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Water purification ;An effective distillation method in rural India.

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Abstract

Availability of purified drinking water is the basic need for good health.Rural people of India is suffering from water borne disease due topolluted water.Several water purification systems are available locally which are costly. Large scale of drinking water supply system is not available in India. Distillation is the best method to get purified water. A domestic water distillation method is applied to remove all impurities. This is done by locally available low cost fuel. This present method of distillation system to purify water is a good remedy for life threading water borne disease and toxic chemicals.

Keywords:-**Impurities ,water borne disease, distillation, contamination, pollutants, heavy metals, affected ,low cost fuel, aeration, absorption.**

1. Introduction

97% water is salt water and 3% are fresh water world wide. Out of 3% ,69 part is locked in glacier and ice ,30 part is groundwater and one part is surface fresh water[1,2,3] .Desalination of sea water is costly. Among different methods ,distillation is the best practical and most economic for mass production of freshwater from high saline water like sea water [4,5] .Few people collect groundwater and purify it.Poor People Collect water from local sources to drink.These water sources are contaminated by pollutants. Many people died in water borne disease.Scenes 2000 billions of people gained access for drinking water and sanitation services while access to safe water free from chemical and biological contamination remainsa significant challenge [6]. Biologically contaminated water is estimated to cause 485,000 deaths each year [7] .Such diseases can be affected by the presence of pathogenic bacteria likeEscherichia Coli, enterococci species andVibrio cholera within untreated water [8,9,10,11] . People from many industrial areas are affected by the presence of heavy metals in drinking water.The continuous exposing of heavy metals on the human body can cause multiple and dangerous health damages [12] . For example, heavy metals can act as a reason for cancer in the human [13]. Fluoride levels are high for almost 300 million individuals [14]. The major impacted Nations are China,India , Africa and American countries. In India ,the fluoride maximum limit is setting as1mg per litre.Fluoride related disorders are recognised as a global epidemic[15].Pesticides are recognisedas a reagents for protecting crops against harmful pests and diseases in human.It'scontrol improve the living standard of the global population.An average of 2 million tons of pesticides is used each year globally to control with insects and pests[16].Our drinkable water should be clean, pure, non toxic and free from microbes . Different purified methods available to remove TDS (specially iron), harmful and heavy chemicals ,pathogenic bacteria, insoluble particles etc. These methods generally includes filtration ,boiling, use of UV light, distillation,reverse osmosis, chlorination etc.Rural agricultural based people can

use solid dry plant Waste as fuel to collect their purest safe hygienic drinking water during the whole yearspecially when they are affected by toxic chemicals as well as harmful water borne bacteria.

2. Review of literature

2.1 Physico-chemical aspects:

Total solids:

Turbidity indicate the extent of total suspended solids, is an important parameter for characterising the quality of water and covers wide variety of suspended materials which range in size from colloidal to coarse dispersions depending on the extent of turbulence[17] .

PH:

pH ,temperature and turbidity have a major influence on bacterial population and growth[18,19,20,21] . Relatively low temperature can retard the growth of microorganism,specifically coliforms.

Turbidity:

phytoplankton, microorganism, clay, Slit and other organic matter make a lake target[22] . Presence of high turbidity signify large amount of suspended solids[23] .

Total hardness:

Hardness of water depends on the amount of calcium or magnesium salts or both.The hardness of water indicates water quality mainly in terms of calcium and magnesium ions expressed as calcium carbonate[24] .The World health organisation has stipulated the tolerance level of hardness as 500 mg /L [25] .

TDS:

soluble pesticides carried away by water during the precipitation by percolating downward into the soil layers and ultimately reach surface waters and ground water.

Heavy metals:

presence of heavy metal like cadmium ,mercury, lead, iron, chromium etc are harmful and toxic to human. Different techniques have been developed and applied for waste water treatment to remove heavy metals from environment.Thesemethods includes membrane filtration, ion exchange ,absorption chemical precipitation, nanotechnology and advance oxidation processes.

Presence of fluoride and its removal:

Fluorine is an essential element for human health as it plays a major role in bone and dental mineralisation[26].70-90% of fluoride intake into the human body is fulfilled by drinking water [27] . At low concentration fluoride is an essential nutrient for human body but at high concentration, fluoride can be caused to several health problems like skeletal fluorosis, thyroid disorder ,neurological damage[28] .

2.2 Bacteriological aspects:

Groundwater contains a broad spectrum of microbial biological types found in surface soils and waters [29] . Bacteria fungi , protozoa and most physiological types . Pathogenic viruses, bacteria and protozoa of gastro intestinal origin from domestic, agriculture and other human activities infiltrate through soils sediments and rocks to the groundwater[30] . Groundwater has been contributed between 21% and 30%, with an estimated average of about 25%, of the total annual freshwater use worldwide according to the most-recent data on global groundwater and total freshwater use [31]. . Studies show that contaminated water sources and poor sanitation practices are responsible for over 80 % of all human infections [32] Diseases are transmitted through pathogens in drinking water are hepatitis A and E ,cholera, typhoid, dysentery. In India

about 80% of the diseases are belief to be water related and the world health organisation has reported that nearly 5 million human death or car each year through polluted drinking water [33] .The quality of water is determined by monitoring microbial presence specifically faecal coliform bacteria and physico-chemical parameters [34] . The consequences of water borne bacteria and virus infection ,polio, hepatitis, cholera, typhoid, diarrhoea, stomach cramps etc, have been established but nitrate contamination results in death.Potential to cause water borne disease that can have a severe negative impact on health specially in population with weak immune systems. Contaminated water frequently contains bacteria like E.Coli , salmonella[35] . According to [36] , these pathogens can induce gastrointestinal disorders like diarrhoea, vomiting and abdominal pain. In extreme situation they can even result in kidney failure or death [37] .Waterborn viruses include roto virus, norovirus and hepatitis a virus . The public health is affected by liver inflammation, jaundice and gastro intestinal problems [38] .Consumption of water contaminants with this microorganisms can cause gastro intestinal tract infections which can lead to protract diarrhea, dehydration and malnutrition .Waterborn infection have a negative impact on the developing fetusas well as the mother increasing the risk of complications and possible birth defects in expectant mothers[38] .

2.3 Conventional methods of water purification includes:

Aeration:

Aerationis a natural process of water purification that introduces air into the water which promote the release of dissolved gases and volatile compounds.It also oxidizing dissolved iron and manganese.

Coagulation and flocculation:

coagulating agent like aluminium sulfate or iron sulphate is added.It's object is to remove colloidal particles, bacteria, soil, sand and clay articles.

Sedimentation:

Sedimentation is a natural water purification method that utilises gravity to separate suspended solids from water.Itallow to stand undisturbed heavier particles settled to the bottom and leaving clean water above.

Slow sand filtration:

Much larger area is needed to reduce bacteriological and viral levels to get drinking water.

Boiling:

Boiling is the simplest and most traditional method of water purification.In involves heating water toit'sboiling point andkill bacteria and other pathogens. Boiling water for at least 10 minutes is sufficient to make it safe for drinking.

Filtration:

A highly effective technique for eliminating microorganisms from varieties of substance is called filtration[39] . Filtration is a method of removing impurities from water by passing it through a filter. The filter is generally made of Sand, charcoal or ceramic. Filtration can remove impurities like sediment, bacteria and some viruses. It may not remove chemicals or heavy metals. The important advantage of filtration is that it is acost effective way to purify water .

Ultraviolet radiation:

In ultraviolet radiation process, contaminated water is exposed to radiation of short wavelength of light to destroy any micro organism present in the water. Ultraviolet radiation is an effective physical method of removing bacteria which does not affect water quality and no chemical agent is added to the water for

disinfection [40]. Due to their unique properties, the test ,smell and the pH remain unchanged, the only target is to kill the bacteria.

Disinfection:

Disinfection is a destruction or removal of vegetative pathogens by autoclaving ,membrane filtration, chlorination ,ozone treatment etc.

Adsorption:

It is a filtration technique based on the coating of the filter medium with adsorbents resulting in modified media which can act as a filter and also adsorbent.It is a process of adsorptionby which a variety of dissolved contaminants are attracted to and absorbed on the surface of the carbon particles. Organic contaminants,unwanted colouring and taste and odor causing compounds are adsorbed in the surface of granular or powder activated carbon and are thus removed from the drinking water.

Reverse osmosis:

Reverse osmosis is a method of water purification which uses a semi permeable membrane to remove impurity. The membrane allows water molecules to pass through but blocks impurities like chemicals, minerals and bacteria. Reverse osmosis can produce high quality safe water but it is economic for running and to purchase the equipment.

Desalination:

Many countries now suffer from shortage in freshwater.Currently 12 5 countries around the world are taking advantage of desalination methods to access fresh water from sea water.As desalinationis one of the important process for production of portable water that can be used for human consumption, irrigation and industry. In the last decades people conducted research to minimise the cost of this process and several methods have been developed. Among different methods distillation appear as one of the best practical and most economical for mass production of pure water from high saline water like sea water.

Distillation:

distillation is a process of purifying water by boiling it and then condensing the steam into water again. Distillation produce high quality pure water but it is an energy consuming process which requirespecial equipment.

3. Material and Methods

The outer part of a tea kettle is connected with a long rubber tube. The tea kettle is filled with 2L of impure water. The tea kettle is placed above a Bunsen burner and the outer tube of the kettle is made spiral and gplaced in a water filled container .The end part of the tube inserted in a collecting container. The water filled kettle is heated with a Bunsen burner. The steam generated is passed through the tube is condensed to form purified water and in collected drop wise in the colleting container. The water filled kettle can be heated by low cost alternative fuel like dry wood, straw or any kind of locally available dry leaf.

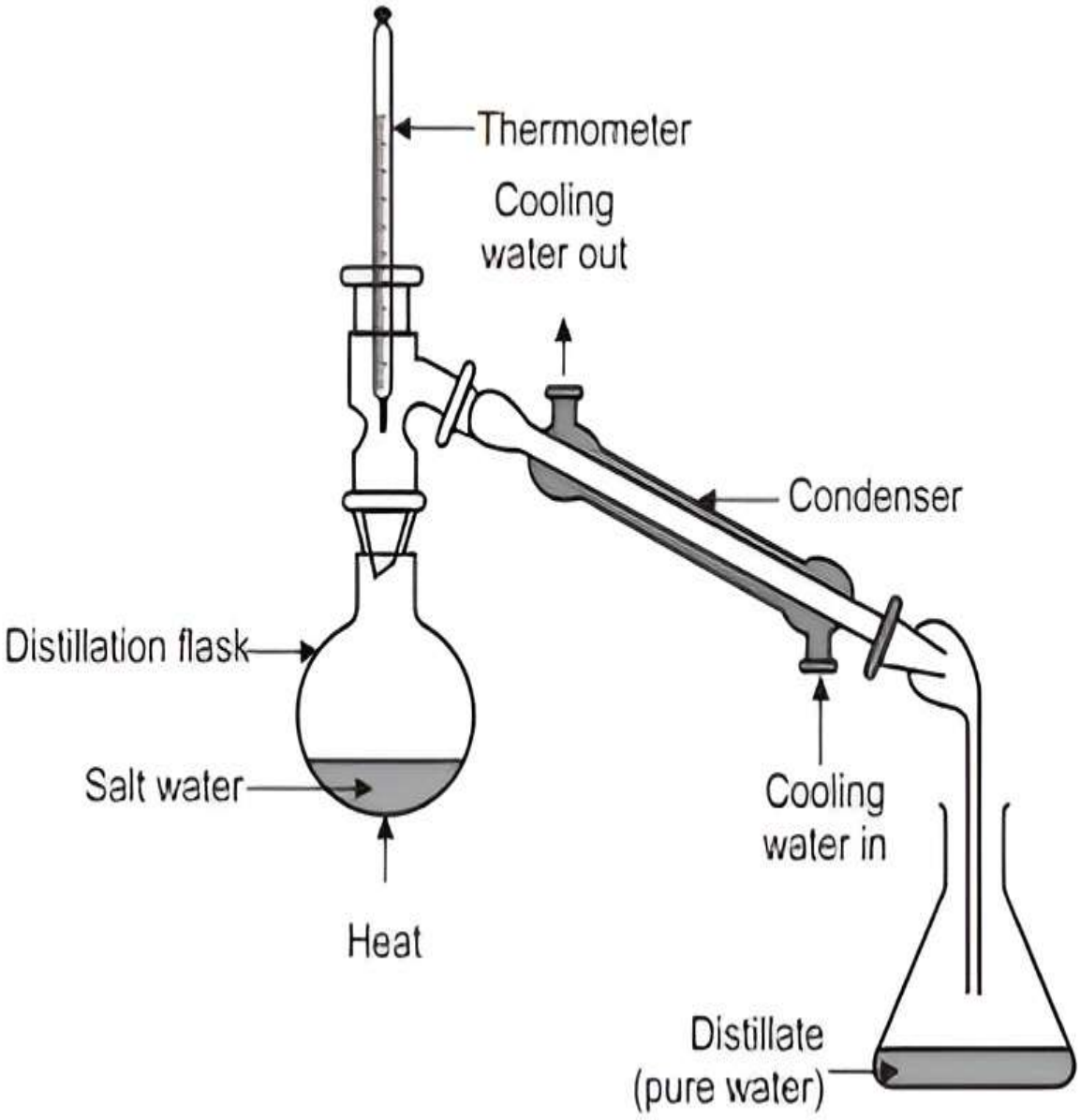

Fig.1. Schematic diagram of a general distillation (desalination) set up

Fig.1.1 Schematic diagram of experiment set up for pure (distilled) water

4. Result and Discussion

The water collected by the steam distillation method is drinkable from our health and hygienic point of view. The purified water collected is free from TDS, harmful industrial pollutants, pesticides and insecticide, pathogenic bacteria and other harm full microbes, unresolved metallic and non-metallic ions and heavy metallic ions. It can be generated by using low cost locally available plant fuel. This processes is economic and purified water is best for our health.

5. Conclusion:

The mean constant of water distillation method is must wastage of energy, large scale purification process. It may a remove beneficial material along with contaminants. It may remove volatile organic compound during evaporation.

Water distillation process is still fruitful to us from hygienic point of view as it removed word rang of contaminants, bacteria, virus and heavy metals. This process produce high by purified water.

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