

Mobile Aqua Purifier

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In the end of year 2011. Thailand faced a major flood , roads and electricity were cut off which makes it hard to help and the victims were suffered. The authors foresee of the difficulties of living without clean water for utilize. Then we bring environmental engineering knowledge to applied for invent Mobile Aqua Purifier for victims who lack of clean water for consumption. The Mobile Aqua Purifier can transform water from a common water source become to clean water for suitable utilize. The filter who installed on the Mobile Aqua Purifier that can be easily purchase in the market and inexpensive. We design propel filter system to be power of the bike system instead of using electricity.

Key Words : *Mobile aqua purifier , no electricity, easy to used, clean, suitable for utilize*

1. INTRODUCTION

Water is your body's principal chemical component and makes up about 60 percent of your body weight. Every system in your body depends on water. For example , water flushes toxins out of vital organs , carries nutrients to your cells, and provides a moist environment for ear , nose and throat tissues. Humans living being need water for survival. Usually human should drink 6-8 glasses of water or 1.5 - 2 liters per day drinking water must be clean antiseptic and without contamination. The water contains additives can cause a health hazard in short and long term. At present , the most popular drinking water is a bottled water that has been treatment by the filter. Water quality will vary depending on the sources of water and manufacturer. For safety , bottled water must be standardized According to the Ministry of

Public Health.

In end of year 2011. Thailand faced a major flood especially in Sukhothai , Phitsanulok , Phichit , Nakhon Sawan , Lop Buri and Saraburi. Some provinces were isolated by flood. Roads and electricity were cut off and hard to help, make them are living difficult. it made suffer almost all of Thailand.

The government assist the flood victims by accepting donations of food , drinking water and emergency survival bags but these ways could help only for a short term when food and water run out it needs a new donation soon. The authors foresee this point so we bring environmental engineering knowledge to applied for invent Mobile Aqua Purifier for victims who lack of clean water for a long term. Mobile Aqua Purifier can transform water from a common water source become to clean water for suitable utilize.

2. METHODOLOGY :FILTRATION SYSTEM

The definition of filtration contains any of various mechanical , physical or biological operations that separate solids from fluids by interposing a medium through which only the fluid can pass. The fluid that passes through a filter is called the filtrate. In physical filters , oversize solids in the fluid are retained and in biological filters particulates are trapped and ingested and metabolites are retained and removed. However , the physical separation is not complete , solids will be contaminated with some fluid and filtrate will contain fine particles general filtration system are classified by particle size as shown in **Table 1**

Table 1 Classification of filtration system by particle size.

Filtration	Partical size	Unit
Partical Filtration	More than 1	Micron
Micro Filtration	0.04 - 2	Micron
Ultra Filtration	0.001- 0.1	Micron
Nano Filtration	0.0009 – 0.009	Micron

The Mobile Aqua Purifier contains 5 filters in a serial system followed by spun filters , a polypropylene filter , ceramic filters , activated carbon blocks and reverse osmosis membranes.

Spun filters are the first stage in filter system used to trap large pieces such as stone , gravel , twig , leaves , plastic , sand , mud , suspended solids , etc. These filter effective for applications requiring an absolute rated filter to remove particles 10 microns and larger. Spun filter is a nylon rope wrapped around a cylinder core. Nylon rope has the ability to resist heat , resist chemical , resist fungi , flexible and long lifetime. The life of the filter is determined by the quality of raw water and how often it be used. Under normal laboratory conditions , expect from 6 to 12 months.

Polypropylene filter is formed by high quality synthetic fiber. These filter effective for applications requiring an absolute rated filter to remove particles 1 microns and larger. These are used to remove fine sand , mud , moss , rust , dust and any fine particles that may conterminated in the water . Purpose of polypropylene filter is to increase efficiency in filtration system before next step. The life of the filter is determined by the quality of raw water and how often it be used. Under normal laboratory conditions , expect 3 months or 2,500 liters.

Ceramic filters are an inexpensive and effective type of

water filter , that rely on the small pore size of ceramic material to filter dirt , debris , and bacteria out of water. Ceramic filtration does not remove chemical contaminants. Contaminants larger than the minute holes of the ceramic structure will remain on the surface of ceramic filters as shown in **Fig. 1**. The filter can be cleaned by brushing them with a soft brush and rinsing them with clean water. Hot water and soap can also be used. The life of the filter is determined by quality of raw water and how often it be used. Under normal laboratory conditions, expect from 6 to 12 months.

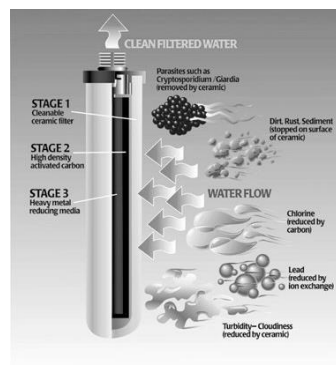


Fig. 1 Ceramic water filter showing contaminants removed

Activated carbon block is the most effective filter of all the carbon filters and uses chemical absorption for removal. Activated carbon block will remove chlorine , suspended particles such as sand, dirt , rust , and also will remove salts and minerals. The removal of these contaminants particularly assists with removing odours and chemical materials affecting the taste of water. Carbon block should be replaced at approx 6 month intervals , up to 9 months maximum. However , It is depending on the quality of raw water and how often it be used.

Reverse osmosis membrane (RO) is a water purification technology that uses a semipermeable membrane to remove ions , molecules , and larger particles from water. In reverse osmosis , an external 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. 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 but should allow smaller components of the solution such as solvent molecules to pass freely as shown in **Fig. 2**.

The life of the filter is determined by quality of raw water and how often it be used. Under normal laboratory conditions , expect from 5,000 to 10,000 liters.

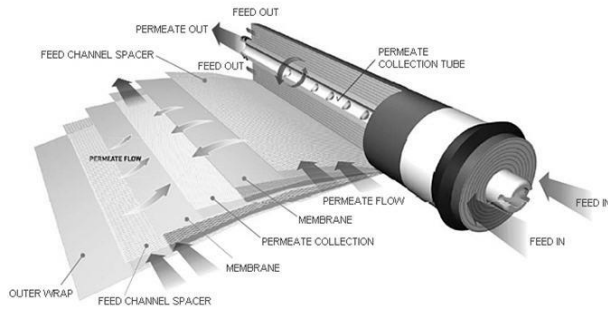


Fig. 2 Reverse osmosis membrane showing contaminants removed

Water that can pass through a semipermeable membrane will be drinking water . On the other hand , water that can not through a semipermeable membrane it will be consumption water.

Because lifetime of filters are different , the authors arranged the filters by using 3 of spun filters , 10 of ceramic filters , 3 of activated carbon blocks , 1 of polypropylene filter and 6 of reverse osmosis membranes. Arrangement of all filters as shown in **Fig. 3**.

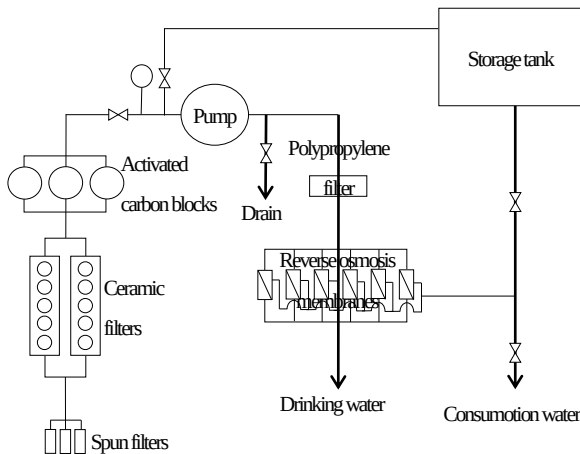


Fig. 3 Diagram of filtration system in Mobile Aqua Purifier

3. METHODOLOGY: DESIGN PROPEL SYSTEM

The authors are realized that the Mobile Aqua Purifier must be used in an environment with no electricity. The authors design propel filter system to be powered by a bike system instead of using electricity.

In the design of the pump we choose a reciprocating

pump which has a flow rate from 1,500 to 25,000 liters per hour. The working of the reciprocating pump is very simple. First of all the piston has the function of providing the suction force , so that the liquid can be lifted up or can be sucked in with great force. After that comes the compression part which will impart the required pressure energy to the fluids. In this part of the phase the piston has to do a great work so that the liquid can be compressed properly and its pressure can increase to the desired level.

Normally, the reciprocating pump use rubber belt to control pump. Hardworking conditions can be cause slack of rubber belt. The authors modified reciprocating pump by changing from rubber belt to chains to extend lifetime and by using gear in propel system to get more quantity of water while decreasing input power by man as shown in **Fig. 4**.

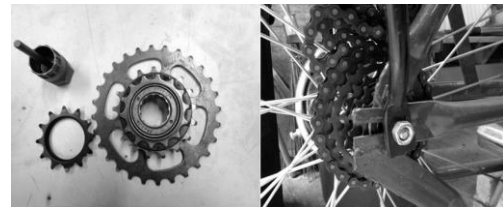


Fig. 4 Propel system in Mobile Aqua Purifier

To be able to use in multiple conditions , the authors designed a device in propel system that made the Mobile Aqua Purifier be able to make clean water while moving forward or even standing. This device is called moving gear by the authors as shown in **Fig. 5** and Mobile Aqua Purifier as shown in **Fig. 6**.

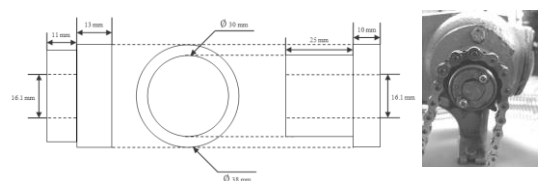


Fig. 5 Moving Gear



Fig. 6 Mobile Aqua Purifier

4. RESULTS AND DISCUSSION

The rate of consumption water from Mobile Aqua Purifier is 300 liters per hour and the rate of the drinking water is 30 liters per hour at pressure 1.5 bar. The drinking water from Mobile Aqua Purifier was found that the quality of water is equal to water quality standards which have been approved by the Metropolitan Waterworks Authority. But the consumption water included value of fluoride and Coliform more than water quality standard of the Metropolitan Waterworks Authority. However, the water from Mobile Aqua Purifier is safety to drink and consume depend on usability. Analysis of water quality from Mobile Aqua Purifier as shown in **Table 2**

Table 2 Analysis of water quality from Mobile Aqua Purifier

Parameter	Unit	Consumption water	Drinking water
<u>Physical</u>			
Colour	Platinum-Cobalt	10	0
Turbidity	Silica scale unit	6.34	0.49
Total Solid	mg / L	721	76
pH	-	7.71	7.06
<u>Chemical</u>			
Ferrous	mg / L	0.16	0
Manganese	mg / L	0.08	0
Calcium	mg / L	67.2	0.8
magnesium	mg / L	14.4	0
Chloride	mg / L	74	8
Sulfate	mg / L	67	3
Nitrate	mg / L	32.17	1.93
Fluoride	mg / L	1.38	0.04

Parameter	Unit	Consumption water	Drinking water
<u>Toxicity</u>			
Lead	mg / L	0.0014	0.002
Cadmium	mg / L	0.00029	Nd
<u>Biological</u>			
Coliform	MPN / 100 cm ²	More than 23	3.6

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