need for an automatic
10 mechanism that ensures that the water does not flow once the biocide is consumed. This application discloses an end of life indicator having a magnetic automatic shut off mechanism.

EP1870381B1 (2009, Unilever) discloses a biocide cartridge for use in a water purification device having a simple and effective automatic water flow shutoff
15 mechanism which stops the flow of water when the biocide is consumed and overcomes the defects of the magnetic shutoff mechanism where there is a possibility of the biocide reacting with the magnetic material and interfering with the shutoff mechanism.

WO11013142 (Tata Chemicals Limited) discloses an auto shut off device for liquids
20 comprising of at least one liquid inlet, at least one liquid outlet, a casing that defines an opening, and a stopper shaped to close the opening comprising of a top, bottom and side surfaces. The stopper further defines a liquid inlet aperture on the top surface, a liquid outlet aperture on the top surface; a connecting passage connecting the liquid inlet aperture to the liquid outlet aperture, a liquid inlet passage connecting the liquid
25 inlet to the liquid inlet aperture, and a liquid outlet passage connecting the liquid outlet aperture to the liquid outlet. A water dissolvable tablet and a plunger are placed within the casing the plunger including a plug configured to block the liquid inlet aperture.

WO2011067792 A2 (Tata Chemicals Limited) discloses a gravity fed water purifier
30 having an end of life chamber containing a water soluble tablet and a plunger with a plug configured to close an inlet or an outlet of the chamber when the water soluble

tablet is dissolved after a predetermined amount of water passes. This discloses only a few compounds such as calcium sulphate, calcium oxide or magnesium oxide that may be used but does not disclose any specific composition or ranges that would determine controlled solubility to provide appropriate end of life indication at varying flow rates.

- 5 There is also a mention that the composition may contain 100% calcium sulphate mixed with water and compacted to form a tablet which may be used for the purpose, it is further mentioned that two such tablet having 10gm of calcium sulphate are completely dissolved in approximately 3000 litres of continuous or discontinuous flow of water. It is now found that calcium sulphate has high solubility in water is not useful
10 when one has to design an auto shut off mechanism for water flow from 500 to 10000 litres.

- The known end of life indicators includes a tablet composition having a water soluble material or a water soluble biocide. Tablet composition having water soluble biocide provides for indicating whether the biocide has been consumed and provide for an
15 effective automatic water flow shutoff mechanism which stops the flow of water when the biocide is consumed. Tablet composition having a water soluble material other than biocide provides for automatic water flow shutoff mechanism when the water soluble material is consumed.

- It has been found by the present inventors that the tablet composition having any water
20 soluble material may not provide for controlled dissolution of the tablet at varying flow rates and that a selective ratio of a mixture of ingredients is essential to provide an effective end of life indication and to design an auto shut off mechanism.

- It is thus an object of the present invention to provide a tablet composition in an automatic shut off mechanism for use in a water purification device for drinking water
25 purposes having various means to take care of the microbiological purity.

It is another object of the present invention to provide for a tablet composition for an automatic shut off mechanism for use in a water purification device which stops the flow after predetermined amount of water has passed through the device the amount of water ranging from 500 to 10000 litres.

It is yet another object of the invention to provide for a tablet composition for an automatic shut off mechanism for use in even water purification devices that do not require any external energy.

5 The present inventors have developed a tablet composition for an automatic shut off mechanism with any type of water purification device having various means to provide microbiological purity. It has been found that the tablet composition provides for dissolution of the tablet after predetermined amount of water has passed through the purifier and can be manipulated to a range of 500 to 10000 litres and provides a flow rate of purified water from 50 to 300 ml/minute. It has been further found that the tablet
10 composition of the present invention is non-corrosive and can be effectively used with any auto shut off mechanism including a magnetic auto shut off mechanism. Yet another advantage of the tablet composition of the present invention is that it provides as an end of life indicator for any consumable component used in the water purification device.

15

Summary of the invention

Thus according to a first aspect of the present invention there is provided a tablet composition for use in an automatic shut off mechanism for a water purification device comprising:

- 20 (i) calcium carbonate;
(ii) magnesium carbonate;
(iii) 23 to 50 wt% calcium sulphate;
(iv) 0.5 to 8 wt% binding agent;

wherein the ratio of the total amount of calcium carbonate and magnesium carbonate
25 to that of calcium sulphate is 0.9:1 to 3:1 and wherein 0.9 to 18 wt% of the composition is magnesium carbonate.

According to a second aspect of the present invention there is provided a process for manufacturing the tablet composition according to the first aspect comprising the steps of:

- 30 (i) blending calcium carbonate, magnesium carbonate and calcium sulphate;
(ii) granulating the blend obtained in step 1;

- (iii) mixing the binding agent to the blend before or during granulation;
- (iv) obtaining granules of particle size from 200 micrometers to 1180 micrometers; and,
- (v) compressing the granules at a force of 2 to 15 tons to obtain the tablet.

5 According to a third aspect of the present invention there is provided an automatic shut off mechanism including a cartridge comprising:

- (i) an inlet for feed water and an outlet for water exiting the cartridge;
- (ii) a container in fluid communication with said inlet containing the tablet composition of the first aspect resting on a base having atleast one port for
10 passage of water and a movable support stacked on said tablet composition; and,
- (iii) an arm attached to said movable support at its proximal end and having a plug means at its distal end,

such that as the tablet is dissolved, the movable support moves towards the base and
15 the plug means plugs said outlet or inlet thereby shutting off the flow of water.

The features and advantages of the invention will become apparent to those of ordinary skill in the art from a reading of the following detailed description and the appended claims. For the avoidance of doubt, any feature of one aspect of the present invention may be utilised in any other aspect of the invention. The word "comprising" is intended
20 to mean "including" but not necessarily "consisting of" or "composed of." In other words, the listed steps or options need not be exhaustive. It is noted that the examples, embodiment and figures given in the description below are intended to clarify the invention and are not intended to limit the invention to those examples per se.

25 Detailed description of the invention

According to the first aspect of the invention disclosed is a tablet composition having calcium carbonate, magnesium carbonate, calcium sulphate and binding agent.

Tablet composition

Disclosed tablet composition includes calcium carbonate, 0.9 wt% to 18 wt%
30 magnesium carbonate, 23 to 50 wt% calcium sulphate and 0.5 to 8 wt% binding agent.

The weight ratio of the total amount of calcium and magnesium carbonate to that of the calcium sulphate is 0.9:1 to 3:1, more preferably the weight ratio is 1:1 to 2:1, further preferably 1.8:1 to 2:1 and most preferably 1.9:1 to 2:1.

Preferably the density of the tablet composition is from 1.75 to 2.5 grams/ cm³ more preferably from 1.8 to 2.0 grams/ cm³.

The rate of disintegration or dissolution of the tablet composition also known as the rate of leaching as determined by the formula

$$\text{Leaching rate} = \left(\frac{\text{initial weight of tablet (g)} - \text{final weight of tablet at end of life position (g)}}{\text{Volume of water filtered before end of life position (L)}} \right) \times 1000$$

is preferably 0.4 to 4 ppm more preferably from 1 to 3.5 ppm and most preferably from 2 to 3 ppm.

The tablets may be of any shape. Preferable cross-sections of the tablet are circular, square, rectangular, hexagon or oval. The leading cross sectional dimension may be from 1.2 cm to 2.0 cm, more preferably from 1.5 to 1.8 cm. The tablet preferably has a thickness in the range of 1.5 cm to 2.5 cm, more preferably 1.8 to 2.0 cm.

15 Calcium carbonate

Disclosed tablet composition includes calcium carbonate. Preferably the tablet includes 35 wt% to 75 wt% of calcium carbonate, more preferably 36 wt% to 73 wt%, still preferably from 45 wt% to 70 wt% and further preferably from 50 to 65 wt% of the tablet composition. Optimal tablet compositions have calcium carbonate from 55 wt% to 60 wt% of the tablet composition.

Calcium carbonate for use in the tablet composition is preferably of food grade. Preferred calcium carbonate includes precipitated, crystalline and/or amorphous calcium carbonate. Preferred calcium carbonate minerals includes but is not limited calcite (CaCO₃), aragonite (CaCO₃), vaterite (CaCO₃), ikaite (CaCO₃·6H₂O) and amorphous calcium carbonate (CaCO₃·nH₂O). Preferred commercially available calcium carbonate suitable for the present invention includes calcite (from Sudarshan Minechem Ltd., India and Nikunj Chemicals, India). The calcium carbonate is

preferably in the form of a fine powder having preferably a particle size of 20 to 100 micrometers more preferably from 25 to 75 micrometers.

Magnesium carbonate

Disclosed tablet composition includes 0.9 wt% to 18 wt% of magnesium carbonate, preferably the tablet composition includes 1 wt% to 15 wt%, more preferably from 1.5 wt% to 14 wt% and further preferably from 2 wt% to 12 wt% and still further preferably from 4 to 10 wt% of magnesium carbonate.

The magnesium carbonate is preferably be selected from precipitated, crystalline and/or amorphous magnesium carbonate. Magnesium carbonate minerals is preferably selected from but are not limited to dypingite ($\text{Mg}_5(\text{CO}_3)_4(\text{OH})_2 \cdot 5(\text{H}_2\text{O})$), magnesite (MgCO_3), barringtonite ($\text{MgCO}_3 \cdot 2\text{H}_2\text{O}$), nesquehonite ($\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$), lanfordite ($\text{MgCO}_3 \cdot 5\text{H}_2\text{O}$), and amorphous magnesium carbonate ($\text{MgCO}_3 \cdot n\text{H}_2\text{O}$). Preferred magnesium carbonate for use in the tablet composition according to the present invention is of food grade. Preferably the magnesium carbonate is in the form of a fine powder having a particle size from 20 to 100 micrometers and preferably 25 to 75 micrometers.

Calcium sulphate

Disclosed tablet composition includes 23 wt% to 50 wt% calcium sulphate. Preferably the tablet composition includes not less than 23.5 wt% calcium sulphate by weight of the tablet composition, still preferably not less than 24 wt%, further preferably not less than 25 wt% and still further preferably not less than 30 wt% of calcium sulphate. The tablet composition preferably includes not more than 49.5 wt%, still preferably not more than 45 wt% still preferably not more than 40 wt% and further preferably not more than 35 wt% of the tablet composition.

Calcium sulphate is preferably selected from precipitated, crystalline and/or amorphous calcium sulphate. Preferably the calcium sulphate is of a food grade material. Preferably the calcium sulphate is in the form of a fine powder having a particle size from 20 to 100 micrometers and preferably 25 to 75 micrometers.

Binding agent

Disclosed tablet composition includes 0.5 to 8 wt% binding agent, preferably from 0.5 to 7 wt%, more preferably from 1 to 5 wt% and still preferably from 2 to 5 wt% of the tablet composition.

5 Preferably the binding agent is of a food grade material. Preferred binding agents are selected from water soluble or water insoluble or inorganic or an organic and can be monomeric or polymeric in nature.

10 Examples of suitable water soluble binding agents includes starch, gum, gelatin, sucrose, lactose, acacia gum, polyvinylpyrrolidone (PVP), hydroxypropylmethylcellulose, hydroxyethylmethylcellulose, polyethyleneglycol, poly vinyl alcohol, sodium and potassium silicates.

Examples of suitable water insoluble binding agents include calcium phosphate, zinc stearate, magnesium stearate, aluminium stearate, calcium stearate or clay (kaolin, bentonite, aluminosilicates).

15 It is also preferred to use water as a binding agent in preparing the tablet composition of the present invention.

It is particularly preferred that the binding agent is selected from water, polyvinylpyrrolidone (PVP), hydroxypropylmethylcellulose or hydroxyethylmethylcellulose or mixtures thereof. It is highly preferred that the binding agent is selected from water, polyvinylpyrrolidone (PVP) or mixtures thereof.

20

Process for manufacturing the tablet composition

25 According to a second aspect of the present invention there is provided a process for manufacturing the tablet composition having the steps of (i) blending calcium carbonate, magnesium carbonate and calcium sulphate; (ii) granulating the blend of calcium carbonate, magnesium carbonate and calcium sulphate; (iii) mixing the binding agent to the blend before or during granulation; (iv) obtaining granules of particle size from 200 micrometers to 1180 micrometers; and, (v) compressing the granules at a force of 2 to 15 tons to obtain the tablet.

- Calcium carbonate, magnesium carbonate and calcium sulphate can be blended in any suitable blender but is preferably blended in a ribbon blender. The blend of calcium carbonate, magnesium carbonate and magnesium carbonate is then granulated. One skilled in the art would know what granulation means. Granulation of the blend of
- 5 calcium carbonate, calcium sulphate and magnesium carbonate is preferably by wet granulation, dry granulation, fluid bed granulation, agglomeration and spheronization. When wet granulation process is used it is preferred that after granulation the granules formed is dried at a temperature of 30 to 45 °C. Preferably the drying is carried in a fluidised bed drier.
- 10 Preferably the granules obtained from the granulation step provides for free-flowing granules having sufficient cohesive properties for compression into tablets. Preferably the granule has a compressibility index in the range of 2 to 8. The granules have a size in the range of 200 micrometers to 1180 micrometers and preferably in the range of 400 to 1000 micrometers. Preferably the moisture content of the granule is 4 to 10% by
- 15 weight of the granule more preferably from 4 to 8% by weight of the granule. Without wishing to be bound by theory it is believed that when granules having a moisture content below 4% are compressed they may form a tablet composition which is dry and develops crack and when the moisture content of the granule is above 10% the resulting tablets break at the edge and are difficult to be compacted to form a tablet
- 20 composition.

The granules are preferably compressed to form the tablet composition in a 15 tons rotary tablet machine. Preferably the granules are compressed to form the tablet with a force of 2 to 15 tons more preferably 5 to 10 tons.

Auto shut-off mechanism

- 25 According to a third aspect of the present invention there is provided an automatic shut off mechanism preferably having a cartridge with an inlet, an outlet and a container.

Cartridge:

- The cartridge preferably has an inlet for feed water, a container in fluid communication with said inlet having the tablet composition according to the present invention and an
- 30 outlet for water exiting the cartridge.

Container:

Preferably the container is in fluid communication with the inlet of the cartridge. The container preferably has a base with at least one port for passage of water. The water entering the port preferably contacts the lowermost tablet resting on the base of the container. Preferably the container includes at least one tablet according to the present invention. Preferably the container includes 2 to 4 tablets, more preferably 2 tablets.

When a plurality of tablet is present, they are configured such that they are stacked one on top of the other in the container.

Movable support:

10 Preferably the container has a movable support stacked on the uppermost tablet. The movable support may be a plate, a disc or a tablet shaped member, most preferably a tablet shaped member. The movable support is preferably made of a material which is inert. Alternately the movable support may be made of any material and coated with an inert material. The movable support is usually brightly coloured e.g. in red, blue or
15 green. The movable support preferably has an arm attached at its proximal end and provided with a plug means at its distal end. Preferably at the end-of-life position, the movable support has moved sufficiently low to cause the plug means to plug the water outlet or inlet, thereby shutting off the flow of water from the cartridge. The arm may be of any shape and size but it is preferably "L" shaped. The arm may be detachable from
20 the movable support but it is highly preferred that the arm is fixedly attached at its proximal end to the movable support.

It is preferred that the container has a fixed top end and preferably has a resilient member situated between the movable support and the fixed top end. The resilient member may be a spring or a bellows. The movable support resting on top of the
25 tablets descend by the force of gravity as the tablets are consumed. The resilient member provides additional force to ensure that the movable support descends as the tablets are consumed by urging against the movable support plate.

Water purification device

Preferably the auto shut-off mechanism having the tablet composition of the present invention is suitable for use in a gravity fed water purification device.

Preferably the gravity fed water purification device includes an inlet for feed water, a filtration unit, a microbial interception unit, a flow control means, a retention chamber, a scavenger means and the auto shut-off mechanism having the tablet composition of the present invention.

Preferably the water purification device includes a filtration unit. The filtration unit that is most generally used is a carbon block. Carbon blocks are generally made using powder activated carbon mixed with powdered polymeric binder and subjecting the mixture to high temperature and high pressure. Preferably the particle size of the powder activated carbon is such that not more than 5% of carbon particles pass through a sieve of 150 mesh (106 micrometers) and not more than 5% is retained on a sieve of 12 mesh (1700 micrometers). The powder activated carbon is preferably present in an amount in the range of 50 wt% to 95 wt% of the carbon block. The polymeric binder is generally present in 5 wt% to 50 wt% of the carbon block. The most preferred polymeric binders are those having Melt Flow Rate less than 5 grams/10 minutes, more preferably less than 2 grams/10 minutes, most preferably less than 1 gram/10 minutes. The melt-flow rate (MFR) is measured using ASTM D 1238 (ISO 1133) test. Suitable examples of polymeric binders include ultra high molecular weight polymer preferably polyethylene, polypropylene and combinations thereof, which have these low MFR values. The molecular weight is preferably in the range of 10^6 to 10^9 g/mole. Binders of this class are commercially available under the trade names HOSTALEN from Ticona GMBH, GUR, Sunfine (from Asahi, Japan), Hizex (from Mitsubishi) and from Brasken Corp (Brazil). Other suitable binders include LDPE sold as Lupolen (from Basel Polyolefins) and LLDPE from Qunos (Australia). The ratio of activated carbon to polymeric binder is preferably in the range of 1:1 to 20:1, more preferably in the range of 2:1 to 10:1 parts by weight. The filtration unit may be used along with other known filtration means such as sediment filter means preferably, a washable or replaceable sediment filter for removing fine dust and other micro-particulates. The sediment filter can be a non-woven fabric preferably a microporous fabric.

The filtration unit may preferably be in fluid communication with a microbial interception unit. The microbial interception unit may be any of the known means used in a water purification device for removing microorganisms from the water to be purified. The microbial interception unit may be a membrane or a biocide dosing unit. Particularly
5 preferred flow biocide dosing unit as per the invention is as described in WO2007144256 A1.

When a biocide is used as a microbial interception unit the water purification device may include a retention chamber, the retention chamber holds the water containing the biocide for a predetermined period of time that ensures adequate time for killing of
10 pathogenic microorganisms like bacteria and virus. It is preferable that the water is held for a time in the range 30 to 300 minutes and more preferably 60 to 180 minutes in the retention chamber. Any means to hold the water for this period of time in the water purification system may be used preferably the embodiments illustrated in WO04000732 A1.

15 The microbial interception unit is preferably in fluid communication with a flow control means that regulates the flow rate of water exiting the filtration unit. The flow regulation is preferably achieved using means that do not require input of external energy for example electrical energy. The flow control means may include flow throttling means like stopcocks, valves, venturies or baffles. Particularly preferred flow
20 control means as per the invention is that described in our application WO2004074182A1. The flow control means according to WO2004074182A1 includes a flow control reservoir of pre-selected dimensions adapted to discharge the required volume of water comprising at least one inlet means for entry of the water from the outlet of said filtration unit into the reservoir and at least one siphon discharge means
25 operatively connected to said flow control reservoir and adapted to control the flow rate of the water from said reservoir. The rate of flow of water as described in the above application can be regulated to a high degree by way of selective dimension of the control reservoir and selective embodiment of the siphon discharge means of a tubular member of pre-selected dimensions including diameter and shape preferably an
30 inverted tubular "U/ V" shaped member to facilitate the flow rate control. The use of this preferred aspect of the flow control means ensures excellent regulation of the flow rate of the water irrespective of the flow rate of water exiting the filtration unit.

The flow control means is preferably in fluid communication with an auto shut off mechanism having a tablet composition according to the present invention.

Preferably the gravity fed water purification device includes a scavenging means. The water exiting the retention chamber passes through a scavenging means before exiting the water purification system. The scavenger means preferably separates the dispensed biocide from water. The scavenger means is preferably bacteriostatic activated carbon. Although the water may flow through the scavenger means in the downward direction or in the upward direction, it is preferred that the water flows through the scavenger means in the upward direction. Various embodiments may be envisaged for such flow including the one described in WO04014803 A1.

The invention will now be explained in details with the help of non-limiting examples.

Examples

Evaluation of preferred and comparative tablet composition for providing an auto shut off mechanism

i. Process for preparing the tablets:

A batch of 5 kg was prepared. Known amounts of calcium carbonate (particle size 20 to 40 micrometers), magnesium carbonate (particle size 20 to 40 micrometers) and calcium sulphate (particle size 20 to 40 micrometers) were blended in a ribbon blender for 8 to 10 minutes. The blend was added to a granulator (GPCG3.0 from Glatt, Germany) and granulated by a wet granulation method. At the start of the wet granulation method the blend of calcium carbonate, magnesium carbonate and calcium sulphate was fluidised by introducing air at ambient temperature of around 25°C into the granulator. To the fluidised blend in the granulator a 5% aqueous solution of Polyvinylpyrrolidone (PVP) (PVPK 90 from BASF) as the binding agent was added at a flow rate of about 50ml/minute over a period of 30 minutes. The temperature of the air blown into the granulator was gradually raised from 45 to 50°C and the granules formed in the granulator were dried to a moisture content of 4%. The granules formed were removed and cooled. The granules were sieved through a 16 mesh ASTM sieve (1180 micrometers) and the granules that passed through the sieve were collected to

obtain the granules with the desired particle size of 200 micrometers to 1180 micrometers. The particle size distribution of the granules obtained was analysed with a 30 mesh ASTM (600 micrometers) sieve. 60% of the granules passed through the 30 mesh sieve (ASTM) and 40% of the granules were retained on the mesh. Around 5
5 grams of the granules having the desired particle size of 200 micrometers to 1180 micrometers were compressed with a force of 3 to 5 tons in a tableting machine (Stoke's SJ5RD4 from Advance Engg., USA) to form a tablet. The density of the tablet was 1.9+/- 0.1 grams/cm³.

The amounts of calcium carbonate, magnesium carbonate, calcium sulphate and
10 Polyvinylpyrrolidone (PVP) (PVPK 90 from BASF) and water as binding agent taken for preparing individual tablet compositions are provided in Table 1. In Table 1, tablet compositions A to I are comparative compositions and tablet compositions 1 to 8 are preferred compositions.

ii. Evaluation of the tablet in an auto shut-off mechanism:

15 A gravity fed water purification device provided with an auto shut off mechanism with a cartridge was used in the evaluation. The cartridge of the auto shut-off mechanism had a container, an inlet and an outlet. The container had a base with a port for passage of water and a top closed end. A 5 gram tablet composition prepared with a composition as provided in Table 1 was placed on the base of the container. On top of the tablet a
20 movable support in the shape of a tablet was placed. The movable support was provided with an arm. The proximal end of the arm was attached to the movable support and the distal end of the arm had a plug means for plugging the outlet of the cartridge when the tablet has dissolved substantially. A bellow was placed between the top closed end of the container and the movable support. The cartridge was placed in
25 the water purification device and the inlet of the cartridge was in fluid communication with a flow control means made of a siphon mechanism which maintained the flow rate of water entering the inlet of the cartridge in the range of 50 to 300 mL/minute. Water was passed through the water purification device which entered the inlet of the cartridge and came in contact with the bottom part of the tablet. A portion of the tablet
30 composition leached into water and then exited the cartridge through the outlet. The leaching rate of the tablet composition was determined using the formula:

$$\text{Leaching rate} = \left(\frac{\text{initial weight of tablet (g)} - \text{final weight of tablet at end of life position (g)}}{\text{Volume of water filtered before end of life position (L)}} \right) \times 1000$$

The leaching rate is provided in Table 1. The amount of water that was flown through the cartridge at the end of life position that is before the plug means plugged the outlet and shut the flow of water through the cartridge was also determined and is provided in

5 Table 1.

TABLE 1

Tablet composition (wt %)								
Example	CaCO ₃	MgCO ₃	CaSO ₄	PVP K90	Water	Carbonate: CaSO ₄	Leaching rate (in ppm)	volume of water purified (L)
A	29.92	7.48	56.10	2.5	4	0.67:1	0.096	40625
1	37.40	9.35	46.75	2.5	4	1:1	0.9	4111
2	48.62	12.16	32.73	2.5	4	1.86:1	1.2	3333
3	56.10	14.03	23.38	2.5	4	3:1	1.1	3259
B	59.84	14.96	18.70	2.5	4	4:1	0.33	11803
4	35.06	11.69	46.75	2.5	4	1:1	1.3	2777
5	52.59	17.53	23.38	2.5	4	3:1	0.4	9750
C	18.33	0.37	74.80	2.5	4	1:4	0.01	410000
D	36.65	0.75	56.10	2.5	4	0.67:1	0.28	12783
6	45.82	0.94	46.75	2.5	4	1:1	1.2	3083
7	59.56	1.22	32.73	2.5	4	1.86:1	2.5	1560
8	68.72	1.40	23.38	2.5	4	3:1	1.6	2312.5
E	73.30	1.50	18.70	2.5	4	4:1	9	389
F	46.75	0.00	46.75	2.5	4	1:1	12.2	327.3
G	60.78	0.00	32.73	2.5	4	1.86:1	12	325
H	70.13	0.00	23.38	2.5	4	3:1	15	267
I	0	0	93.5	2.5	4	-	38	100

In Table 1 the preferred tablet compositions (Example 1 to 8) leached uniformly to provide auto shut off after 500 to 10000 litres of water has flown through the tablet composition at a flow rate of water maintained between 50 to 300 ml/minute as compared to the comparative tablet composition (A to I) which did not provide the desired auto shut off mechanism. Comparative tablet composition E to I was found to be very soft and leached out completely after less than 500 litres of water was flown through the tablet composition and the comparative tablet composition A to D was found to be hard and did not leach out sufficiently and did not reach the end of life position after 10000 litres of water was purified through the water purification device.

It will be appreciated that the illustrated examples provide for a tablet composition which provides auto shut off mechanism with any type of water purification device having various means to take care of the microbiological purity. It will also be appreciated that the illustrated examples provide for a tablet composition which stops the flow of water in a water purification device after an amount of water ranging from 500 to 10000 litres has passed through the device. It will also be appreciated that the illustrated examples provide for a tablet composition for an automatic shut off mechanism that does not require any external energy like electrical energy to run the mechanism.

- 10 iii. Evaluation of the tablet compositions of the prior art in an auto shut-off mechanism

The composition of the tablets were as shown in Table 2. 5g tablets were prepared by using calcium sulphate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) or calcium oxide (CaO) or Magnesium oxide (MgO) or a combination of the same as base material along with PVPK30 as the binder. The process used was basically as described in the publication WO2011013142. The tablet was evaluated in a gravity fed water purification device provided with an auto shut off mechanism with a cartridge as described above.

20 Table 2

Example	Tablet composition (wt %)						Leaching rate (in ppm)	volume of water purified (L)
	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	CaO	MgO	PVPK30	Water	Ratio $\text{CaSO}_4 \cdot 2\text{H}_2\text{O} : \text{CaO}$		
J	49.25	49.25	-	1.5	4	1:1	0.25	15200
K	-	98.5	-	1.5	4	-	0.17	22350
L	-	-	98.5	1.5	4	-	0.21	18000
M	98.5	-	-	1.5	4	-	8.8	430

CaO or MgO alone or in combination with $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ are very hard and the leaching of the material when water is passed over it was very low. As the tablet did not leach out sufficiently and the system did not reach the end of life position until more than 15000 litres of water was purified through the water purification device. It is seen that when $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ was used alone the leaching rate was very high as the tablet was

very soft and leached out completely after 430 litres were passed. Since it is a single component tablet it will not be possible to change the formulation to design for higher volumes of water to be purified.

- 5 It should be understood that the specific forms of the invention herein illustrated and described are intended to be representative only as certain changes may be made therein without departing from the clear teachings of the disclosure.

Claims

1. A tablet composition for use in an automatic shut off mechanism for a water purification device comprising:
 - (i) calcium carbonate;
 - (ii) magnesium carbonate;
 - (iii) 23 to 50 wt% calcium sulphate;
 - (iv) 0.5 to 8 wt% binding agent;wherein the ratio of the total amount of calcium carbonate and magnesium carbonate to that of calcium sulphate is 0.9:1 to 3:1 and wherein 0.9 wt% to 18 wt% of the composition is magnesium carbonate.
2. A tablet composition as claimed in claim 1 wherein the particle size of said calcium carbonate is 20 to 100 micrometers.
3. A tablet composition as claimed in claim 1 or 2 wherein the particle size of said magnesium carbonate is 20 to 100 micrometers.
4. A tablet composition as claimed in claim 1 to 3 wherein the particle size of said calcium sulphate is 20 to 100 micrometers.
5. A tablet composition as claimed in any one of the preceding claims wherein the density of the tablet is 1.75 to 2.5 grams/cm³.
6. A tablet composition as claimed in claim 1 wherein the binding agent is a food grade material.
7. A tablet composition as claimed in claim 6 wherein the binding agent is selected from water, polyvinylpyrrolidone or hydroxypropylmethylcellulose or hydroxyethylmethylcellulose or mixtures thereof.
8. A tablet composition as claimed in any one of the preceding claims wherein the leaching rate of the tablet composition is 0.4 to 4 ppm.

9. A process for manufacturing the tablet composition according to any one of the preceding claims comprising the steps of:
- (i) blending calcium carbonate, magnesium carbonate and calcium sulphate;
 - (ii) granulating the blend obtained in step 1;
 - (iii) mixing the binding agent to the blend before or during granulation;
 - (iv) obtaining granules of particle size from 200 micrometers to 1180 micrometers; and,
 - (v) compressing the granules at a force of 2 to 15 tons to obtain the tablet.
10. A process as claimed in claim 9 wherein the force of compressing is 5 to 10 tons.
11. A process as claimed in claim 9 wherein the granules of step (ii) are dried to a moisture content of 4 to 10%.
12. An automatic shut-off mechanism comprising a cartridge comprising:
- (i) an inlet for feed water and an outlet for water exiting the cartridge;
 - (ii) a container in fluid communication with said inlet containing the tablet composition as claimed in claims 1 to 5 resting on a base having at least one port for passage of water and a movable support stacked on said tablet composition; and,
 - (iii) an arm attached to said movable support at its proximal end and having a plug means at its distal end,
- such that as the tablet is dissolved, the movable support moves towards the base and the plug means plugs said outlet or inlet thereby shutting off the flow of water.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/075370

A. CLASSIFICATION OF SUBJECT MATTER INV. C02F1/68 B01F1/00 C02F1/00 C04B18/02 ADD. C02F1/28 C02F1/44 C02F1/50 C02F9/00														
According to International Patent Classification (IPC) or to both national classification and IPC														
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) C02F B01F C04B														
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched														
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data														
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>WO 2011/067792 A2 (TATA CHEMICALS LTD [IN]; DAS GAUTAM [IN]; DEY AMRITA BIJANKUMAR [IN];) 9 June 2011 (2011-06-09) cited in the application pages 4-14 figures 7-8</td> <td>1-12</td> </tr> <tr> <td>X</td> <td>WO 2011/013142 A2 (TATA CHEMICALS LTD [IN]; TATA CONSULTANCY SERVICES LTD [IN]; AHMAD DIL) 3 February 2011 (2011-02-03) cited in the application claims 1,16-19 pages 4-12</td> <td>1-12</td> </tr> <tr> <td></td> <td style="text-align: center;">----- -/-</td> <td></td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	WO 2011/067792 A2 (TATA CHEMICALS LTD [IN]; DAS GAUTAM [IN]; DEY AMRITA BIJANKUMAR [IN];) 9 June 2011 (2011-06-09) cited in the application pages 4-14 figures 7-8	1-12	X	WO 2011/013142 A2 (TATA CHEMICALS LTD [IN]; TATA CONSULTANCY SERVICES LTD [IN]; AHMAD DIL) 3 February 2011 (2011-02-03) cited in the application claims 1,16-19 pages 4-12	1-12		----- -/-	
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X	WO 2011/067792 A2 (TATA CHEMICALS LTD [IN]; DAS GAUTAM [IN]; DEY AMRITA BIJANKUMAR [IN];) 9 June 2011 (2011-06-09) cited in the application pages 4-14 figures 7-8	1-12												
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.														
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family														
Date of the actual completion of the international search		Date of mailing of the international search report												
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Rozanska, Agnieszka												

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2013/093944 A2 (TATA CONSULTANCY SERVICES LTD [IN]) 27 June 2013 (2013-06-27) paragraphs [0016], [0017] - [0019], [0028] - [0029], [0034] - [0035], [0041] - [0045] -----	1-12
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A	JP S53 76982 A (TOKUOKA KOUGIYOU KK) 7 July 1978 (1978-07-07) the whole document -----	1-12
A	JP S53 76551 A (TOKUOKA KOUGIYOU KK) 7 July 1978 (1978-07-07) the whole document -----	1-12
A	WO 2010/137499 A1 (PANASONIC ELEC WORKS CO LTD [JP]; NISHIKAWA TOSHIKAZU [JP]; KODAMA MAK) 2 December 2010 (2010-12-02) the whole document -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/075370

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011067792	A2	09-06-2011	NONE
WO 2011013142	A2	03-02-2011	NONE
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