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PURIFICATION OF IMPURE POTABLE WATER

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ABSTRACT

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.

Keywords: Contaminant, pollution, purification, quality and water.

I.INTRODUCTION

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. Water quality is measured by several factors, such as the concentration of dissolved oxygen, bacteria levels, the amount of salt (or salinity), or the amount of material suspended in the water (turbidity). In some bodies of water, the concentration of microscopic algae and quantities of pesticides, herbicides, heavy metals, and other contaminants may also be measured to determine water quality.

According to a 2007 World Health Organization (WHO) report, 1.1 billion people lack access to an improved drinking water supply, 88% of the 4 billion annual cases of diarrheal disease are attributed to unsafe water and inadequate sanitation and hygiene, while 1.8 million people die from diarrheal disease each year. The WHO estimates that 94% of these diarrheal disease cases are preventable through modifications to the environment, including access to safe water.[1] Simple techniques for treating water at home, such as chlorination, filters, and solar disinfection, and storing it in safe containers could save a huge number of lives each year.[2] Reducing

deaths from waterborne diseases is a major public health goal in developing countries. 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. Although scientific measurements are used to define water quality, it is not a simple thing to say "that water is good" or "that water is bad." So, the determination is typically made relative to the purpose of the water – is it for drinking or to wash a car with or for some other purpose? Poor water quality can pose a health risk for people. Poor water quality can also pose a health risk for ecosystems. In the Florida Keys, good water quality is essential to a healthy marine ecosystem. Sea grass and coral reef communities thrive in clean water that is relatively low in nutrients. Too many nutrients in the water can cause excess growth of algae, which can smother corals and sea grass. Pollutants such as metals, oils, pesticides, and fertilizers run off from land into the waters, causing excess algae growth and other harmful impacts. Within Florida Keys National Marine Sanctuary, recommendations for actions to restore and maintain water quality conditions needed to sustain healthy plant and animal populations are generated through the Water Quality Protection Program.

There are things you can do to prevent degradation to sanctuary waters, such as supporting and participating in advanced wastewater treatment programs that remove unwanted nutrients and harmful bacteria, using "pump-out" stations for your vessel's sanitation device, using as many "green" products as possible at home, and reducing or eliminating the use of fertilizers, herbicides, and pesticides.

II.RESULT AND DISCUSSION

Identification of water pollution -

In public potable water supply systems, the Water Company or governmental supplier will detect the pollution and notify residents. In developing countries one must test the water before drinking it and the same is recommended for any water source that there is a doubt regarding its safety. In severe cases of water pollution it's clear from the start that there's a problem, the water will smell bad, they will be cloudy or murky or greasy, the taste will be bad and/or it will have particles in it.

The best and most common ways to test water pollution levels is either sending samples to a lab to scan for chemicals, biological, non-biological and other contaminants or using chemical indicators that tell in an easy and fast way if the water contains certain contaminants. If we are talking about a water source in the wild, we can examine the wildlife and plants around it to look for any sign of water pollution.

III.ORIGINS OF WATER POLLUTION

Water pollution can be a point source pollution where the contamination came from one clear place or source or it can be a non-point source pollution where the contamination source is unknown or from multiple places/sources. The overall origins of most cases of water pollution are:

- Untreated wastewater or improperly treated wastewater.
- Biological contaminants in the water source or supply system.
- Industrial waste and wastewater.

- Deliberate water pollution by chemical, physical or biological agents.

IV.COMMON TYPES OF WATER CONTAMINANTS

- Pathogens: Bacteria, viruses, micro-organisms, viruses, parasite worms and more.
- Chemicals and others : These can be organic or inorganic contaminants Organic chemicals: detergents, food processing waste, disinfection chemicals, herbicides, pesticide, insecticide, petroleum products, plant debris, and industrial solvents; Inorganic: Acidity forming pollutants, Ammonia, Chemical products and waste, fertilizers and heavy metals.
- Large contaminants that cause water pollution, such as plastic, glass, paper, hygiene products etc.

V.METHODS FOR PURIFICATION OF IMPURE POTABLE WATER

- 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. Boiling: Bringing it to its boiling point at 100 °C (212 °F), is the oldest and most effective way since it eliminates most microbes causing intestine related diseases,[3] but it cannot remove chemical toxins or impurities.[4] For human health, complete sterilization of water is not required, since the heat resistant microbes are not intestine affecting. The traditional advice of boiling water for ten minutes is mainly for additional safety, since microbes start getting eliminated at temperatures greater than 60 °C (140 °F). Though the boiling point decreases with increasing altitude, it is not enough to affect the disinfecting process.[3][5] In areas where the water is "hard" (that is, containing significant dissolved calcium salts), boiling decomposes the bicarbonate ions, resulting in partial precipitation as calcium carbonate. This is the "fur" that builds up on kettle elements, etc., in hard water areas. With the exception of calcium, boiling does not remove solutes of higher boiling point than water and in fact increases their concentration (due to some water being lost as vapour). Boiling does not leave a residual disinfectant in the water. Therefore, water that is boiled and then stored for any length of time may acquire new pathogens.
- Granular Activated Carbon adsorption: a form of activated carbon with a high surface area, adsorbs many compounds including many toxic compounds. Water passing through activated carbon is commonly used in municipal regions with organic contamination, taste or odors. Many household water filters and fish tanks use activated carbon filters to further purify the water. Household filters for drinking water sometimes contain silver as metallic silver nanoparticle. If water is held in the carbon block for longer periods, microorganisms can grow inside which results in fouling and contamination. Silver nanoparticles are excellent anti-bacterial material and they can decompose toxic halo-organic compounds such as pesticides into non-toxic organic products.[6]
- Distillation involves boiling the water to produce water vapour. The vapour contacts a cool surface where it condenses as a liquid. Because the solutes are not normally vaporised, they remain in the boiling solution. Even distillation does not completely purify water, because of contaminants with similar boiling points and droplets of unvapourised liquid carried with the steam. However, 99.9% pure water can be obtained by distillation.

- **REVERSE OSMOSIS** - Mechanical pressure is applied to an impure solution to force pure water through a semi-permeable membrane. Reverse osmosis is theoretically the most thorough method of large scale water purification available, although perfect semi-permeable membranes are difficult to create. Unless membranes are well-maintained, algae and other life forms can colonize the membranes.
- The use of iron in removing arsenic from water.
- Direct contact membrane distillation (DCMD). Applicable to desalination. Heated seawater is passed along the surface of a hydrophobic polymer membrane. Evaporated water passes from the hot side through pores in the membrane into a stream of cold pure water on the other side. The difference in vapour pressure betw the hot and cold side helps to push water molecules through.
- Desalination – is a process by which saline water (generally sea water) is converted to fresh water. The most common desalination processes are distillation and reverse osmosis. Desalination is currently expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas.
- Gas hydrate crystals centrifuge method. If carbon dioxide or other low molecular weight gas is mixed with contaminated water at high pressure and low temperature, gas hydrate crystals will form exothermically. Separation of the crystalline hydrate may be performed by centrifuge or sedimentation and decanting. Water can be released from the hydrate crystals by heating[7]
- In Situ Chemical Oxidation, a form of advanced oxidation processes and advanced oxidation technology, is an environmental remediation technique used for soil and/or groundwater remediation to reduce the concentrations of targeted environmental contaminants to acceptable levels. ISCO is accomplished by injecting or otherwise introducing strong chemical oxidizers directly into the contaminated medium (soil or groundwater) to destroy chemical contaminants in place. It can be used to remediate a variety of organic compounds, including some that are resistant to natural degradation.
- Bioremediation is a technique that uses microorganisms in order to remove or extract certain waste products from a contaminated area. Since 1991 bioremediation has been a suggested tactic to remove impurities from water such as alkanes, perchlorates, and metals.[8] The treatment of ground and surface water, through bioremediation, with respect to perchlorate and chloride compounds, has seen success as perchlorate compounds are highly soluble making it difficult to remove. Such success by use of Dechloromonas agitata strain CKB include field studies conducted in Maryland and the Southwest region of the United States.[9][10][11] Although a bioremediation technique may be successful, implementation is not feasible as there is still much to be studied regarding rates and after effects of microbial activity as well as producing a large scale implementation method.

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