Water Purification by Bio-Remediation and use of Hydroponics

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Abstract— In the device of hydroponic, we search about the makes use of of hydroponics that how to purified the water. There are many sorts of plant use of hydroponics system like that water course, carrot etc. Hydroponics is a subset of hydroculture, The technique of developing plants without soil, the usage of minerals nutrients solutions in a water solvent. Terrestrial plant life may be grown with only theirs roots exposed to the mineral solution, or the roots supported by an inert medium, such as perlite or gravel. The nutrients in hydroponics can come from an array of various sources, these can include but are not constrained to byproduct from fish waste, duck manure, or ordinary nutrient. We use distinctive kind of technics like that static solution culture, continuous flow solution culture (NFT technique), aeroponics, fogponics, passive sub irrigation.

Keywords: Biochemical oxygen demand, Assessment method, Biodegradation, Water conservation, Nutrients management, Hydro phonics

I. INTRODUCTION

Plants grow through a process called photosynthesis, during which they use sunlight and a chemical inside their leaves called chlorophyll to convert CO2 (a gas within the air) and water into glucose (a sort of sugar) and oxygen. Write that out chemically and you get this equation.

$$6CO2 + 6H2O \rightarrow C6H12O6 + 6O2$$

There's no mention of "soil" anywhere in there—and that's all the proof you would like that plants can grow without it. What they are, what they need for water and nutrients, both easily obtained from soil. But if they will get this stuff somewhere else—say, by standing with their roots during a nutrient-rich solution—they can do without soil altogether. That's the basic principle behind hydroponics. In theory, the word "hydro-ponics" means growing plants in water (from two Greek words meaning "water" and "toil"), but because you'll grow plants without actually standing them in water, most of the people define the word to mean growing plants without using soil. Although the advantages of hydroponics have some-times been questioned, there seem to be many advantages in growing without soil. Some hydroponic growers have found they get yields repeatedly greater once they switch from conventional methods. Because hydroponically grown plants dip their roots directly into nutrient-rich solutions, they get what they have far more easily than plants growing in soil, in order that they need much smaller root systems and may divert more energy into leaf and stem growth. Hydroponic plants also grow faster. Many pests are carried in soil, so doing without it generally gives you a more hygienic growing system with fewer problems of disease. Since hydroponics is right for indoor growing, you'll use it to grow plants all year round. Automated systems controlled by timers and computers make the entire thing a breeze. Environmental infection through heavy metals from anthropogenic and commercial activities has brought about great irreparable harm to aquatic ecosystems. Sources encompass the mining and smelting of ores, effluent from garage batteries and car exhaust, and the manufacturing and insufficient use of fertilizers, pesticides, and plenty of others. The metals which are available in the world and metalloids that contaminate waters and are maximum typically discovered withinside the surroundings consist of lead, chromium, mercury, zinc, arsenic, cadmium, uranium, silver, gold, and nickel etc. These metals are the concern of situation because of their excessive toxicity. Apart from being hazardous to human health, additionally they have a detrimental impact at the fauna and flora, and they're not biodegradable in nature. Thus, there's a want to are looking for new strategies in growing treatments to reduce or maybe do away with metals gift withinside the surroundings.

II. ESTIMATION OF HEAVY METAL POLLUTION

The term "heavy metal" typically refers to aluminous parts with an mass higher than that of metallic element (55.8 g mol–1) or density bigger than 5.0 g cm–3, and these metals are naturally present within the environment. However, some metals with an atomic weight under that of Fe, for example, Cr, et al that are considering metalloids. serious metals can play a job as micronutrients, such as Cu, Fe, Mn, Mo, Zn, and Ni, however they will even be noxious to humans, e.g., Hg, Pb, Cd, Cu, Ni, and Co betting on the exposure levels Contamination by heavy metals causes several injurious effects, which have an effect on not solely fauna and flora however conjointly human health. Serious metal ions have a robust electricity attraction and high binding affinities with a similar site that essential metal ions ordinarily bind to in various cellular structures, inflicting destabilization of the structures and biomolecules (cell wall enzymes, polymer and RNA), therefore causation replication defects and ensuant mutagenesis, hereditary genetic disorders, and cancer. Serious metals are notable contaminants because they are toxic, no biodegradable within the environment, and simply accumulated in living organisms The contamination of waters with heavy metals happens through natural and anthropogenic activities, in the main relating to industrialization. Table below shows the natural and anthropogenic sources of some of the foremost widespread study serious metals as setting AL pollutants, along with a quick list of their adverse health effects and their applications. Although studies on bioremediation typically contemplate the overall quantity of metal gift in the environment, the toxicity of those metals depends on their chemical form. The wide range of chemical forms during which heavy metals may be present within the environment includes cationic/anionic species and complexes (hydroxylated or complexed to Cl), and their oxidation state varies betting on the medium hydrogen ion concentration and composition. Heavy metals contaminated in soil will accumulate and persist for long periods of your time and may be harmful to very important processes involved in microorganism nutrient sport. The toxicity and mobility of heavy metals are powerfully

obsessed on their chemical type and specific binding properties. Changes within the environmental conditions in soils, love natural process and variations in the oxidoreduction potential, will cause the mobilization of heavy metals from the solid phase to the liquid phase, thereby permitting the potential contamination to the plants grown in these soils. In water bodies, an important metal in comparatively high concentrations affects the biota thanks to its toxicity, or it may be bio accumulated.

III. WHAT ARE BOD AND COD?

Chemical Oxygen Demand (COD) and Biological Oxygen demand (BOD) are the two main characteristic properties that indicate the strength of sewage. Both the parameters test the oxygen-demanding strength of the wastewaters.

To determine COD, the sample water is taken in a closed container and incubated with a strong oxidant like potassium dichromate with sulphuric acid under standard conditions of temperature and time. COD is the oxygen demand that is consumed by both inorganic and organic matter present in the wastewater sample. The chemical oxygen demand is expressed as the mass of oxygen consumed over the volume of the solution. Its SI unit is milligrams per liter (mg/l).

BOD is defined as the amount of oxygen demanded by the micro-organisms in the sewage for the decomposition of bio-degradable matter under aerobic condition.

Components	Man-made waste	Uses	Detrimental wellbeing consequence
Zn	Pigments, electro plasting, pipe lines, industrial waste	Fertilizer, pigment, plastic	Vomiting and diarrhea, headache, gastric irritation, anemia
Ni	Metal alloys, battery plants, production of vegetable oils	Batteries, electronics, catalyst	Lung, fibrosis, skin allergies
Pb	Pipelines, coal, gasoline, pigments, paints	Batteries, alloys	Neurotoxic
Cu	Electroplating, domestic and industrial waste, mining waste, pesticides	Electric conductor properties	Anemia and other toxic effects
Cr	Electro plating, industrial seage, anti-corrosive products	Detergents and pestisides	Mental disturbances, hyperkeratosis, cancer
Cd	Mining waste, battery plants	Automobile exhaust	Renal effects, cardiovascular

Table 1: Components, man-made waste, uses, detrimental wellbeing consequences

IV. PROCESS DESCRIPTION OF HYDROPONICS MODEL

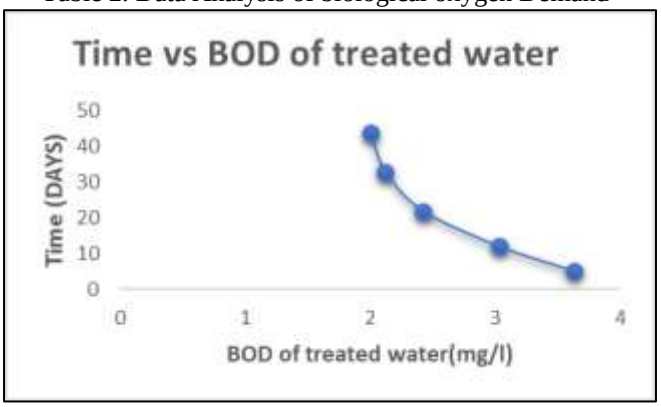
Model is designed with multiple horizontal pipelines above the ground level. Industrial waste water sample was circulated with constant flowrate through the pipes. Furthermore, plants were put in the pipelines at some distance as shown in figure (1). The waste water was circulating constantly for 45 days at the same time water samples were taken and measure COD and BOD within duration of experiment time span. As well as dissolved oxygen was measured before COD and BOD analysis. Nutrient Film Technique, is a type of hydroponic system where a continuous flow of nutrient solution runs over the plants roots. This type of solution is on a slight tilt so that the nutrient solution will flow with the force of gravity. And we have used this same method to establish the hydroponics model. This type of system works very well. Since only the tips of the roots come in contact with the nutrient solution, the plant is able to get more oxygen which facilitates a faster rate of growth. In addition it consumes more minerals from waste water which has more amount of BOD.

Fig. 1: working model of hydroponics

V. DATA ANALYSIS OF BIOLOGICAL OXYGEN DEMAND

Time (Days)	Initial dissolved oxygen (mg/l)	Treated dissolved oxygen (mg/l)	BOD initial (mg/l)	BOD treated (mg/l)
1-5	2.98	3.10	4.43	3.63
6-12	3.10	3.20	3.63	3.03
13-22	3.20	3.28	3.03	2.42
23-33	3.28	3.35	2.42	2.12
34-44	3.35	3.41	2.12	2

Table 2. Data Analysis of biological oxygen Demand



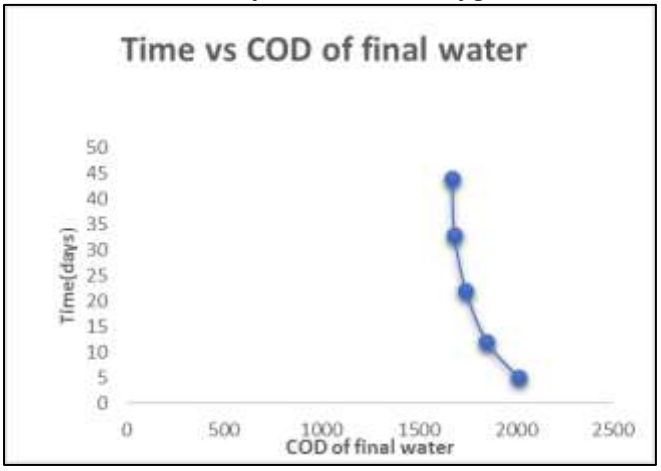
Graph 1: Time vs BOD of treated water (mg/l)

The represented pictogram depicts statistics about biological oxygen demand within given time period. Dissolved oxygen was considerabley less at the initial stage of process but it increased with time. Because of this trend biological oxygen demand decereased gradually till end of timespan.

A. Data Analysis of Chemical Oxygen Demand

Time (days)	COD initial (mg/l)	COD final (mg/l)
1-5	2353.22	2014.13
6-12	2014.13	1850.18
13-22	1850.18	1742.66
23-33	1742.66	1683.45
34-44	1683.45	1671.67

Table 3. Data Analysis of chemical oxygen demand



Graph 2: Tme vs COD of final water

The represented pictogram depicts statistics about chemical oxygen demand within given time period. It was considerabley high at the initial stage of process but it decreased with time. Because of this trend chemical oxygen demand became low till end of timespan.

VI. CONCLUSION

To conclude, although there are several methods available to decerase contamination from water, through this method we reduce approximately 55% Biological oxygen Demand (BOD) and about 29% Chemical oxygen Demand (COD). So, overall this is a very efficient method to remove toxic elements and other compounds from the water.

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