A LITRATURE REVIEW PAPER ON TRICYCLE POWERED WATER FILTRATION SYSTEM

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ABSTRACT

Treatment for drinking water production involves the removal of contaminants from raw water to produce water that is pure enough for human consumption without any short term or long term risk of any adverse health effect. This review paper focuses on the history of water filtration systems which were used for years in the historic period. Further studies can be carried out in the field of water filtration which may focus on removal of other foreign chemicals and impurities from water to make it drinkable and safe.

1.1 HISTORY OF WATER PURIFICATION

- **Aqueducts**

Fig 1 :- Ancient Roman Aqueducts

The Assyrians built the first structure that could carry water from one place to another in the 7th century BC. It was 10 meters high and 300 meters long, and carried the water 80 kilometers across a valley to Nineveh. Later, the Romans started building many of these structures. They named them aqueducts. In Latin, aqua means ‘water’, and ducere means ‘to lead’. Roman aqueducts were very sophisticated pieces of engineering that were powered entirely by gravity, and carried water over extremely large distances. They were applied specifically to supply water to the big cities and industrial areas of the Roman Empire. In the city of Rome alone more than 400 km of aqueduct were present, and it took over 500 years to complete all eleven of them. Most of the aqueducts were underground structures, to protect them in times of was and to prevent pollution. Together, they supplied Rome with over one million cubic meters of water on a daily basis. Today, aqueducts can still be found on some locations in France, Germany, Spain and Turkey. The United States have even taken up building aqueducts to supply the big cities with water again. Many of the techniques the Romans used in their aqueducts can be seen in modern-day sewers and water transport systems.

- **Archimedes screw**

Fig 2 :- Archemedes Screw

Archimedes was a Greek engineer that lived between 287 and 212 BC, and was responsible for many different inventions. One of his findings was a device to transport water from lower water bodies to higher land. He called this invention the water screw. It is a large screw inside a hollow pipe that pumps up water to higher land. Originally, it was applied to irrigate cropland and to lift water from mines and ship bilges. Today, this invention is still applied to transport water from lower to higher land or water bodies. In The Netherlands for example, such structures can be found in the city of Zoetermeer, in the west close to The Hague. The water screw formed the basis for many modern-day industrial pumps.

Eventually, starting **1914** drinking water standards were implemented for drinking water supplies in public traffic, based on coliform growth. It would take until the **1940s** before drinking water standards applied to municipal drinking water. In **1972**, the Clean Water Act was passed in the United States. In **1974** the Safe Drinking Water Act (SDWA) was formulated.

Starting in **1970**, public health concerns shifted from waterborne illnesses caused by disease-causing micro organisms, to anthropogenic water pollution such as pesticide residues and industrial sludge and organic chemicals. Regulation now focused on industrial waste and industrial water contamination, and water treatment plants were adapted. Techniques such as aeration, flocculation, and active carbon adsorption were applied. In the **1980s**, membrane development for reverse osmosis was added to the list.
Water treatment experimentation **today** mainly focuses on disinfection by-products. An example is trihalomethane (THM) formation from chlorine disinfection. These organics were linked to cancer. Lead also became a concern after it was discovered to corrode from water pipes. The high pH level of disinfected water enabled corrosion. Today, other materials have replaced many lead water pipes.

The most common type of filter is a rapid sand filter. Water moves vertically through sand which often has a layer of activated carbon or anthracite coal above the sand. The top layer removes organic compounds, which contribute to taste and odour. The space between sand particles is larger than the smallest suspended particles, so simple filtration is not enough. Most particles pass through surface layers but are trapped in pore spaces or adhere to sand particles. Effective filtration extends into the depth of the filter. This property of the filter is key to its operation: if the top layer of sand were to block all the particles, the filter would quickly clog.

To clean the filter, water is passed quickly upward through the filter, opposite the normal direction (called *backflushing* or *backwashing*) to remove embedded particles. Prior to this step, compressed air may be blown up through the bottom of the filter to break up the compacted filter media to aid the backwashing process; this is known as *air scouring*. This contaminated water can be disposed of, along with the sludge from the sedimentation basin, or it can be recycled by mixing with the raw water entering the plant although this is often considered poor practice since it re-introduces an elevated concentration of bacteria into the raw water.

Some water treatment plants employ pressure filters. These works on the same principle as rapid gravity filters, differing in that the filter medium is enclosed in a steel vessel and the water is forced through it under pressure.

Advantages:

- Filters out much smaller particles than paper and sand filters can.
- Filters out virtually all particles larger than their specified pore sizes.
- They are quite thin and so liquids flow through them fairly rapidly.
- They are reasonably strong and so can withstand pressure differences across them of typically 2–5 atmospheres.
- They can be cleaned (back flushed) and reused.

2.1 REVERSE OSMOSIS FILTERATION SYSTEM

Reverse osmosis (RO) is a water purification technology that uses a semipermeable membrane to remove ions, molecules, and larger particles from drinking water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property, that is driven by chemical potential differences of the solvent, a thermodynamic parameter. Reverse osmosis can remove many types of dissolved and suspended species from water, including bacteria, and is used in both industrial processes and the production of potable water. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. To be "selective", this membrane should not allow large molecules or ions through the pores (holes), but should allow smaller components of the solution (such as solvent molecules) to pass freely.

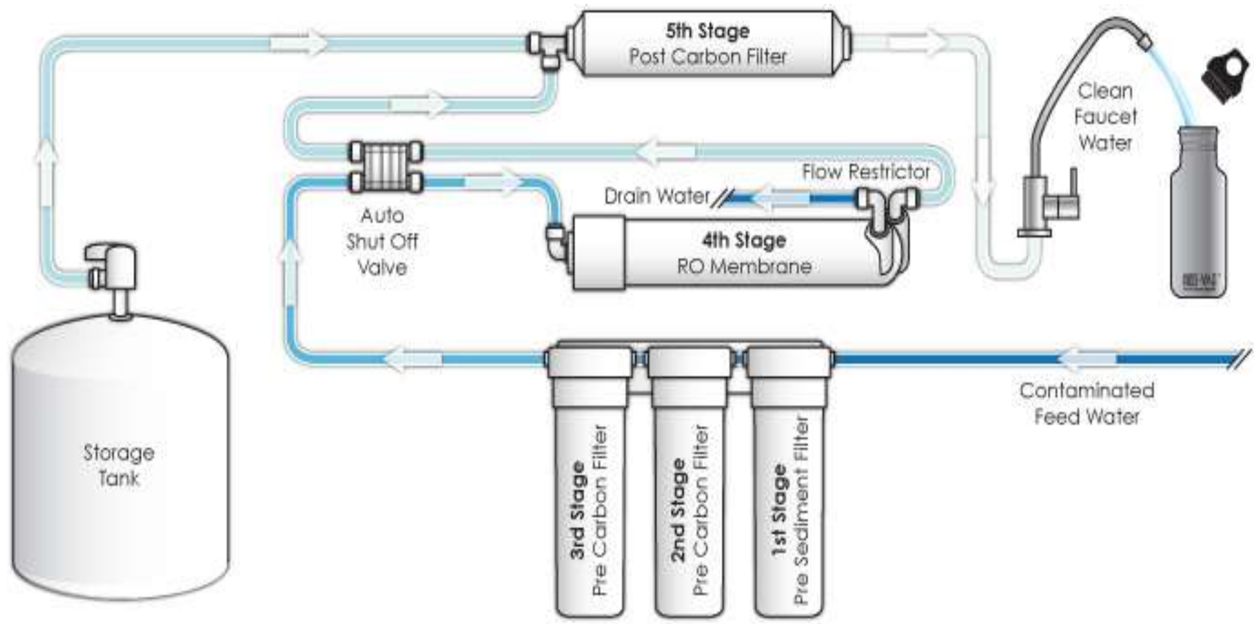

Fig 3 :- Reverse osmosis water purification system

In the normal osmosis process, the solvent naturally moves from an area of low solute concentration (high water potential), through a membrane, to an area of high solute concentration (low water potential). The driving force for the movement of the solvent is the reduction in the free energy of the system when the difference in solvent concentration on either side of a membrane is reduced, generating osmotic pressure due to the solvent moving into the more concentrated solution. Applying an external pressure to reverse the natural flow of pure solvent, thus, is reverse osmosis. The process is similar to other membrane technology applications. However, key differences are found between reverse osmosis and filtration. The predominant removal mechanism in membrane filtration is straining, or size exclusion, so the process can theoretically achieve perfect efficiency regardless of parameters such as the solution's pressure and concentration. Reverse osmosis also involves diffusion, making the process dependent on pressure, flow rate, and other conditions. Reverse osmosis is most commonly known for its use in drinking water purification from seawater, removing the salt and other effluent materials from the water molecules.

2.2 PROCESS

Osmosis is a natural process. When two solutions with different concentrations of a solute are separated by a semipermeable membrane, the solvent has a tendency to move from low to high solute concentrations for chemical potential equilibration.

Formally, reverse osmosis is the process of forcing a solvent from a region of high solute concentration through a semipermeable membrane to a region of low solute concentration by applying a pressure in excess of the osmotic pressure. The largest and most important application of reverse osmosis is the separation of pure water from seawater and brackish waters; seawater or brackish water is pressurized against one surface of the membrane, causing transport of salt-depleted water across the membrane and emergence of potable drinking water from the low-pressure side.

The membranes used for reverse osmosis have a dense layer in the polymer matrix—either the skin of an asymmetric membrane or an interfacially polymerized layer within a thin-film-composite membrane—where the separation occurs. In most cases, the membrane is designed to allow only water to pass through this dense layer, while preventing the passage of solutes (such as salt ions). This process requires that a high pressure be exerted on the high concentration side of the membrane, usually 2–17 bar (30–250 psi) for fresh and brackish water, and 40–82 bar (600–1200 psi) for seawater, which has around 27 bar (390 psi) natural osmotic pressure that must be overcome. This process is best known for its use in desalination (removing the salt and other minerals from sea water to get fresh water), but since the early 1970s, it has also been used to purify fresh water for medical, industrial, and domestic applications.

2.3 DISADVANTAGES OF REVERSE OSMOSIS SYSTEM

Household reverse osmosis units use a lot of water because they have low back pressure. As a result, they recover only 5 to 15% of the water entering the system. The remainder is discharged as waste water. Because waste water carries with it the rejected contaminants, methods to recover this water are not practical for household systems. Wastewater is typically connected to the house drains and will add to the load on the household septic system. A reverse osmosis unit delivering five gallons (19 L) of treated water per day may discharge between 20 and 90 gallons (75–340 L) of waste water per day.

Large-scale industrial/municipal systems recover typically 75% to 80% of the feed water, or as high as 90%, because they can generate the high pressure needed for higher recovery reverse osmosis filtration. On the other hand, as recovery of wastewater increases in commercial operations, effective contaminant removal rates tend to become reduced, as evidenced by product water total dissolved solids levels.

Due to its fine membrane construction, reverse osmosis not only removes harmful contaminants present in the water, but it also may remove many of the desirable minerals from the water. A number of peer-reviewed studies have looked at the long-term health effects of drinking demineralised water.

3. CONCLUSION

There are many home treatment alternatives that can purify drinking water to a greater extent than city treatment plants. Reverse osmosis and distillation, two of these alternatives, are moderately successful at removing some contaminants, but they are expensive and wasteful. Bottled water, besides being expensive and highly unfeasible as a main drinking water source, is not under the same government regulations as municipal water systems and may actually contain more contaminants than tap water. The absolute best technology now available for treating water and removing undesirable contaminants is water filtration. Water filters, when compared to any other water treatment alternative, will remove more contaminants and provide safer, healthier drinking water.

4. REFERENCES

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