A review on several methods of water purification techniques

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***Abstract*—Water purification is a very important issue in environment. It involves the various techniques and manufacturing processes for water purification using renewable sources. It consist of a several modules which is an effective method to remove bacteria and viruses, removal of inorganic solutes, suspended solids, metal ions, heavy metals , nitrate, natural organic content, protozoan, complex organic compounds, and other pollutants etc. All this method can be made ease, low cost, potable and energy efficient high quality water to solve the needs of pure water. However, in this paper we emphasize on all available physical, chemical and biological methods of water purification which is useful information for researchers and scientist who work in the area of water purification system.**

***IndexTerms*—Physical, Biological and Chemical Method of water purification.**

I. INTRODUCTION

The most common and useful liquid on the earth is water. Pure water is basic need for human survival .The supply of water for drinking is either ground water or surface water [1]. Water has a very important impact on all aspects of human life including health, economy, energy and food.In addition pure water is essential for the safety of children and for their health.

It is concluded that 10–20 million people die each and every year due to waterborne and non-fatal infection. Nearbydaily approx. 5,000 – 6,000 children die due to the water-borne related diseases. Currently more than 0.78 billion people around the world who do not access pure and safe water resulting they faced major health related issue.And only accessible pure water is 0.5% of the worlds, poorly distributed across the global [2].

Limited possibility of an increase in the supply of purewater due to competing demands of increasing populations day by day throughout the world and also water-related problems are expected to increase further more due to changes in climate and more growth in population. Contaminated surface and ground water resources is another cause ofdecrease in amount of pure water supply. There is little confusion about the urgent nature of the water problem facing the world.

The water from each resource contains some of the impurities. So that it requires different processes for removal of these impurities from contaminated water [3]. In remote areas in India, there is lack of development in infrastructure due to poor economic situations, so that they do not have pure drinking water, communication, sanitation, electrical power facilities and therefore these issues becoming more important. In remote and poor areas, water is drawn from the pond or lake, river for cooking, washing, drinking and cleaning purpose. It is necessary to supply pure drinking water at low cost and with high purity [1].

Accomplish this functions, impurities must be removed by applying several processes.The water must be stored in safe place so that any recontamination from bacterial growth must be avoided. There is urgent and essentialneed to supply environmentally safe and sound technology for the awareness of clean water in remote and rural areas. The treatment of this contaminated water and delivery of high quality pure water is a worldwide field of research, science and technology [22].

II. PHYSICAL METHOD

S.S.Phuse, R.S.Shelke [1] present a solar photovoltaic cell which consists of three filters out of that pre carbon filter is first filter which is absorbs and eliminate chlorides and organic material from waste water. Second filter eliminates various foreign materials that comes from water pipes and the third filter is the RO membrane filter; purify the water by membrane filter [1].

Deepak Devasagayam introduced, Humidification dehumidification (HDH) desalination technology to remove dissolved salts from ocean water by followed the rain cycle [5]. Hefei Zhang et al represent a hybrid solar desalination process and its basin-type unit. Guangping Cheng et al present a solar desalination process using air HDH. M. Amidpour et al experimentally estimate the HDH desalination process for production of pure water from brackish water.

Neskakis A. et al. presented feasibility of a small Photovoltaic driven reverse osmosis desalination plant, with a daily production of safe drinking water with discharge of 0.8-3 m^3 per day [5]. Adsorption methods introduced by electrosorption, for the removal of all contaminants, is carried out with activated carbon, because of its high exposed surface area. A new technique, flow-through capacitor, is representing for future applications of water purification system, which has been recently patented [4]. E. Joe Middlebrooks, Donald B. Porcella, Robert A. Gearheart present, Centrifugation, Microstraining, Autoflocculation, Coagulation-flocculation, baffles, pond removal of particulate matter, Biological harvesting, Dissolved air flotation, Biological discs, raceways, pond chemical precipitation of suspended materials, Oxidation ditches and Soil mantle disposal used for algae removal, Intermittent media filtration and granular sand filtration techniques used for water purification [6]

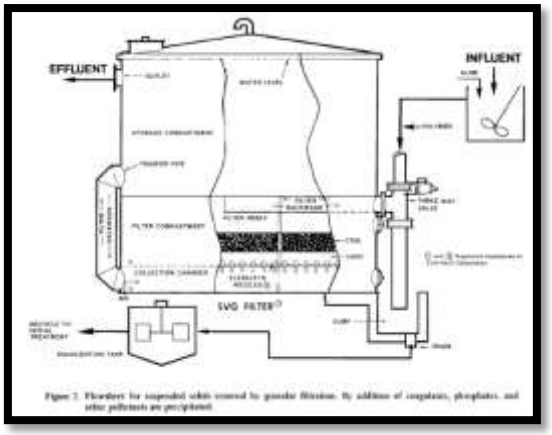

Fig. (a)

Fig. (b)

Figure (a) Granular Filtration and (b) Wastewater treatment station model.

Ultrafiltration, nanofiltration and microfiltration, reverse osmosis are applied pressure filtration processes, are considered as effective processes which has alternative methods to removing huge amounts of organic micro pollutants.RO membrane technology has developed over the last few years to a 44% in the world for production and 80% for desalination plants installed worldwide [8]. Cellulose-based adsorbents, chitosan and its derivatives has great application in water treatment area [7]. Membranes based incorporated nanoparticles, carbon nanotubes or graphene based material show promising and innovative desalination technologies with high performance in terms of salt rejection and water permeability [9]. Currently, membrane technology has introduced as a new promising technology because of its innate advantages over the traditional technologies such as distillation, extraction and adsorption, its provides a better membrane separation especially for water flux and retention [10].

III. CHEMICAL METHOD

Biological treatment like activated sludge and biological trickling filters are unable to remove contaminants and they remain soluble in the effluent so that they approach nanomaterials.Carbon nanotubes are contributing more efficiently in water treatment system and also provides a unique perspective on research methodology and conventional technologies.

M. T. Amin, A. A. Alazba, and U. Manzoor represent nanomaterials like Ag, titanium, and zinc capable of disinfecting waterborne disease-causing microbes. Because of their charge capacity, they possess antibacterial properties. TiO photo catalysts and metallic and metal-oxide nanoparticles are the most important nanomaterials found with antimicrobial properties. Nanocomposite membranes containing Ag and TiO nanoparticles, the number of coatings in TiO/ (aluminum oxide) composite ceramic membranes coated by iron oxide nanoparticles (FeO), Zeolite-based membranes graphene membranes for water desalination, Other nanostructure material like lyotropic liquid crystals and aquaporins exhibited selective water transportation, Cerium oxide nanoparticle supported on CNTs are used effectively to adsorb arsenic, TiO nanoparticles and nanosized magnetite, photo catalysts such as TiO nanoparticles has been investigated in detail to reduce toxic metal ions from waste water. A nanocomposite of TiO nanoparticles anchored on graphene sheet was also used to reduce Cr (VI) to Cr (III) in sunlight. MnO hierarchical hollow nanostructures were used for the removal of organic pollutant in waste water.

Single-enzyme nanoparticles are used for decontaminating a large no. of organic contaminants as highlighted in the study. NF is used for the removal of organic material and nitrates from ground and surface waters. And it has been reported that quality of water gradually decrease by the removal of organic contaminants. The improving UF processes for water treatment which is containing organic and inorganic solute material, dendritic polymers are used as water-soluble ligands for radionuclides and inorganic anions. In addition of metal oxide nanoparticles like silica, TiO, alumina, and zeolites to polymeric ultrafiltration a membrane has helped to reduce foul [2]. Electro flotation process is a known as gravity separation process which is originated from mineral process and shows the contribution of recycling byproducts and waste materials [11].

The primary aim of this study was to estimate the feasibility of wastewater electrolysis cell for toilet wastewater disinfection. And the treated wastewater was module to reuse for toilet flushing and agricultural irrigation purpose. Chemical chlorination (CC) disinfection with hypochlorite [NaClO] was the only one effective method used for the inactivation of viruses [18].

Advanced heterogeneous photo catalysis such as zinc oxide photo catalyst appears to be one of the most important technology that minimizes electron loss during excitation state and maximize the photon absorption and also improve the heterogeneous photo catalysis under examination of UV, visible and solar illumination [12].

Polymer functionalized nanocomposites (PFNCs), increasingly attention because they retain the surface properties of nanoparticles while the polymeric support materials gives high stability and process ability. These nanoparticles matrix materials are of great attention for removal of metals and metalloids from water [13].

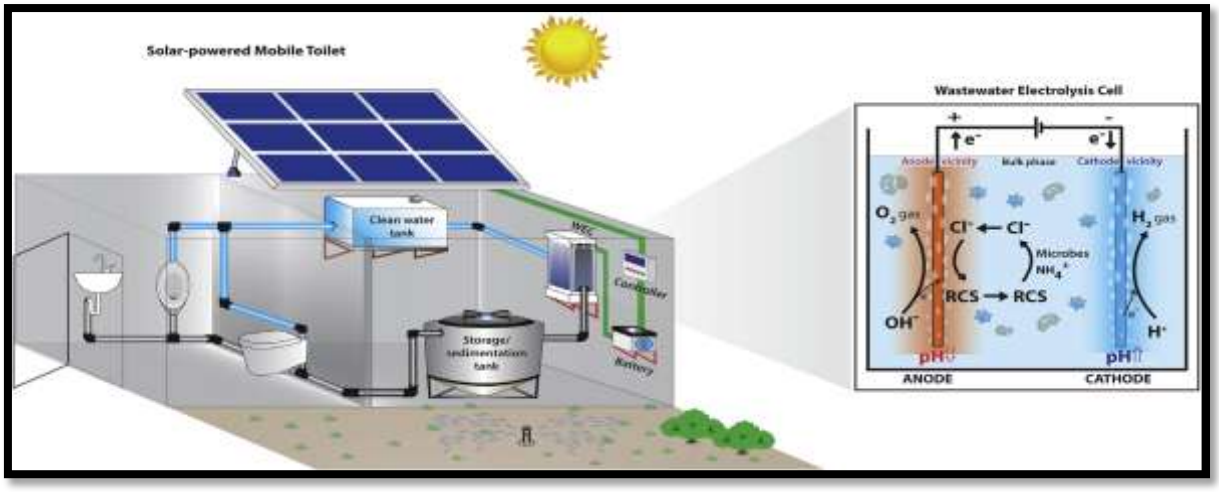

Fig.2. Schematic diagram of a solar-powered electrolysis cells for toilet wastewater treatment.

Electrochemical oxidation is used successfully to deactivate different organic pollutants and to treat municipal wastewaters and disinfect drinking water.Coupling electro oxidation process with other technologies improves the purification results of water [14]. Nanoporous Graphene sheets and Capacitive Deionization (CDI) method, used for water filtration and desalination at a removal efficiency of 33 to 100% depending on their pore size and the applied pressure [15].

The effects of UV-LEDs multiple wavelengths and pulsed illuminations are represented over UV and its Mechanisms of microorganism inactivation discussed briefly by Kai Song, Madjid Mohseni, and Fariborz Taghipour [16]. Coagulation and flocculation with $FeCl_3 \cdot 6H_2O$ allow to remove 63% of COD and 80% of turbidity and 74% of total polyphenols. Solar photo Fenton examines excellent ability to treat with the remaining pollutant of landfill leachate [17]. A fungal membrane bioreactor is coupled with membrane photocatalytic reactor used sequentially to treat textile waste water [19]. Catalytic Ozonation and molecular ozone reaction means removal of contamination from water.

IV. BIOLOGICAL METHOD

N. Abdel-Raouf, A.A. Al-Homaidan, and I.B.M. Ibraheem represent Sewage treatment processes, first introduced Conventional sewage treatment technology for the removal of biochemical oxygen demand, and suspended solid material, coliform bacteria and nutrients. The main target is getting purified and safe water. The preliminary treatment of sewage is to discard large amount of solid materials passed by sewers that could stop flow through the plant equipment.After removal of the waste materials, primary treatment of sewage followed the sedimentation process, which is purpose to remove the settleable by gravity.The secondary treatment process introduced decrease in the amount of BOD exerted by reducing organic matter.And tertiary treatment of sewage aims to remove all organic ions from water. It can be achieved by biologically or chemically. They also represent anaerobic processes [20]. Conventional purification techniques, such as biological methods like aerobic and anaerobic treatment are mainly used to purify waste waters [14]. Biological treatment and Ozonation technique has been developed to reduce excess amount of sludge production with a smaller amount of ozone [21].

V. CONCLUSION

Any wastewater can be treated very effectively by followed physical, chemical and biological processes. The use of these techniques removes almost all contamination from waste water. All these techniques will be very useful for water purification with better result.

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