FABRICATION OF PEDAL POWERED WATER PURIFIER

V.SRIDHAR[1], G.VINAY[2], K.SAI RAM[3], B.AJAY RAM[4],
[1,2,3,4] B.Tech Student, Dept. of Mechanical Engineering, Vaageswari College of Engineering, *TS,Karimanagar India*.

Abstract

Pure, clean drinking water is a need of every household as humans can't live without it. Electricity at rural and remote areas is extremely erratic, thus making conventional water purifiers almost redundant for use. Thus, this project is specifically aimed at such areas and conditions of the world where water supply is erratic or non-existent and access to clean drinking water is sometimes at long distances. A pedal operated water filtration system is a water filtering apparatus which can filter water by using human muscle power via a pedal operated mechanism. This apparatus is preferably mounted on a supporting frame for increased portability. It will be specifically designed to perform three important functions: storing water, filtering it and transporting it to the final destination. the aim of this project is to solve purifying drinking water by creating a durable apparatus which is cheap to manufacture and to buy, which can last for a long time in rural conditions and which can be detachable so that it can be mounted on any frame. The system works on the sprocket chain system with power generator dynamo along with supporting frame interfaced with filters, container with integrated heating element and supporting circuit to achieve this system development. The overall apparatus is designed to be as lightweight and as cheap as possible so as to make it easily accessible to a very wide range of people. The apparatus is also designed to be made detachable so that it can be easily shifted from one place to another with minimal modifications**.**

I. INTRODUCTION

Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from water. The goal is to produce water fit for a specific purpose. Most water is disinfected for human consumption

(Drinking water), but water purification may also be designed for a variety of other purposes, including fulfilling the requirements of medical, pharmacological, chemical and industrial applications. The methods used include physical processes such as filtration, sedimentation, and distillation; biological processes such as slow sand filters or biologically active carbon; chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light.

Purifying water may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, fungi, as well as reducing the concentration of a range of dissolved and particulate matter.

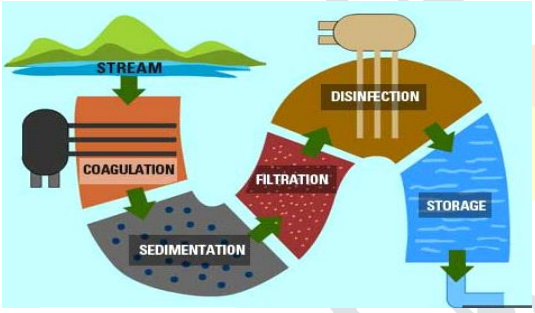
The standards for drinking water quality are typically set by governments or by international standards. These standards usually include minimum and maximum concentrations of contaminants, depending on the intended purpose of water use.

Visual inspection cannot determine if water is of appropriate quality. Simple procedures such as boiling or the use of a household activated carbon filter are not sufficient for treating all the possible contaminants that may be present in water from an unknown source. Even natural spring water – considered safe for all practical purposes in the 19th century – must now be tested before determining what kind of treatment, if any, is needed. Chemical and microbiological analysis, while expensive, are the only way to obtain the information necessary for deciding on the appropriate method of purification.

II. WORKING METHODOLOGY

Water purification methods

The goals of the treatment are to remove unwanted constituents in the water and to make it safe to drink or fit for a specific purpose in industry or medical applications. Widely varied techniques are available to remove contaminants like fine solids, micro-organisms and some dissolved inorganic and organic materials, or environmental persistent pharmaceutical pollutants. The choice of method will depend on the quality of the water being treated, the cost of the treatment process and the quality standards expected of the processed water.
The processes below are the ones commonly used in water purification plants. Some or most may not be used depending on the scale of the plant and quality of the raw (source) water.



- **Pre-treatment**

Pumping and containment – The majority of water must be pumped from its source or directed into pipes or holding tanks. To avoid adding contaminants to the water, this physical infrastructure must be made from appropriate materials and constructed so that accidental contamination does not occur.

- **Screening**

Screening the first step in purifying surface water is to remove large debris such as sticks, leaves, rubbish and other large particles which may interfere with subsequent purification steps. Most deep groundwater does not need screening before other purification steps.

III. LITERATURE REVIEW

- Ademola Samuel Akinwonmi et. al (2012)has prepared pedal power water purification and design was focused on process of conception, invention, visualization, calculation etc. he also made a force analysis to check performance criteria. The physical parameter of design was determined by the appropriate calculation and the practical consideration with some reasonable assumption. It is discovered that the design is simple, cheap, efficient and affordable as could be seen from the readily available materials used. It also use the Bernoulli's principle for the flow calculation with the help of peristaltic pump.

- Betzabe Gonzalez et. al (2014) has studied on the design and he used peristaltic pump with silicone tubing. This tubing was visually better suited for our project having no kinds to reduce flow, easy to clean and flexible enough to create suction between rollers. Sidecar is added to the bicycle for the two tanks setup one of dirty water & other of clean water tank for utilization around the home. Filtered water we get through this design.

- Yuichi katsuara et. al (2011) president of Nippon basic company was the first company to give Portable Water Purifying System "Cycloclean" powered by pedaling bicycle to make 5 liter(max.) of clean water in a minute at a technology fair in Tokyo. It need man power to turn a bike chain driving motor to pump water through series of filter (without the use of electricity). Clean water can be utilized for domestic purpose.

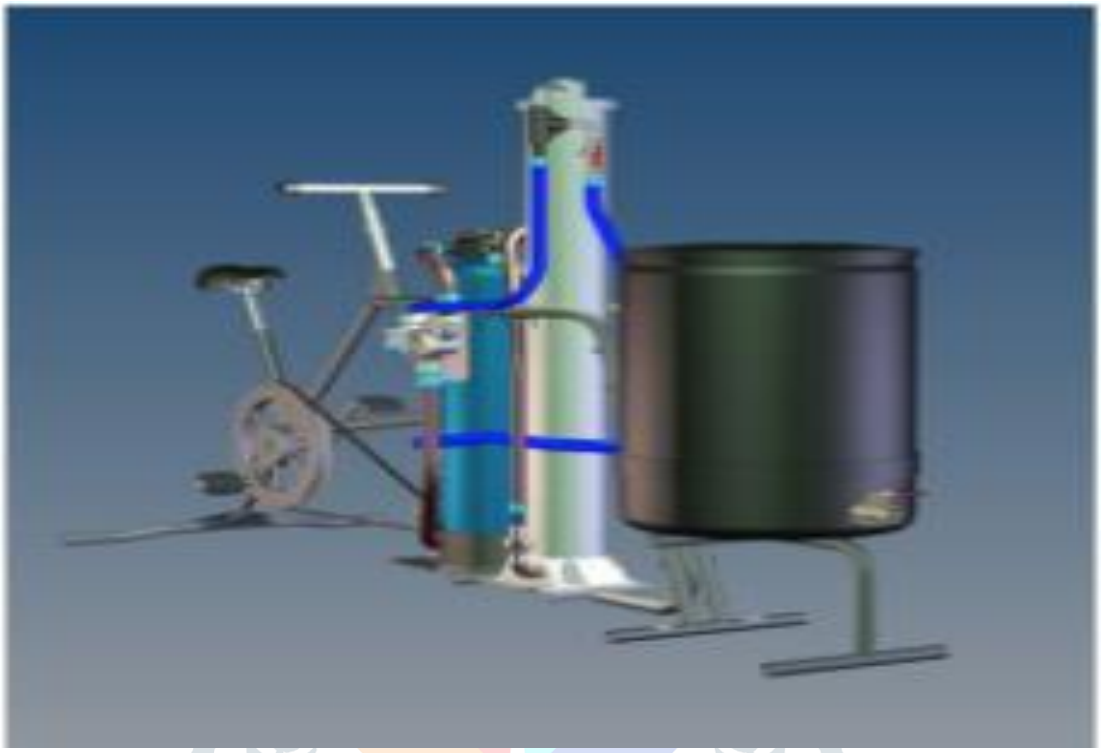
- A. Peramanan et. al (2014) has studied the fabrication of Human Power Reverse Osmosis Water Purification Process. The device use pedal to harms human motion to convert it into usable power to run a reverse osmosis filtration system. Osmosis is a natural process in which a liquid from a less concentrated solution flows through a semi permeable membrane to more concentrated solution. Reverse osmosis is an effective method of reducing the concentration of total dissolved solid sand many impurities found in water. The project has been carried out to make an impressing task in the field of water purification method.

Jayant Gidwani et. al (2016) has done the fabrication and experimental investigation of pedal powered water pump along with the purification system which is use for pure drinking water supply and garden irrigation purpose. The design has the working of centrifugal pump which is been operated by pedal power.

IV. PROPOSED METHODOLOGY

Water is present everywhere on earth, but it needs to be purified before it can be consumed. Here comes the difficult part. It needs electricity to or fuel along with large systems to purify it and make it consumable. So here we propose a pedal based water purification system that uses pedal power to purify water and make it available for drinking. The design and fabrication of pedal powered water purifier includes sprocket chain system with power generator dynamo along with supporting frame, filters, container with integrated heating element and supporting circuit to achieve this system development. The system uses a pedal fixed sprocket with chain attached to supply circular force to the dynamo to be driven. The power generated by dynamo is then used to store in batteries. The water before getting pressurized is passed through filters to remove large particles and basic filtering. The container on the other end is used to draw pure water from it

using a tap. Thus we achieve a pedal powered water purification system as a renewable water purifier.



Working principle

The system uses a pedal fixed sprocket with chain attached to supply circular force to the dynamo to driven. The power generated by the dynamo is stored in the battery.
Then the power is supplied to filter which are used to purifies the water.
Thus we achieve a pedal powered water purification system as a renewable water purifier.

V. DESCRIPTION OF THE PARTS

- **PEDAL**

The bicycle pedal is the part of a bicycle that the rider pushes with their foot to propel the bicycle. It provides the connection between the cyclist's foot or shoe and the crank allowing the leg to turn the bottom bracket spindle and propel the bicycle's wheels. Pedals usually consist of a spindle that threads into the end of the crank and a body, on which the foot rests or is attached, that is free to rotate on bearings with respect to the spindle.
Pedals were initially attached to cranks connecting directly to the driven (usually front) wheel. The safety bicycle, as it is known today, came into being when the pedals were attached to a crank driving a sprocket that transmitted power to the driven wheel by means of a roller chain.

Fig shows the pedals

- **FREE WHEELS OF BICYCLE**

in mechanical or automotive engineering, a freewheel or overrunning clutch is a device in a transmission that disengages the drive shaft from the driven shaft when the driven shaft rotates faster than the driveshaft. An overdrive is sometimes mistakenly called a free wheel, but is otherwise unrelated.

The condition of a driven shaft spinning faster than its driveshaft exists in most bicycles when the rider holds his or her feet still, no longer pushing the pedals. In a fixed-gear bicycle, without a free wheel, the rear wheel would drive the pedals around.

The simplest freewheel device consists of two saw-toothed, spring-loaded discs pressing against each other with the toothed sides together, somewhat like a ratchet. Rotating in one direction, the saw teeth of the drive disc lock with the teeth of the driven disc, making it rotate at the same speed. If the drive disc slows down or stops rotating, the teeth of the driven disc slip over the drive disc teeth and continue rotating, producing a characteristic clicking sound proportionate to the speed difference of the driven gear relative to that of the (slower) driving gear.

Fig shows the pulley

- **DYNAMO**

A dynamo is an electrical generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter. Today, the simpler alternator dominates large scale power generation, for efficiency, reliability and cost reasons. A dynamo has the disadvantages of a mechanical commutator. Also, converting alternating to direct current using power rectification devices (vacuum tube or more recently solid state) is effective and usually economical.

The electric dynamo uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct electric current through Faraday's law of induction. A dynamo machine consists of a stationary structure, called the stator, which provides a constant magnetic field, and a set of rotating windings called the armature which turn within that field. Due to Faraday's law of induction the motion of the wire within the magnetic field creates an electromotive force which pushes on the electrons in the metal, creating an electric current in the wire. On small machines the constant magnetic field may be provided by one or more permanent magnets; larger machines have the constant magnetic field provided by one or more electromagnets, which are usually called field coils.

Fig shows the dynamo

- **STRUCTURAL ARRANGEMENT FRAME (OR) CHASIS FRAME**

A chassis plural chassis consists of an internal vehicle frame that supports an artificial object in its construction and use, can also provide protection for some internal parts. An example of a chassis is the under part of a motor vehicle, consisting of the frame (on which the body is mounted). If the running gear such as wheels and transmission, and sometimes even the driver's seat, are included, then the assembly is described as a rolling chassis.

FOR BICYCLE

A bicycle frame is the main component of a bicycle, onto which wheels and other components are fitted. The modern and most common frame design for an upright bicycle is based on the safety bicycle, and consists of two triangles: a main triangle and a paired rear triangle. This is known as the diamond frame. Frames are required to be strong, stiff and light, which they do by combining different materials and shapes.

Fig shows the chasis Frame

- **BATTERIES**

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smart phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that when connected to an external circuit will flow and deliver energy to an external device. When a battery is connected to an external circuit, electrolytes are able to move as ions within, allowing the chemical reactions to be completed at the separate terminals and so deliver energy to the external circuit. It is the movement of those ions within the battery which allows current to flow out of the battery to perform work. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved additionally to include devices composed of a single cell.

Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the

original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and smart phones.

Fig shows the battery

- **WATER FILTERS**

A water filter removes impurities by lowering contamination of water using a fine physical barrier, a chemical process, or a biological process. Filters cleanse water to different extents for purposes such as providing agricultural irrigation, accessible drinking water, public and private aquaria, and the safe use of ponds and swimming pools.

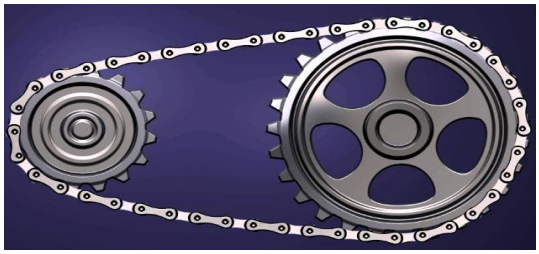
• CYCLE CHAIN

A bicycle chain is a roller chain that transfers power from the pedals to the drive-wheel of a bicycle, thus propelling it. Most bicycle chains are made from plain carbon or alloy steel, but some are nickel-plated to prevent rust, or simply for aesthetic.

Efficiency

Bicycle chain can be very energy efficient: one study reported efficiencies as high as 98.6%.The study, performed in a clean laboratory environment, found that efficiency was not greatly affected by the state of lubrication. A larger sprocket will give a more efficient drive because it moves the point of pressure farther away from the axle, placing less stress on the bearings, thus reducing friction in the inner wheel. Higher chain tension was found to be more efficient: "This is actually not in the direction you'd expect, based simply on friction.

Fig shows the chain



VI. APPLICATION PROCESS;

- **CHAIN,PULLEY,FREE WHEEL, PEDAL**
  These components are used for the cycling process.
  Pedals are connected to the main free wheel. There to chain is attached to the small free wheel.
  When cycling speed is increased on main free wheel then the chain rotates in heavy motion .Automatically smaller free wheel get rotates because of chain attachment.

- **Dynamo**
  Here dynamo is attached to the smaller free wheel .As the wheel rotates the dynamo rotates. Here dynamo plays a major role in creation of power.

- **BATTERIES**
  These are the main power sources to run the water purification filters.
  This battery gets charged from the dynamo.
- **FILTERS**
  UN used water or Waste water is converted to purified water using this filter set up process.

VI. CONCLUSIONS & FUTURE WORK

Finally pedal water purifier is developed using following components and process. Hence we can collect the purified water.

The benefits associated with access to safe drinking water provide a strong argument to increase resource allocations to interventions aimed at further improving the current drinking-water situation, as a key entry point for achieving much wider livelihood benefits.
The pedal operated water filtration system is a new system that is useful in developing countries like India to have daily access to safe drinking water all by harnessing the energy of pedal power.

REFERENCES

Curtis, V. And Cairncross (2003), S. Effect of Washing Hands with Soap on Diarrhoea Risk in the Community: A Systematic Review. *Lancet Infectious Diseases 3*, pp. 275– 281. Howard, G(2006).

Groundwater and Public Health, In: Schmoll O. et al. (eds). Protecting Groundwater for Health:Managing the Quality of Drinking-Water Sources, London, *International Water Association Publishing*, pp. 3−19.

Payment, P., Hunter, P. R. (2001), Endemic and Epidemic Infectious Intestinal Disease and Its Relationship to Drinking

Water, In: Fewtrell L., Bartram J. (eds), Water Quality Guidelines, Standards and Health, London, *International*

Water Association (IWA) Publishing, 61−88pp.

Garneau, C. McNamara, K. and Chung J. (2008), Peristaltic Pump Project, *Unpublished Final Project Report, Team D,*

ME 340.4, 41pp.

B. Gonzalez ,S. Alzate, J. Cromartie ,K. Hernandez, Advisor: Dr. Andres Tremante (April 7, 2014), Bicycle Powered Water Filtration System, *A B.S. Thesis prepared in partial fulfillment of the requirement for the Degree Of Bachelor Of Science In Mechanical Engineering, Florida International University*

A. S. Akinwonmi, S. K. Adzimah, F. Oppong, Department of Mechanical Engineering, University of Mines and Technology, Tarkwa, Ghana. 2012,Pedal Powered Centrifugal Pump Purified Water Supply System, *Innovative Systems Design and Engineering ISSN 2222-1727 (Paper) ISSN 2222-2871 (Online)* ,Vol 3, No.11

http://www.engineeringtoolbox.com/colebrook-equation-d_1031.html

http://www.engineeringtoolbox.com/dynamic-absolute-kinematic-viscosity-d_412.html.