

Conversion of Human waste water into useful water using Inoculum Bacteria

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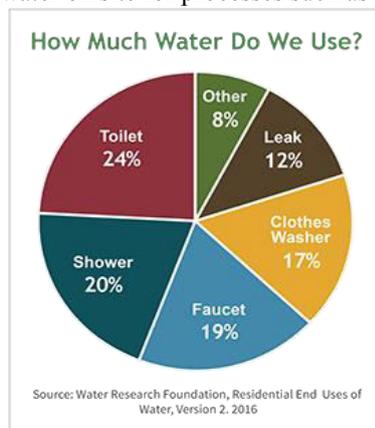
Abstract- : The disposal of human waste is a very big problem. Incineration and chemical treatment of human waste has also been attempted to overcome the problem. However, all these methods are either unhygienic or not practically viable alternatives. Biological treatment on the micro-organisms, freezing of the substrate, non-availability of conventional energy sources and hilly terrains are some of the hurdles which need to be solving to make the process practically possible. This Toilet provide a way to solve this problem. It secured the environment and make eco-Friendly. The corrosion caused by the faecal matter can be minimized by using thistoilet. By using this toilet, we can purify the solid waste into the pure water by means of bacteria Inoculum. We can be utilized this water for agriculture purpose.

Index Terms- Inoculum, Incineration, Toilet.

Introduction

In this present modern world, about 90% of the world population uses Flush type toilet. Even though this type of toilet gives more comfort to the people especially old people it consumes more amount of water than any other normal toilets. The main motto of this project is to reuse the used water using microbial inoculum (bacteria). Water that is on the Earth today is the same water that was here when the Earth began. This is possible because of recycled water, both naturally occurring and as a result of human technology.

The Earth naturally reuses its water; however, water recycling in the human population uses technology to speed up the process through practices like reusing waste water for purposes such as irrigation, flushing a toilet or filling up a groundwater basin. Another common form of water recycling is industrial recycling, where an industrial facility will reuse "waste" water on site for processes such as cooling.



One of the key advantages of recycling water is that it reduces the need for water to be removed from natural habitats such as wetlands. When you recycle the water that you use in your area, this means that you do not have to take water from other areas. Many areas where pure water is plentiful are delicate ecosystems that suffer when their water is removed. When the water is recycled, it makes it easy for places like the wetlands to keep their water supplies.

Many times, recycling water not only prevents its removal from sensitive environments, but it keeps wastewater from going into bodies of water such as ocean or rivers. Recycling water takes wastewater such as sewage and reuses it, instead of routing it directly into the nearest river or ocean where it could spread pollution and disrupt the aquatic life.

Literature Review

Following literature review is observed for obtaining the base for the completion of the objective of this project work. Research work carried out by Research Designs and Standards Organization under the title Specification for "Retention Tank Toilet System with Chemical Treatment" gives the following details Preamble: Retention tank toilet system with chemical treatment treats human waste so that solids are treated and entrapped in the filter. The liquids are made free from pathogen before being discharged. This Schedule of Technical Requirements specifies the waste processing, discharge and interfacing of Western and Indian style toilets. The biological toilet system is required to meet the following objectives. Clean, odour-less, hygienic and aesthetically pleasing toilet. No discharge of unprocessed waste. The toilet system should be simple to operate and safe for users. It should not contain any components, which are prone to pilferage. It should be robust, reliable and low-maintenance, and should require minimum ground. The system should be able to handle normal waste and even some foreign objects thrown in. Any choking should be possible to be rectified on the spot without needing attention of maintenance. The water consumption shall be minimum, with 100% wash of the commode (max. 2.5 litre per flush for Indian type and 1.5 litre for Western type). The toilet system is required to suit the space constraints of different types of coaches. All parts of the system should be at least 225 mm above rail level (preferably 400 mm).

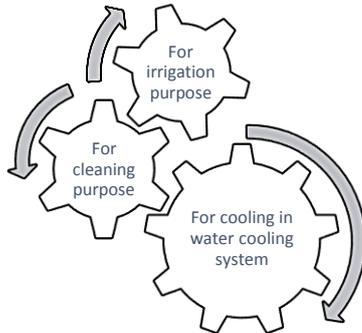
Motivation

The main motivation of our project is to save the used water from the drainage, but this idea is very expensive and it requires several permissions from the government. Therefore, we are planning to install this in the house. This will save more amount of water which is being continuously wasted in each and every house.

As by adopting the above practices all major constructs of a research paper can be written and together compiled to form a complete research ready for Peer review.

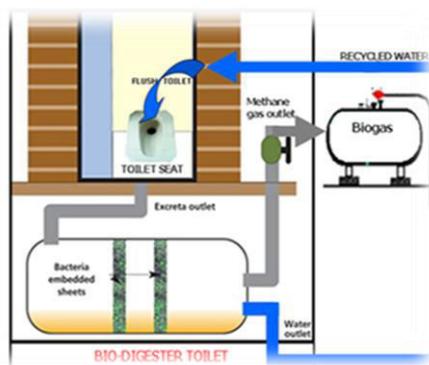
Background

To Preserve The Used Water From The Toilets We Are Using A Special Type A Biological Agent Called Inoculum Bacteria. This Bacterium Has The Ability To Transform The Human Wastes Into Water, Carbon-Di-Oxide And Methane.



This bacterium uses several reactions to produce the above mentioned compounds. The sump is the area where all the waste matters will be stored and filtration process also takes place here. It is made of FRP (fibre reinforcement plastic). The volume of the sump is 0.3 cubic meter. It consists of multilayer. The first two layers acts as a filter which will remove the macro components. Third layer is the region where the bacteria is loaded and in the remaining layers the gases are removed. Contents in human Faecal matter: Faces are mostly made of water (75%). The rest is made of dead bacteria that helped us digest our food (Lactobacillus, E. coli and Bacteroids), living bacteria, protein, undigested food residue (known as fibre), waste material from food, cellular linings, fats, salts, and substances released from the intestines (such as mucus) and the liver.

Configuration



This is the setup for the process. There will be a tank in which the human wastes are being collected. This tank comprises of three filters. The first two filters will collect the macro particles from the human filters. The last filter is mainly used for collecting the micro particles. This filter contains the bacteria named inoculum bacteria.

The human waste is collected in the sump which is placed under the toilet. The following reactions take place in the sump,

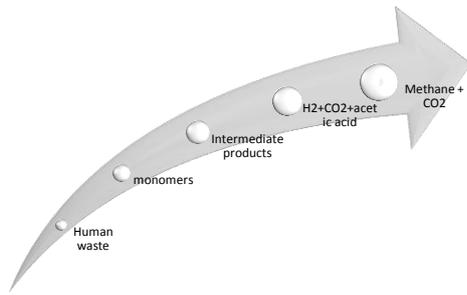
1. Hydrolysis
2. Acidogenesis
3. Acetogenesis
4. Methanogenesis

Hydrolysis: Hydrolysis is a reaction involving the breaking of a bond in a molecule using water. The reaction mainly occurs between an ion and water molecules and often changes the pH of a solution. In chemistry, there are three main types of hydrolysis: salt hydrolysis, acid hydrolysis, and base hydrolysis.

Acidogenesis: Acidogenesis is the second stage in the four stages of anaerobic digestion: Hydrolysis: A chemical reaction where particulates are solubilized and large polymers converted into simpler monomers. It is a biological reaction where volatile fatty acids are converted into acetic acid, carbon dioxide, and hydrogen. Biogas is generated during anaerobic digestion when microorganisms break down (eat) organic materials in the absence of air (or oxygen). Biogas is mostly methane (CH_4) and carbon dioxide (CO_2), with very small amounts of water vapour and other gases. Methane is produced in the rumen and hindgut of animals by a group of Archaea known collectively as methanogens, which belong to the phylum Euryarcheota. Among livestock, methane production is greatest in ruminants, as methanogens are able to produce methane freely through the normal process of feed digestion. Methanogens are the methane-producing bacteria used during the production of biogas. The methanogenic bacteria digest the organic mass to produce marsh gas during the secondary treatment of sewage. Marsh gas is a mixture of gases containing methane, hydrogen sulphide and carbon dioxide which form biogas.

Acetogenesis: Acidogenesis is the second stage in the four stages of anaerobic digestion: Hydrolysis: A chemical reaction where particulates are solubilized and large polymers converted into simpler monomers; ... Acetogenesis: A biological reaction where volatile fatty acids are converted into acetic acid, carbon dioxide, and hydrogen.

Methanogenesis: Methanogenesis or biomethanation is the formation of methane by microbes known as methanogens. Organisms capable of producing methane have been identified only from the domain Archaea, a group phylogenetically distinct from both eukaryotes and bacteria, although many live in close association with anaerobic bacteria.



The human faeces is being collected in the sump. There will be three filters in the sump. First two filters will collect the macro particles from the human waste. These can be removed during the maintenance process. In the last layer of the filter, the inoculum bacteria will be added. This will perform the chemical reaction and removes the wastes from the water. There will be four process. They are hydrolysis, acidogenesis, acetogenesis, methanogenesis. In hydrolysis process, the human waste will be converted into monomers. The monomers will stay for a particular time and it will convert into intermediate products. This intermediate product will be converted into H₂ CO₂ and acetic acid in acidogenesis process. Now this compounds will be converted into methane and CO₂ in the methanogenesis process.

Pump: A small pump is used to pump the treated water back to the tub. The energy to the pump is given by the small electric motor.

Methane Valve: This valve will allow only methane to pass out.

Carbon di Oxide Valve: This valve will allow only CO₂ to pass out.

Main Valve: This is a valve which controls the motion of waste particles in to the sump, it can be closed when the toilet is not in use in order to prevent the entry of unwanted substance in to the sump because the bacteria is highly sensitive therefore this matter can damage the bacteria.

Emergency Valve: This is a optional valve which is used in this case of emergency. When this valve is opened both the treated and non-treated matters are released.

Product Yield

As a result of the above process the several products are formed they are,

- ❖ Water
- ❖ Methane
- ❖ Carbon di oxide.

Water: As a result of the Hydrolysis process the water is produced. This water consists of 70% of the normal water content and so it is pumped back into the tub hence it becomes a continuous cycle.

Methane: Methane is produced as a result of Methanogenesis. Even though this methane has many applications we are going to use this for household purposes.

Carbon dioxide: Carbon di oxide is produced as a result of the fermentation process. Even though carbon di oxide is injurious to health, it has many usefulness. A company named Dry ice crop is buying raw carbon di oxide. They process this carbon

di oxide and they convert it into dry ice. This dry ice is then stored in the fire extinguisher.

The main advantages are primarily

- No bad smell in toilets from the tanks
- No Cockroaches & flies
- Faecal matter in the tank not visible
- Effluent is free from off odour and solid waste
- No maintenance required
- Reduction in harmful organic matter by 90%
- No requirement of adding bacteria

Conclusions

When human excreta come in contact with bacteria, it get converted into methane and water through a series a step of anaerobic digestion-hydrolysis acidogenesis methanogenesis. Faecal matter is composed of carbohydrate, protein and fats. The corrosion cost by the faecal matters can be minimised by using this toilet.

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