"PHYTOREMEDIATION OF DOMESTIC WASTE WATER BY USING THE PLANT *Canna indica* L."

KOLHAPUR

Research Project submitted to

Department of Botany,

Vivekanand College, Kolhapur (Autonomous)

Under the guidance of

Dr. Priya Digambar Patil

Assistant Professor,

Department of Botany, Vivekanand College, Kolhapur (Autonomous)

Submitted by

Pradnya S. Kamble and Ritu R. Kumawat

(T.Y. B. Sc. Botany)

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April 2023

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CERTIFICATE

This is to certify that the dissertation entitled **"PHYTOREMEDIATION OF DOMESTIC WASTE WATER USING THE PLANT *Canna indica* L."** submitted by Miss **Pradnya S. Kamble and Ritu R. Kumawat**, B.Sc. Botany in partial fulfillment for the award of degree Bachelor of Science in Botany is a bonafide record of the research work carried out by them under the supervision and guidance of **Dr. Priya D. Patil**, Department of Botany, Vivekanand College, Kolhapur (Autonomous).

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DECLARATION

I hereby declare that the project work entitled, "**PHYTOREMEDIATION OF DOMESTIC WASTE WATER USING THE PLANT *Canna indica* L.**" submitted by **Miss Pradnya S. Kamble and Ritu R. Kumawat** of B.Sc. Botany in partial fulfillment for the award of degree Bachelor of Science in Botany, Vivekanand College, Kolhapur (Autonomous). This work represents bonafide record of the research work carried out by students under the supervision and guidance of **Dr. Priya D. Patil**, Assistant Professor, Department of Botany, Vivekanand College, Kolhapur (Autonomous).

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- Pradnya S. Kamble & Ritu R. Kumawat

CONTENTS

1. INTRODUCTION

Pollution is the introduction of harmful materials into the environment. These harmful materials are called pollutants. Pollutants can be natural, such as volcanic ash. They can also be created by human activity, such as trash or runoff produced by factories. Pollutants damage the quality of air, water, and land. The term "pollution" refers to any substance that negatively impacts the environment or organisms that live within the affected environment. The five major types of pollution include: air pollution, water pollution, soil pollution, light pollution, and noise pollution. Pollution effects are defined as "direct and/or indirect adverse impacts of contaminants on the marine environment, such as harm to living resources and marine ecosystems, including loss of biodiversity, hazards to human health, the hindering of marine activities, including fishing, tourism and recreation and other. Water pollution is an important pollution among pollutions. Water pollution (or aquatic pollution) is the contamination of water bodies, usually as a result of human activities. Water bodies include for example lakes, rivers, oceans, aquifers and groundwater. Water pollution is the leading worldwide cause of death and disease, e.g. due to water-borne diseases. Water pollution happens when toxic substances enter water bodies such as lakes, rivers, oceans and so on, getting dissolved in them, lying suspended in the water or depositing on the bed. This degrades the quality of water. The causes of water pollution are, industrial wastes. Industries and industrial sites across the world are a major contributor to water pollution. Another major reason for pollution is Marine Dumping. The process of marine dumping is exactly what it sounds like, dumping garbage into the waters of the ocean. Other major reasons are sewage and wastewater, oil leaks and spills, agriculture pesticides and chemicals, global warming and radioactive waste. These are the major reasons for water pollution. Water pollution also affects the ecosystem – it can cause a phenomenon called eutrophication. This can cause fish and other aquatic organisms to die. Toxic elements dissolved in water can make their way to humans through fish or other aquatic organisms. Eutrophication is an enrichment of water by nutrient salts that causes structural changes to the ecosystem such as: increased production of algae and aquatic plants, depletion of fish species, general deterioration of water quality and other effects that reduce and preclude use". The main environmental effects of eutrophication are increase of suspended particles owing to extensive macro-algal blooms, decrease of water clarity, and increase in the rate of precipitation that led to the destruction of benthic habitat by shading of submerged vegetation. Major effect of water pollution is Destruction of biodiversity. Water pollution depletes aquatic ecosystems and triggers unbridled proliferation of phytoplankton in lakes. It also contaminate the food chain, lack of potable water, water born diseases, infant mortality. Environmental remediation deals with the removal of pollution or contaminants from environmental media such as soil, groundwater, sediment, or surface water. Remedial action is generally subject to an array of regulatory requirements, and may also be based on assessments of human health and ecological risks where no legislative standards exist, or where standards are advisory. There are mainly two types of environmental remediation .They are Bioremediation and Phytoremediation. Water pollution can be monitored and by measuring the biological oxygen demand. Bioremediation has been used to remove agricultural chemicals that leach from soil into groundwater and the subsurface. Toxic metals and oxides, such as selenium and arsenic compounds, can also be removed by bioremediation. Bioremediation is a process used to treat contaminated media, including water, soil and subsurface material, by altering environmental conditions to stimulate growth of microorganisms and degrade the target pollutants. Cases where bioremediation is commonly seen is oil spills, soils that contaminated with acidic mining drainage, underground pipe leaks, and crime scene cleanups. These toxic compounds are metabolized by enzymes present in microorganisms. Phytoremediation technologies use living plants to clean up soil, air, and water contaminated with hazardous contaminants. The term is an amalgam of the Greek phyto (plant) and Latin remedium (restoring balance). Ammoniacal nitrogen is one of the wastewater contaminants, which can be found in many types of wastewater. Excessive ammoniacal nitrogen in water body may lead to eutrophication, which induces the growth and decay of excessive plant and algal, and caused degradation of the water quality. Phytoremediation is proposed as a cost-effective plantbased approach of environmental remediation that takes advantage of the ability of plants to concentrate elements and compounds from the environment and to detoxify various compounds. The concentrating effect results from the ability of certain plants called hyper accumulators to bioaccumulate chemicals. The remediation effect is quite different. Toxic heavy metals cannot be 4 degraded, but organic pollutants can be and are generally the major targets for phytoremediation. Several field trials confirmed the feasibility of using plants for environmental cleanup.

HISTORY OF PHYTOREMEDIATION

Basic idea that plants can be used for environmental remediation quite old. The knowledge that aquatic or semi aquatic plants such as water hyacinth (*Eicchornia crassipes*), pennyworth (*Hydrocotyle umbellate*), duckweed (*Lemna minor*) and Water velvet (*Azolla pinnata*) can take up Pb, Cu, Fe, and Hg (lead, copper, cadmium, iron, mercury) from contaminated solutions which existed for a long time. This ability is currently utilized in many wetlands, which may be effective in removing some heavy metals as well as organics from water. In India aquatic vascular plants like *Hydrilla verticillata*, *Spirodela polyrrhiza*, *Phragmites karka* and *Scripus lacustis* have used to treat chromium contaminated effluent and sludge from leather tanning industries (Rai and Amith 1999). It has been suggested that phytoremediation would rapidly become commercially available if metal removal properties of hyper accumulator plants, such as *Typha caerulescens* could be transferred to high biomass producing species such as, Indian mustard (*Brassica juncea*) or maize (*Zea mays*) (Brown *et al.*,1995).The selection of phytoremediating species is possibly the single most important factor effecting the extend of metal removal. Ecosystem pollution must be also considered when selecting remediating plants. The advantages of phytoremediation are the cost of the phytoremediation is lower than that of traditional processes, the possibility of the recovery and re-use of valuable metals (by companies specializing in "phyto mining"), it preserves the top soil, maintaining the fertility of the soil, Increase soil health, yield, and plant phytochemicals the use of plants also reduces erosion and 6 metal leaching in the soil. It employs the potentials of plant roots to absorb nutrients from wastewater. Plant species selected for phytoremediation have the ability to accumulate specific or wide range of pollutants. Phytoremediation is a bioremediation process that uses various types of plants to remove, transfer, stabilize, and/or destroy contaminants in the soil and groundwater. In this process, the plant releases natural substances through its roots, supplying nutrients to microorganisms in the soil. In this process, the plant releases natural substances through its roots, supplying nutrients to microorganisms in the soil. Phytoremediation technology includes; (a) Phytostabilization, where contaminants are retained in the soil, (b) Phytodegradation; where organic contaminants are converted to less harmful substances,(c) Phytovolatilization; contaminants are converted inside plants to a gaseous state and released into the atmosphere by evaporation, (d) Phytoextraction; plants are used to accumulate contaminants in the above ground, harvestable biomass. Phytoremediation is a plantbased approach, which involves the use of plants to extract and remove elemental pollutants or lower their bioavailability in soil. Plants have the abilities to absorb ionic compounds in the soil even at low concentrations through their root system. Pollutants taken by plants during phytoremediation can easily be returned to the target environment by postmortem decomposition, thereby degrading the efficiency of the remediation process. Effective management of plant biomass after remediation is therefore necessary. Plant roots stabilize soil and prevent movement of pollutants via runoff and windblown dust. The technique uses plants and natural resources and is therefore generally less expensive. The remediation is done in place, saving transportation and off-site processing costs. Mercury, lead, and arsenic are metals that cause contamination and harm to the environment. Contaminants can affect humans through air pollutants, consumption of contaminated drinking water, and exposure to contaminated soils. Pollution of water sources, increased toxicity in plant and animal life, air pollution. So, we can make a solution by phytoremediation.

OBJECTIVE OF THE STUDY

Objective of study is to assess the phytoremediation capacity of the plant *Canna indica* L. Culturing of this plant was done in domestic sewage water. Waste water quality was analyzed before and after treatment by analyzing physical chemical properties. In order to know improvement in quality of wastewater different physical chemical parameters was analyzed.

2. REVIEW OF LITERATURE

Gersberg (1983) reported Artificial wetlands are ideal for the removal of nitrate from secondary wastewater effluents at high rates; instead of methanol as carbon supply plant biomass was applied to surface of marsh beds, as an alternative for energy effective treatment of municipal and agriculture waste water effluents. Gersberg (1986) recorded aquatic plants in waste water treatment by artificial wetlands quantitatively assess the role of each of three aquatic plant types, *Scirpus validus* (bulrush), *Phragmites communis* (common reed) and *Typha latifolia* (cattail), in the removal of nitrogen BOD and TSS from primary municipal waste waters. Results demonstrated that higher plants play a significant role in secondary and advanced waste water treatment by wetland system. Tripathi *et al.*, (1991) reported the pollutant removal efficiency of certain macrophytes and algae, such as *Eichornia crassipes*, *Microcystis aeruginosa*, *Scenedesmus falcatus*, *Chlorella vulgaris* and *Chlamydomonas mirabilis* has been tested in laboratory conditions to evaluate their potential role in wastewater treatment. Sewage of Varanasi city, mixed with effluent from small scale industries was used for the test. An investigation was done in three stages, followed by an algal culture and then finally a Water hyacinth culture. This three stage aquaculture showed very high reduction of BOD, suspended solute, and total alkalinity, acidity, COB, hardness and coliform bacteria. An increased in the concentration of dissolved oxygen was also observed. Stephen *et al.*, (1996) conducted a study on the phytoremediation efficiency of three species of *Brassica* (*B. napus*, *B. rapa*, *B. juncea*) and they reported that the plants showed sufficient tolerance and metal accumulation to be used to phytoremediation site contaminated with heavy metals Zn and Cu. The *Brassica napus* were more effective in removing Zn from the nutrient solution than Cu. Brix (1997) reported that aquatic plants usually growing in wetlands are called as macrophytes. These can be aquatic vascular plants, aquatic mosses and larger algae. Macrophytes helps in stabilizing surfaces of beds, provide filtration facilities, surface area for microbial growth and nitrification. Macrophyte mediated transfer of oxygen to the rhizosphere by leakage from roots increases aerobic degradation of organic matter and nitrification. Macrophytes provide habitat for 10 wildlife and making wastewater treatment aesthetically pleasing.

3. Material and Methodology

Phytoremediation of domestic wastewater was done by using plant *Canna indica* L. The domestic water collected from Vivekanand College Botany lab. The work was done during September. October, November December and January 2023.

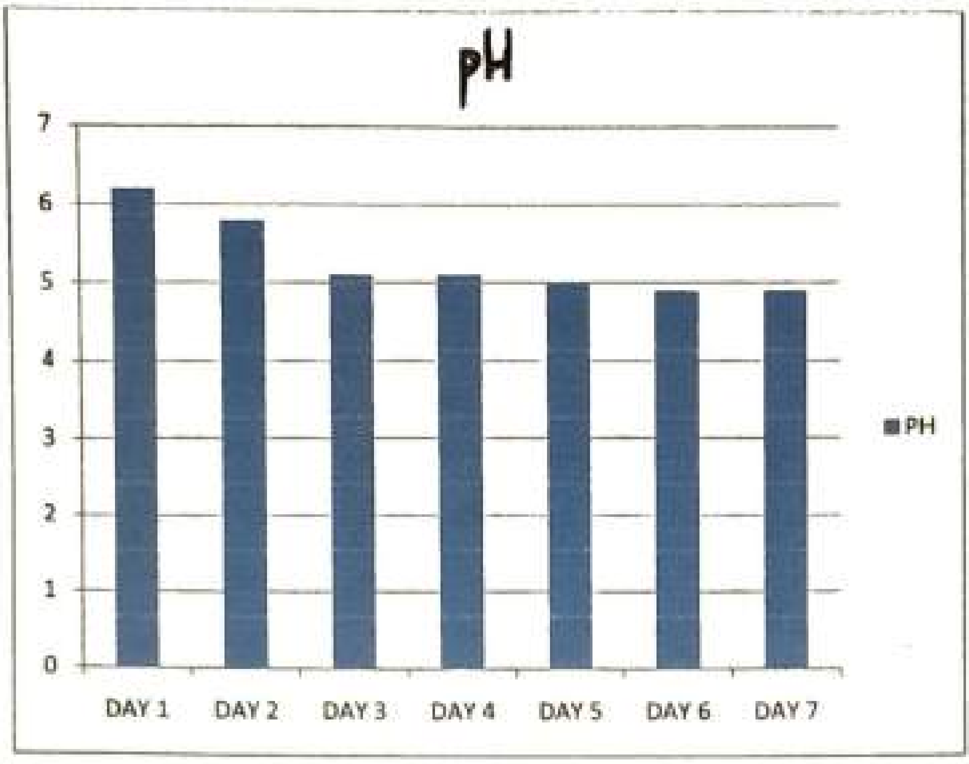
Experimental set up: The plants were collected from nearby areas, then they are washed thoroughly with tap water to the prior to the experiment. Collected plants are grown in 250 ml beakers filled with wastewater. The above setup was kept for 7 days and sample analysis was done. The parameters taken for assessment were pH, Electrical conductivity, total dissolved solids, COD, alkalinity and acidity. Water must be tested with different physical-chemical parameters. Selection of parameters for testing of water is solely depends for what purpose we going to use that water and what extent we need its quality and purity (Patil P.N *et al.*, 2012). Some physical test should be performed for testing of its physical appearance such as temperature, color, odour, pH, TDS etc. while chemical tests should be performed for its COD, alkalinity, acidity etc. The results of the analysis of wastewater samples are expressed in terms of physical and chemical units of measurement. The concentration of physical and chemical pollutants in domestic waste water is quite variable and particular dependent upon local conditions. Samples were collected and analyzed for physico-chemical parameters by adopting the standard methods foe examination for water and waste water (APHA 1985).

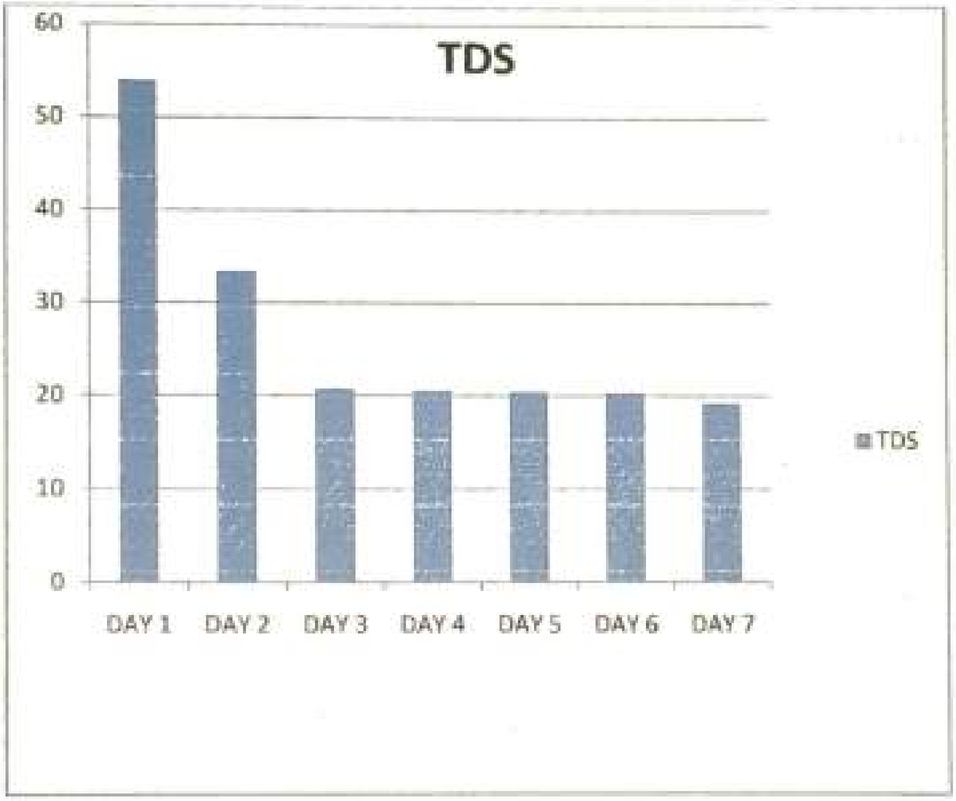
Rollie *et al.*, (2007) studied the efficiency of aquatic macrophyes *Spirodela polyrhiza* as phytotool for remediation of zinc from synthetic effluent. Regular harvest of the plants at regular intervals helped to clean up the enviorment. Harvested biomass was used for composting. Kejian *et al*., (2008) reported the concentration of heavy metals in the leaves of two aquatic plants *Potamogeton pectinatus* L. and *Potamageton malaianus* Miq, was studied by taking samples from Donghe River, China which is contaminated due to industrial activites. Result showed that highest concentrations of Cd, Pb, Cu, Mn and Zn were found in the leaves of *Potamogeton pectinatus*. The potential use of these two plants in wastewater treatment is worth further exploration. Bhupinder *et al.*, (2009) studied Role of both aquatic and terrestrial plants in phytoremediation of various contaminants and role of aquatic macrophytes in phytoremediation technologies with due importance to each group irrespective of being free floating, submerged or emergent. Aquatic macrophytes represent diverse groups with an immense potential for removal of variety of contaminants including heavy metals, inorganic or organic pollutants, radioactive wastes and explosive. Raju *et al.*, (2010) reported Phytoremediation of domestic waste water by using aquatic 12 angiosperm, *Lemna minor* to remove organic and inorganic pollution load of domestic waste water. The domestic wastewater quality analysis was done before and after culture. The increases in biomass of Lemna minor and the physicochemical analysis have proved that *Lemna minor* is a suitable aquatic plant for phytoremediation of domestic wastewater which improved the quality of wastewater by absorbing organic and inorganic pollutants Role of wetland plants in reducing contaminates loads in water and sediments includes metals, volatile organic compounds, pesticides. Physico- chemical properties of wetlands provide many attributes, the expensive rhizosphere of wetland herbaceous shrub and tree species provide an enriched culture zone for microbes involved in degradation (Williams 2010). A study of Physico-chemical parameters of Tamadalage water tank in Kolhapur district, Maharashtra was done by Manjare *et al.*, (2010) monthly changes in physical and chemical parameters such as water Temperature, Transparency, Turbidity, Total Dissolved Solids, pH, Dissolved Oxygen, Free Carbon Dioxide And Total Hardness, Chlorides, Alkalinity, Phosphates and nitrates were analyses for a period of one year. All parameters were within permission limits. The results indicates the tank is non-polluted can be used for domestication and irrigation. Eleni *et al.*, (2011) reported that halophytes plants tolerate other stresses including heavy metals. It has shown that salt tolerant plants may also be able to accumulate metals. Some halophytes use excretion processes in order to remove the excess of salt ions from their sensitive tissue also

Cunningham *et al.*, (1997) reported phytoremediation is a fledging technology intended to address a wide variety of contaminants. Phytoremediation has limitation in that plants are living organisms with specific oxygen, water, nutrients, and pH limits that must be maintained. Despites these limitations may forms of phytoremediation have emerged from laboratories and are currently in practice. Bringing multi disciplinary teams of biologists, chemists, engineers, as well as lawyers, accountants and public advocates can be help in giving solutions and possibilities for continued application of phytoremediation. Chandra *et al.*, (1997) explained the ability of aquatic plants to absorb, translocate and concentrate metals has lead to the development of various plant based treatment systems. The potential to accumulate Chromium by *Scripus lacustris*, *Phragmites karka* and *Bacopa monnieri* was assessed by subjecting them to different chromium concentration under laboratory conditions. The plants were then harvested and used for biogas production. Wetlands of wastewater treatment focus mainly of use of wetlands and their functioning constructed wetlands reported by Verhoevena *et al.*, (1999) reported designed to remove more than 90% of BOD,COD, suspended solids and bacteriological pollutions from through flowing wastewater. Stottmeister (2003) explained the mechanism of both plant in constructed wetland and the microorganism in the root zone which come in play when they remove contaminants from wastewater. Uptake of nutrients and direct degradation of pollutants with the help of oxygen plays a crucial role in the activity of microorganisms. Jae-Min *et al.*, (2004) reported Indian mustard (*Brassica juncea*) has been effective in accumulating high tissue concentrations of lead when grown in contaminated soil with addition of chelating agent, such as EDTA. Addition of electric field around plant is an approach to increasing the uptake of lead. The effect of a range of parameter such as operating current with different concentration, application time of EDTA and electric potential, and daily application time of electric potential were studied. Zaimoglu (2006) reported that constructed wetland is a popular treatment method for different sources of wastewaters, being an alternative to conventional wastewater treatment methods that have operational and financial restrictions, especially for decentralized wastewater systems. A pilot scale, continuous flow, subsurface flow wetland was constructed at Cukurova University, Turkey. Pandey *et al.*, (2007) conducted a study on phytoremediation of heavy metals like $CdCl2$ and $PbCl2$ using the plant *Catharanthus roseus*. It was concluded that the toxic effects of cadmium and lead with respect to *Catharanthus roseus* was maximum during germination and plant become more resistant to these heavy meals as it attains maturity. This plant seems to be cadmium accumulator and lead avoider. Rollie *et* disorders observed both in human and livestock due to metal toxicity. Finding the suitable hyperaccumulation plant species is of first and foremost step for successful application of this economically useful technology. The study involved by Ugya (2015) assessed laboratory experiment on the use of *Lemna minor*.L. in the phytoremediation of a stream polluted by wastewater from Kaduna Refinery and petrochemical after the treatment. The experiment lasted for three weeks and rate of reduction was recorded. *Lemna minor* was used effect in the treatment of Kaduna Refinery Waste Water there by reducing the toxicity on the flora and fauna since it is able to remove and degrade pollutants presents in the streams to a significant level in all point. Phytoremediation of waste water using three aquatic plants were analyzed by Gupta *et al.*, (2015) Vertiver Grass, *Hydrilla* and water hyacinth. Minewater, municipal wastewater and tap water were compared by different combination of materials taken. Experimental proved that the significant reduction in pH ,nitrate ,Sulfate, Iron With Vertiver Grass, *Hydrilla* and water hyacinth in all water samples taken for study. Based on the studies by Phukan *et al* ., (2015) on *Hydrilla verticilliata*, it was shown that this plant can be used as possible application in reclamation and revegetation of adversely affected environments, it is been suggested as a cheap technology of chromium and cadmium from polluted water . Irshad *et al.*, (2015) investigated the removal potential of heavy metals by native species, *Cannabis sativa* L,. *Chenopodium album* L., *Datura stramonium* L., *Sonchus asper* L., *Amarathus viridus* L., *Oenothera rosea* (L Her), *Xanthium stramonium* L., *Polygonum macalosa* L., *Nasturtium officinale* L. and *Conzya Canadensis* L. growing at municipal waste water site in Pakistan. Majority of species accumulated more heavy metals in roots than shoot. Higher accumulation of heavy metals in these plant species signifies the application of these species for 16 phytostabilization and phytoextraction of heavy metals from polluted sites Ranjitha *et al.*, (2016) reported that hydrophytes are used as an indicator for the removal of heavy metal from industrial effluents. The concentration of chromium, lead, and cadmium before and after treatment were analyses using atomic absorption spectrophotometer (AAS).The result revealed that *Salvinia molesta* can grow healthy with the accumulation of these metals. Kouame *et al.*, (2016) studied the Phytoremediation potential of water hyacinth and water lettuce on reduction of wastewater toxicity was done. Toxicity test were performed in an aquarium with a population of *Sarotherodon melanotheron* contaminated by different concentration of wastewater before and after phytoremediation with *Eichhornia crassipes* and *Pistia stratiotes*. After phytoremediation, result showed that *Eichhornia crassipes* can maintain the fish life beyond 24 hours of exposure.

macro algae species to absorb the organic and inorganic pollutants. Some algae are characterized by fast growing rate which is advantage for phytoremediation, but there are also other factors which limit the efficiency of phytoremediation of contamination sites. According to Kumar *et al.*, (2013) explained Plants in urban areas plays an important role in cleanse the pollution in human enviornment. The choice of eco-friendly plant species mainly local and exotic species and their right placement in urban environment to overcome the air-borne particulate pollution problems etc. Inclusion of ornamental plants having pollution mitigating ability in the landscape plan will serve the dual purpose of cities green and pollution free. Studies on potential use of water hyacinth, *Pistia* and *Azolla* by Deshmukh *et al.*, (2013) find out municipal waste water treatment or sewage purification were tested on laboratory scale. It was found that water hyacinth was significantly more effective than *Azolla* and *Pistia* in municipal waste water treatment. The use of such free floating macrophytes for treatment of urban sewage is viable option. Prasannakumari *et al.*, (2014) explained metal accumulation efficiency of selected macro flora associated with Poovar estuary. *Cyperus tenuispic*, *Bacopa monnieri* (L.) Pennell, *Mariscus javanicus* (Houtt.) Merr & Metc and *Acanthus ilicifolius* L. were collected from Poovar estuary and subjected to various elemental analyses such as Copper, Zinc, Cadmium, Chromium and Lead. All the macrophytes were efficient accumulators of all these metals and could be used as bioindicators for metal pollution. The report of Nurkhasanah *et al.*, (2014) reported that water quality affects the body conditions of aquatic organisms. The study was to find out the best aquatic plants to reducing metabolism residues from aquatic organisms. 5 aquariums containing 4 different plants in each such as water Hyacinth, *Salvinia* ,*Cabomba*, and *Hydrilla*, last one with 13 goldfish was maintained. The result of survival rate of goldfish for all treatment is 100%. Based on this study best aquatic plants top reduce metabolism was *Hydrilla*. Sharma *et al* ., (2014) explained the concepts of using plants to clean up contaminated environment was not new, about 300 years ago, plants were used in treatment of wastewater and land pollution by heavy metals. In developing countries like India, China, Pakistan, Bangladesh soil and water pollution is severe where small industrial sub units are pouring their untreated effluents, the use of plant species for cleaning polluted soil and water named as phytoremediation has gained increasing attention as an emerging cheaper technology. Traditional methods of remediation have many real 15 risks, both to human and environmental health that must also considered. Mandal *et al* ., (2014) reported that heavy metal contamination is to be concern due to widespread reports emanating from India and all over the world and about various diseases and excreted by salt glands or trichomes a novel phytoremediation process called phytoextraction. So these halophytes are commonly selected for phytoextraction processes. Hussian *et al.*, (2011) investigated the heavy metal accumulation potential and medicinal property of *Bacopa monnieri* (L) Pennell. The plant was cultivate in medium artificially contaminated with macro quantities HgCl2 and CdCl2. Bioaccumulation of Hg and Cd reveals the phytoremediation potential of plant while the bioaccumulation property is hazardous to health since plant is highly medicinal and important ingredient of many ayurvedic preparations'. Saravanakumar *et al.*, (2011) studied the groundwater quality of Ambattur industrial area in Chenni city. The parameters suchas pH, total alkanity, total hardness, turbidity, chloride, sulphate, fluoride, 13 total dissolved solids and conductivity were studied. It was observed that there is slight fluctuation in the physico-chemical parameters among water sample studied. It was observed that there is slight fluctuation in the physico- chemical parameters of water sample with who and icmr limits showed that the ground water is highly contaminated and account for health hazards for human use. Patil *et al.*, (2012) studied the physical chemical parameters of water samples. Physical chemical parameters such as color, temperature, acidity, alkalinity, hardness, pH, sulfate, chloride, DO, BOD, and COD used for testing water quality. Water analysis reports with parameters have exploring parameters have been given for exploring parameter study. Guidelines for different physical chemical parameters also have been comparing the value of water sample Gupta et al., (2012) reported that phytoremediation is a cost effective technique compared to other methods. Various contaminants and physical parameters have been observed with water hyacinth, water lettuce, and Vetiver grass. The role of these plant species, origin and their occurrence, discussed and it has been observed that phytoremediation of wastewater using the floating plant increases biodiversity. The removal efficiency of contaminants like TSS, TDS, BOD, COD, EC, hardness, heavy metals etc varies from plant to plant. Melinda *et al.*, (2013) studied Green technology that involved tolerant plant has been utilized to clean up soil and ground water from heavy metals and other organic toxic compounds. Coasts of using plants along with other concern like climatic restrictions can limit growth of plants. Benefits of using phytoremediation to restore balanced to stress environment, the largest barrier to advancement of phytoremediation are public opposition. The long term implication of green technology is removing or sequestering environmental conditions must be addressed thoroughly. It is important to proceed with care with all new technologies. Role of algae in phytoremediation for absorption of heavy metals explained by Chekroun *et al.*, (2013). There are different techniques used in bioremediation and ability of some micro and

A. PHYSICO-CHEMICAL ANALYSIS OF DOMESTIC WASTE WATER TREATED WITH *Canna indica* L. :





	pH	TDS	CONDUCTIVITY	ACIDITY	ALKALINITY	COD
DAY 1	6.2	53.9	70	40	120	5.8
DAY 2	5.8	33.4	41	21.3	17	142
DAY 3	5.1	20.79	27	18	8	188
DAY 4	5.1	20.6	26.5	15.6	7.8	161
DAY 5	5	20.51	26.1	13.5	7.1	153
DAY 6	4.9	20.3	25.4	12.6	6.4	139
DAY 7	49	19.25	25	10	6	124

TABLE 1: Chemical analysis of water sample after treated with plant *Canna indica* L.

Fig. 1: Experimental set-up for phytoremediation with *Canna indica* L. plant

4. Result and Discussion

❖ RESULT:

Phytoremediation of wastewater was done using *Canna indica* L. The results of the study are given in table 1. Different parameters showed gradual change after treatment with the plant. In this study the plants the plant *Canna indica* L. are collected from Kolhapur region. Both physical and chemical parameters were observed. Odour in domestic wastewater was caused due to decomposition of organic matter or from the substances added to the wastewater. There has been change in odour of waste water after the treatment with the plant. Colour of the wastewater which is typically of grey in color has been changed to normal. In the chemical and biological activities of water bodies, temperature place in wide. It always got influenced by external environmental conditions. So, there is radiation in temperature values in the culture of the plant. Conductivity of water depends upon concentration of the salt ions and water temperature. Electrical conductivity of water helps to indicate waters purity. The pure water always has lower conductivity. As the concentration of dissolved ions increases, the ability of water to conduct electrical current also increases. It has been observed that, the conductivity got reduced in wastewater treated with *Canna indica* L. Total dissolved solids (TDS) value is an important parameter in drinking water and other quality standards. In the present study, TDS value had decreased from the first day in treated water. pH in water gives a straight picture of its acidic or alkaline nature and considered to be a significant parameter in water quality assessment. In the present study, slight variations were observed in pH values. pH values after treatment was decreased slightly. pH values got increased in first few days then it got reduced with slight variations. Acidity is the quantitative capacity of aqueous media to react with OH^- ions or to accept electrons. In present work, acidic value gradually decreased after treatment of seven days. Total alkalinity is a measure of the buffer capacity of the water. In general, alkalinity should not be less than 30 mg/L and values higher than 400 to 500 mg/L are considered too high. Alkalinity after the treatment was reduced due to the absorption of dissolved solids. COD is a measurement of oxygen consumed during the oxidation of oxidizable organic matches by using a strong oxidating agent. The higher value of chemical oxygen demand indicates that higher organic pollution in water sample. After treatment with plant, COD values have increased from the day of treatment.

in blank and sample titrations. The quantity of potassium dichromate used in reaction is equivalent to the oxygen used to oxidize matter of wastewater.

MATERIALS REQUIRED:

- Reflex apparatus
- Nessler's tube
- Erlenmeyr flasks
- Hot plate
- Lab glassware
- REAGENTS:

Potassium dichromate
Standard ferrous ammonium sulphate
Ferroin indicator
Mercuric sulphate
Silver sulphate
Conc. H_2SO_4

Procedure:

Pipette out 20 ml of sample in reflexing flask. Add 10 ml of Potassium dichromate solution. Pinch of Silver sulphate, 0.4 Mercuric sulphate. Then slowly add 30 ml of conc. H2SO4 into it and heat for 2 hours using condenser. Cool and wash down the condenser with distilled water. Dilute it and titrate against ferrous ammonium sulphate using ferroin as indicator. The end point is the appearance of red color in one drop of the titrant. Note down the titrate value. Reflex blank in the same manner using distilled water instead of sample.

Calculation:

$$COD = \frac{(\text{Vol. of Mohrs salt in blank- Vol. of Mohrs salt in sample})\ 8 \times \text{Normality} \times 1000}{\text{Volume of sample taken}}$$

neutralizing samples of pH 4.3. The CO_2 and bicarbonates present in the sample can be neutralized by continuing the titration of pH 8.3. Since, CaCo3 has an equivalent weight of 50, N/50 NaOH is used as titrating agent that 1ml N/50 NaOH till faint pink colour appears.

Calculations: Acidity = $\frac{\text{Volume of NaOH in ml} \times \text{Normality of NaOH} \times 50 \times 1000}{\text{Volume of sample taken in ml}}$

(ii)ALKALINITY: The alkanity of water is a measure of its capacity to neutralize acids. Alkalinity is a measure of ability of water to absorb hydrogen without significant pH change. That is, alkalinity is a measure of buffering capacity of water. It is sum of all titrable bases. Also alkanity is a measure of a solutions capacity to react with strong acids (usually sulfuric acids H_2SO_4 or hydrochloric acid HCl) to a predetermined pH. The alkalinity of a solution is usually made up of carbonate, bicarbonate and hydroxides. Similar to acidity, the higher the alkalinity is, the more neutralizing agent is needed to counteract.

Apparatus required: Pipette, Burette, Conical Flask, Beakers.

Procedure: Pipette out 20 ml of sample into conical flask. Add 2-3 drops of phenolphthalein indicator. To this, add 3 drops of methyl orange indicator and titrated against hydrochloric acid. The end point is the appearance of faint orange color.

Calculations: Alkalinity = $\frac{\text{Volume of HCl in ml} \times \text{Normality of HCl} \times 50 \times 1000}{\text{Volume of sample used in ml}}$

b) CHEMICAL OXYGEN DEMAND (COD): COD is a measure of oxygen consumed during the oxidation of the oxidizable organic matters by using a strong oxidizing agent. COD is used to determine the quality of pollution in water after Waste water treatment. The higher the value of chemical oxygen demand indicates the higher organic pollution in water samples. COD is recommended where the polluted water has toxicity and organic matter can't be determined by biological oxygen demand.

Principle: The organic matter, present in water sample in oxidized by potassium dichromate in the presence of sulfuric acid to produce carbon dioxide and water. The quantity of potassium dichromate used is calculated by difference in volumes of ferrous ammonium sulfate consumed

(d) ELECTRICAL CONDUCTIVITY: Electrical conductivity of water is its ability to conduct an electrical current or it is the numerical expression of waters ability to conduct the electricity. Salts or other chemicals that dissolved in water can break down into positively and negatively charged ions. These free ions in water conductance. Electrical conductivity of water helps to indicate the waters purity. The pure water has lower conductivity. Conductance is defined as they reciprocal of resistance involved and expressed into mho or Siemens. Material required: sample water and conductivity meter Procedure: The electrode of the conductivity meter is dipped in water sample and reading was noted for stable values shown in ms/cm.

- **CHEMICAL ANALYSIS OF WATER SAMPLE**:

e) pH ANALYSIS: the term pH stands for the power of hydrogen and is measurement of hydrogen ion activity in a solution. The hydrogen ion concentration is very difficult to measure directly. Instead, its activity is measured indirectly by the use of specific electrodes in a solution i.e. a standard sensing electrode and a reference electrode. These electrodes are conveniently put together to make pH probes. The electrical potential between these two electrodes in a sample is measured and by comparing these with known pH samples(buffers). pH measured on a scale of 0 to 14 with lower values indicating high hydrogen ion activity(more acidic) and high values indicating low hydrogen ion activity (less acidic). A pH 7 is neutral.

Procedure: 1. Read carefully the operational manual pH meter to be used. 2. Calibrate the pH meter against standard buffer solution of pH 4.0, 7.0 or 9.2 according to the requirements. 3. Wash the electrode and placed in buffer solution pH 7.0 and move the temperature knob to the 22 required or room adjusts the meter accordingly. 4. Wash the electrode with distilled water dip the electrode in buffer of pH 4.0 and move the knob to adjust the marker accordingly. 5. Wash the electrode, dip the electrode in buffer of pH 9.2 and adjust the knob. 6. Wash the electrode with distilled water once again and placed the sample to be analysed and noted down the pH of the samples.

(f) ACIDITY: Acidity of water is its quantities capacity to react with a strong base (usually sodium hydroxide, NaOH) to a designated pH. This is based on total acidic constituent of a solution (strong and weak acids, hydrolyzing salts). There are two types of acidity: Methyl orange acidity is also known as mineral acidity and phenolphthalein acidity or CO_2 acidity. The concentration of mineral acids contributing mineral acidity can be calculated by titrating or

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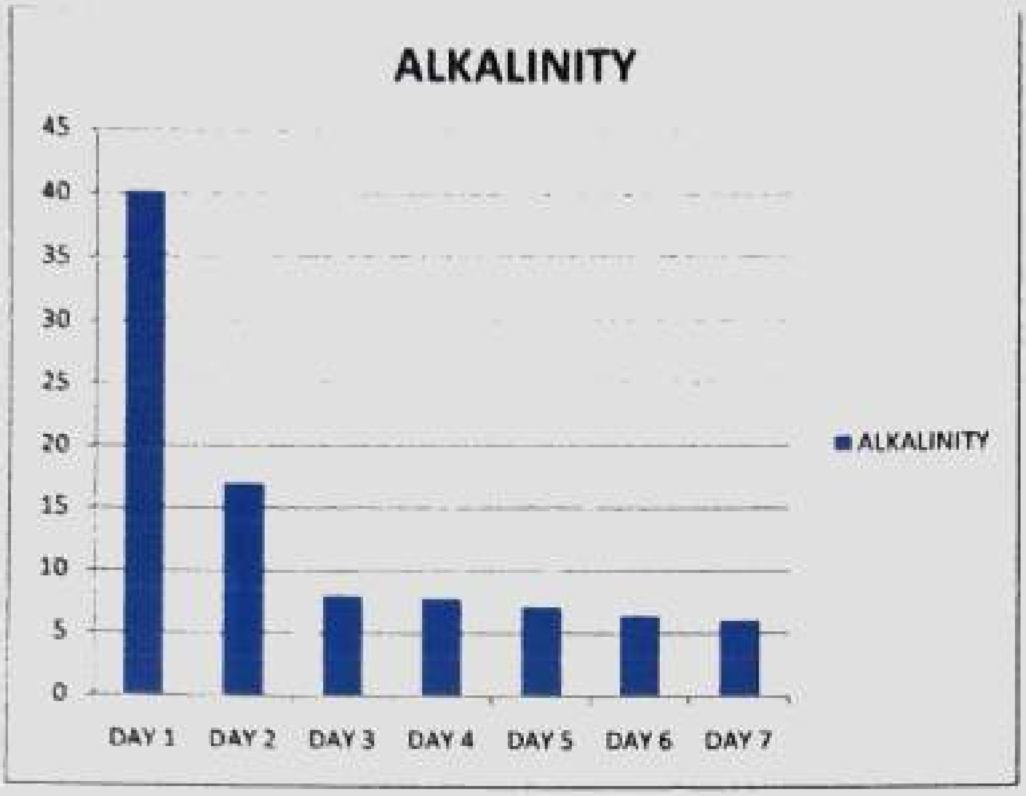
5. CONCLUSION

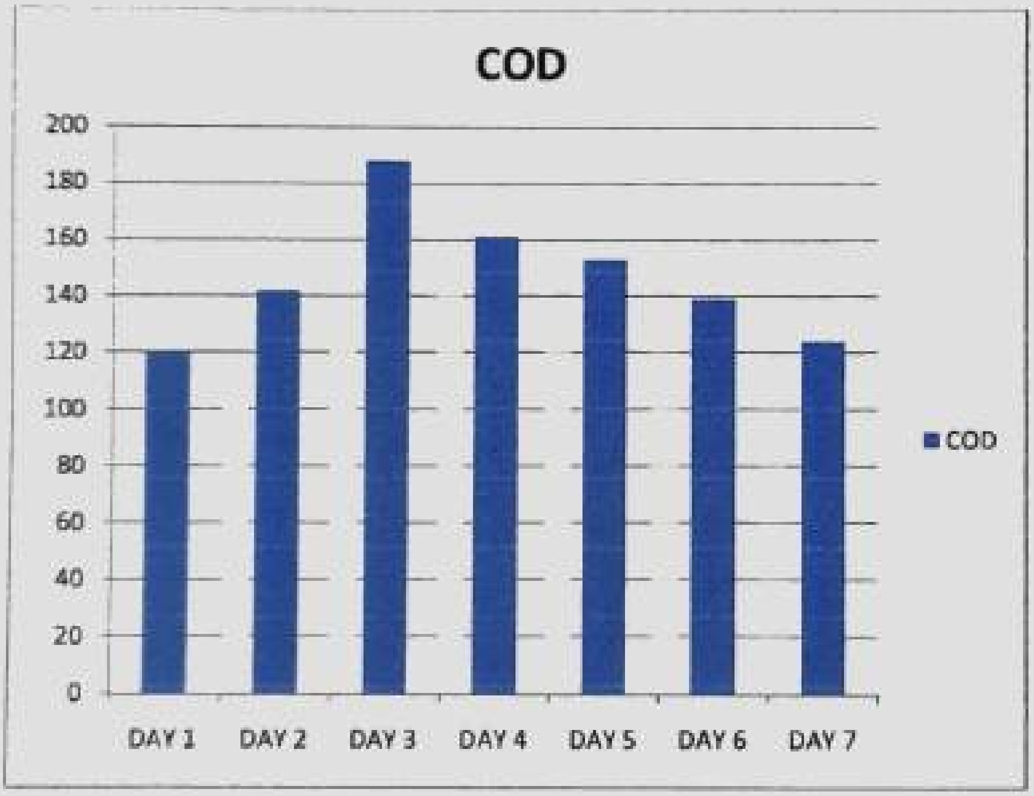
Phytoremediation is the use of plants for the Environmental Restoration is an emerging technology for remediation of contaminated water. In the present work, an attempt has been made to clean up the domestic wastewater by using this technology. Phytoremediation of domestic wastewater was done using *Canna indica* L. The plants are collected from local water bodies. Waste water was collected from local household. Plants are collected and grown in 250 ml wastewater and kept for 7 days and used for analysis. Both physical and chemical analysis was done. pH, electrical conductivity, total dissolved solids, COD, alkalinity and acidity where parameters taken for assessment. It has been observed that physical parameters have been changes from first day analysis onwards. The color of domestic wastewater which was black in color has changed to light grey in colour, similarly the odour of water has been decreased. pH analysis had shown that values has been changed after the treatment similarly both TDS and conductivity has decreased there values. Chemical parameters like acidity, alkalinity and COD also decreased after treatment. The present study reveals that plants ability for remediation of contaminated water. Also artificial wetlands can be constructed and these plants can be grown and helps in recovering wastewater. Mainly water coming from households can be treated and can be used for other purposes. This method is economically cheap and useful to common people.

❖ DISCUSSION:

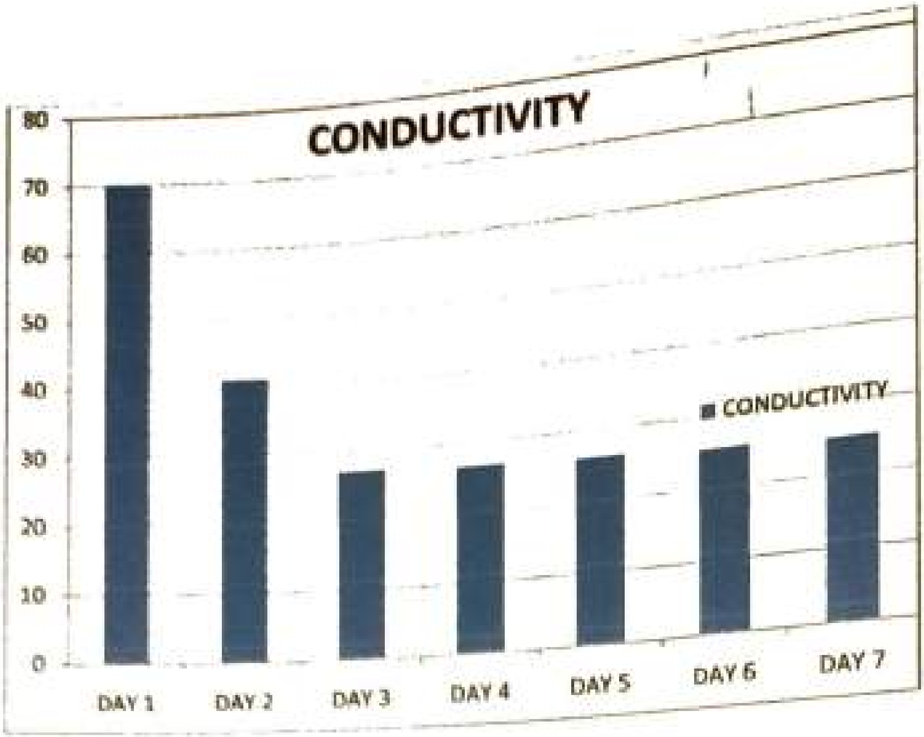
Phytoremediation of domestic sewage water was done by using the plant *Canna indica* L. Different parameters showed a gradual decrease after the treatment. The physical and chemical characters worship and absurd during those days of treatment. Temperature of water is an important parameter, which place a vital role in Aquatic system. Temperatures always get influenced by external environment. Electrical conductivity of water on the first day was higher, but after the treatment with *Canna indica*, there was a significant decrease in the electrical conductivity values. Electrical conductivity of water is dependent upon the concentration of dissolved ions and water temperature. As the concentration of dissolved ions increases, the ability of water to conduct electric current also increased. With decrease in concentration of dissolved ions and water temperature due to treatment with *Canna indica* L. electrical conductivity decreased. Total dissolved solids content of water is defined us residue which is left upon evaporation at 103 degree celsius to 105 degree Celsius. It is aggregated amount of enter floating, suspended and dissolved solids present in water sample. TDS value concentration of dissolved solids is an important parameter in drinking water and other water quality standards.TDS values exhibited has been decreased after the treatment. pH measurement in water gives a straight picture of its acidic or alkaline nature and considered to be significant parameter in water quality assessment. In the present study, slight variation was observed in pH values. Variation in pH values was due to the dissolution of solids. Acidity level in wastewater indicates its corrosive properties and can take leading roles in regulating biological processes as well as in chemical reaction. Alkalinity, too contributes to the property of wastewater, which also affects many biological processes and chemical reactions. It is possible to have highly acidic water but how moderate pH values. Similarly, the pH of a sample can be very low but have a relatively changes due to the planned capability to absorb the pollutants of water. In general, alkalinity should not be less than 30 ml per liter and values than 400 to 500 mg per liter are considered to be high. Also the chemical oxygen demand of water was decreased after the treatment with the plants and this indicate the wastewater has undergone.

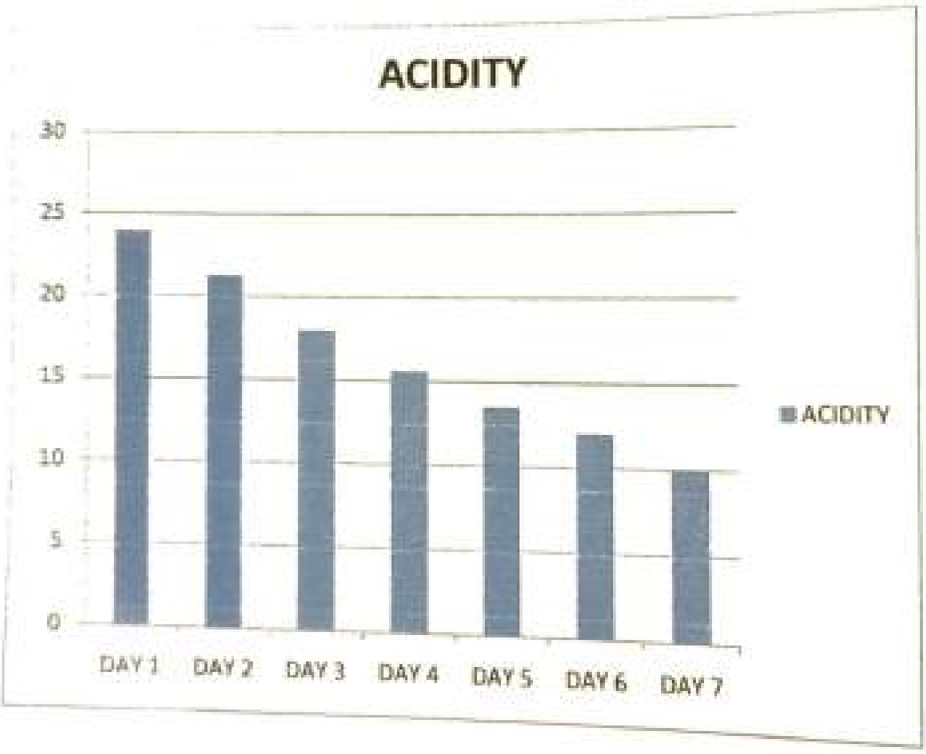


ALKALINITY
45
40
35
30
25
20
15
10
5
0
DAY 1
DAY 2
DAY 3
DAY 4
DAY 5
DAY 6
DAY 7
ALKALINITY



COD
200
180
160
140
120
100
80
60
40
20
0
DAY 1
DAY 2
DAY 3
DAY 4
DAY 5
DAY 6
DAY 7
COD


CONDUCTIVITY
80
70
60
50
40
30
20
10
0
DAY 1
DAY 2
DAY 3
DAY 4
DAY 5
DAY 6
DAY 7
CONDUCTIVITY


ACIDITY
30
25
20
15
10
5
0
DAY 1
DAY 2
DAY 3
DAY 4
DAY 5
DAY 6
DAY 7
ACIDITY

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