Removal of Iron and Manganese from Ground Water by making use of Low-Cost Adsorbents: Methodology with reading.

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ABSTRACT

Sustainability of good health depends upon the purity of water. However groundwater may be exposed towards to contamination by various anthropogenic activities such as agricultural, domestic and industrial. Groundwater quality problem are typically associated with high level of iron concentration.

Iron is a worldwide observed public health problem. One of the major sources of iron is drinking water. Excess concentration of iron creates major issues related to the public concerned. The acceptable limit of iron is 0.3 mg/L according to the guidelines WHO guidelines. In developing countries like India removal cost of metal ions like iron is the major factor of consideration. Adsorption is one of the cost effective method adopted globally because of its ease to use and preparation. This review focused on the different used adsorbents for the removal of iron by using method of adsorption. Utility of different material of various plants, agro- wastes, other bio-masses as bio adsorbents are over viewed with its different parameter.

Keywords: removal of iron and manganese from water, Column Adsorption, natural materials, Vachellia Nilotica, Drinking Water

INTRODUCTION

1.1 Minerals in Maharashtra-Distribution, Location & List of Mines

The Deccan Plateau encircles a sizable portion of Maharashtra. These have squeezed the prehistoric rocks of Maharashtra. Because of this, Maharashtra does not have a lot of mineral resources. There are only mineral resources in 12.33% of the total area. Maharashtra's mineral riches are also distributing dinanunevenway.Only11ofthestate's 36 districts have a high concentration of minerals. Maharashtra ranks 11th in the nation for mineral production, contributing 4.03 percent of the nation's total mineral production.

Maharashtra's share of the total mineral production in the country is 4.03 percent. In the 2010-11 financial years, it was the leading producer of fluorite (graded) in the country.

1. Maharashtra was the country's largest producer of manganese ore & kyanite accounting for 21.63 percent and 36.31 percent of the total production respectively.
2. Among all of Maharashtra's other significant natural resources, the State reported increased production of kyanite, iron ore, manganese ore, and bauxite in 2010–11, but fireclay, fluorite, and sillimanite output decreased by 54.57 percent,48.25 percent, and62.07 percent, respectively.
3. No production of chromite took place during the year under review. Corundumandlatite have been discovered.
4. The production value for the financial year 2010-2011wasestimatedat 317.31crores. In the 2010-11 financial years, 157 mines were reported, down from 158 the previous year.
5. The production index for minerals found in Maharashtra in 2010–11 was 193.3, down from 200.09 (base: 1993–94 = 100).

Table No.01 Fe and Mn storage in Tonnes from Maharashtra

Sr.No.	Mineral	Total Reserves(Million Tonnes)
1	Iron Ore	260.824
2	Mangnese Ore	20.853

Minerals are mainly found in the Vidarbha basin and Konkan in Maharashtra. The mineral resources of Maharashtra are mainly concentrated in East Vidarbha, Konkan and South Maharashtra. In East Vidarbha, Chandrapur Gadchiroli Bhandara Nagpur Gondia and Yavatmal are the main areas of mineral resources.In Konkan and South Maharashtra, the districts of Ratnagiri, Thane, Raigad, Sindhudurg, and Kolhapur are the main areas

1.2 Administrative Division Wise Distribution of Minerals

Below we have provided the Distribution of Mineral Resources in Maharashtra by Administrative Division:

Table No.02 Mineral distribution in Administrative divisions of Maharashtra

Administrative Division	Percentage of Distribution (%)
Nagpur	60
Amravati	10
Konkan	20
Aurangabad	5
Pune	3
Nashik	2

Table No.03 Fe and Mn Ores Reserves in Maharashtra

Sr No	Minerals	Reserve%
1	Manganese	40
2	Bauxite	21
3	IronOre	20

1.3 Iron and Manganese Minerals Wealth of Maharashtra

Major minerals in Maharashtra are manganese,iron ore,bauxite,dolomite,chromite, kyanite and sillimanite, limestone and other minerals.

Table No.03 Minerals in Maharashtra:

1.4

No.	Minerals	Important Information	Location	Mines
1	**Ironore**	Ironorereserves in India are approximately 1346 crore tonnes.20percent of these reserves are found in Maharashtra. Agoodvarietyof iron ore is associated with the rocks of the Dharwad group. Hematite type of iron ore is found in Maharashtra and these minerals are extracted from open pit mines.	**East Vidarbha:**Iron ore is found in taconite rock at Gadchiroli, Chandrapur, Nagpur, Gondia. **South Maharashtra:** Iron ore is found inJamba rock at Sindhudurg, Kolhapur, Ratnagiri, and Raigad.	**Chandrapur:** There are iron oreminesat Pipalgaon,Bhisiin Chimur taluk and Ratnapurand Lohardongri in Brahmapuri taluk. **Gadchiroli:** Gadchiroli and Deulgaon area is famous foríronore.High-qualityironoreis available here. **Gondia:** Magnetite-type iron oreisfoundinGoregaontaluk. Iron ore is found in igneous rocks of the Gondia district.**Sindhudurg -** Reddi, Asoli in Vengurla taluka and some places in Sawantwadi taluka of this district have iron oredeposits.Twokmlongiron ore deposit in the hills near Reddi.**Kolhapur -** Iron ore deposits are found in the Shahuwadi and Radhanagari talukasof this district.
2	**Manganese**	Of the total reserves of India, Maharashtrahas40 percent of manganese reserves.Orissa has thelargest reserves of manganese in India.India ranks sixth inmanganese production.	Bhandara, Nagpur, Sindhudurg	Bhandara-Tumsar Taluk Nagpur-SavnerRamtekTaluka Sindhudurg-Savantwadi,Vengurla, Kankavali (Fonda)

Mineral Wealth Percentage in Maharashtra

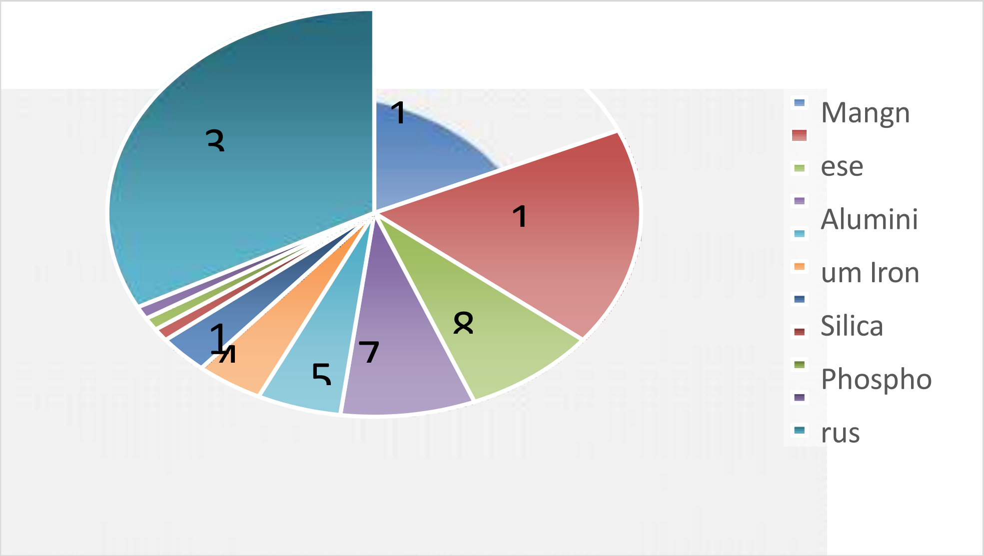

Fig.No.-1.1 Percentage Distribution of Minerals

Structurally, the entire area of the state forms apart of the“PeninsularShield”of India which represents a fairly stable block of earth crust that has remained unaffected by, mountain building movements, since the advent of the Palaeozoic era.Some of the subsequent movements in the crust have been of the nature of normal and block faulting which have laid down certain portions bounded by tensional cracks of faults giving rise to basins in which sedimentary beds of the Gondwana age have been deposited.Particularly in the Vidarbharegiongivingrisetothetheimportantlimestoneas Pengangabedsandcoalfields of the Pench-Kanhan valley, the Umred – Bander field the Wardha valley and Vidarbha valley.ItisgenerallyacceptedthattheWesterncoasthasbeenformedasaresult of the

Faulting. Along this coast from Ratnagiri to Mumbai, and further north in Thane district thereexistsaseriesofhotspringsarrangedalmostinlinearfashionwhichsuggeststhatthey aresituatedonalineoffracture.Furtherevidenceregardingtheformationofwestcoastby faulting is offered by the Western Ghats comprising Deccan trap lava flows, which are several hundred metres thick near the coast and which gradually thins out east wards.

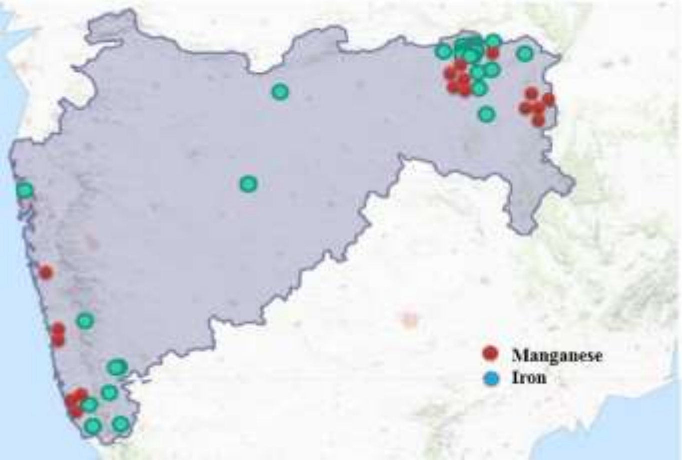

Fig.No.-1.2 Distribution Of Minerals In Maharashtra

An intimate knowledge of geological formations and their geographic distribution provides a very important clue not only to the occurrence of minerals, but also forms the basis on which all future search for economic minerals could be based. From the genetidc and structural point of view, there is a definite relation between the geological formations or rock types in any region and the type of economic minerals that are associated. Thus, the most important iron ore and manganese ore deposits of India occur closely associated with the formations of Precambrian era and the most important limestone and dolomite deposits are associated with the rocks of Penganga, Pakhal and Kaladgi groups. Similarly, the most

Important coal fields areas sociated with the sedimentary rocks of the Gondwana sequence. The important oil deposits of India are associated with rock formations of the Tertiary period and soon. It is, therefore, of prime importance to know intimate elythe nature of occurrence and distribution of different geological formations that occur in the various parts of the State in order to have a proper knowledge of the potentialities of mineral wealth and for guiding the search for future location of mineral deposits.

1.5 Famous Mines in Kolhapur for the Extraction of the Iron and Mangnese ores.

1. 5.1 Chitra Resources(India)Private Limited

Chitra Resources (India) Private Limited is an unlisted private company in corporatedon19 July, 2016. It is classified as a private limited company and is located in Kolhapur, Maharashtra. Its authorized share capital is INR1.00lac and the total paid-up capital is INR lac.

The current status of Chitra Resources (India) Private Limited is- Active.

The last reported AGM (Annual General Meeting) of Chitra Resources (India) Private Limited, per our records, was held on 30 November, 2021.

Chitra Resources (India)Private Limited has two directors-Jayendra Gopalrao Sardesai and Surekha Anant Harshvardhan.

The Corporate Identification Number (CIN) of Chitra Resources (India) Private Limited is U10101PN2016PTC165596. The registered office of Chitra Resources (India) Private Limited is at F4, Landmark Residancy 27k/35a,Tarabai Park, Kolhapur, Kolhapur, Maharashtra.

Fig.No.1.3 Godavari River Iron Ore Area

The Godavari River basin is endowed with rich mineral deposits such as oil and gas, coal, iron,limestone,manganese,copper,bauxite,granite,laterite,andothers.Thefollowingare the few noted deposits:

I. Arakuhills,bauxite

II. Godavari Valley Coalfield,coal

III. Bailadilairon, iron

IV. Krishna Godavari Basin, oil &gas

V. Malanjkhand, copper

VI. MOIL,Manganese

VII. PenchKanhanCoalfield,coal

VIII. RowghatMines,iron

IX. WardhaValleyCoalfield,coal

The River Godavari originates fromTrimbakeshware near Nashik in Maharashtra and after travelling through southern Maharashtra reaches Nanded and then enters Andhra Pradesh and finally opens into the Bay of Bengal. The river covers a total length of 1465 km from its point of origin to the Bay of Bengal. The two sampling stations were selected for the study, i.e., S1, upstream Goverdhan Ghat (uppermost part of river which has pure natural water) and S2 , downstream old bridge (lowermost part which leaves the city and has been contaminated by domestic waste water of the city)along the Nanded city.The samples were collected for a period of 6 months from October 2007 to March 2008 in plastic bottles,which were thoroughly rinsed with nitric acid and then several times with distilled water. The preservatives were added in the bottle.Samples were analysed onthe same day of collection. Temperature was measured by thermometer and pH by digital pH meter in laboratory. The iron content was estimated by phenonthroline method and the manganese by persulphate method.

Untreated domestic sewage and industrial effluents when released in surface water bodies createseriouswaterpollutionproblemsastheycontainsignificantamountofheavymetals, which bio accumulate in the environment and reach man through food chains. Iron occurs relatively abundantly (5%) in the earth's crust, and manganese about 0.085%. Manganese and iron are often found together in water. The two have similar chemical make-up and appear in water that travels throughs oil and rocks. Well water is particularly affected with manganese contamination. Iron and manganese are transition metals, which rarely exceed 1 mg/Lin natural waters. The common sources of iron and manganese in water are natural such as weathering of iron and manganese bearing minerals and rocks, industrial effluents, acid-mine drainage, sewage and landfill leachate. Iron (Fe) and manganese (Mn) can be present in water in one of three basic forms like dissolved: ferrous (Fe2+) and manganous(Mn2+), particulate: ferric (Fe3+) and manganic (Mn4+), and colloidal: very small particles (difficult to settle and filter).The presence of iron and manganese in wateris not considered health problem. Infact, small concentration sareessential for human health. Iron and manganese deficiency in man causes diabetes, nervous in stability, disorder of cartilaginous growth in infants and children, rheumatoid arthritis and anaemia. But, high concentration of iron and manganese may give the water anunpleasantmetallictastewhile still being safe to drink. Excess ofironcauses'haemochromatosis'.Ironbioaccumulatesin

living beings, causes rapid increase in respiration, pulse rate, coagulation of blood vessels, hypertensionanddrowsiness.Manganeseisessentialtraceelementatlowconcentration.A dailyintakeof2.5-5.0mgofmanganesecontributestowellbeingofthecellsbecauseitacts as a co-factor in some enzymatic reactions such asthose involved in phosphorylation, synthesisoffattyacidsandcholesterol.However,higherlevelofmanganeseaccumulatesin kidney, pancreas, intestine, liver and bones, and causes "manganese psychosis" (similar to Parkinson's disease),which is an irreversible brain disease characterized by uncontrollable laghtruphoria, impulsiveness, sexual excitement followed by impotency, etc. Chronic manganese poisoning is known as manganism. Fe and Mn cause reddish-brown and brownish-black stains respectively. Fe and Mn deposits are build-up in pipelines, pressure tanks, water heater and waters of teners reducing the available quantity and pressure of water supply. These are also objectionable to paper industry, laundry work, photographic films and textile industry. The treatment methods for the removal of iron and manganese from water are water softening (cation exchange), aeration, chlorination, filtration, oxidation, chemical precipitation, phosphate treatment, zeolite process, biosorption, household filter, etc.The presentstudydeals with concentration of iron and manganese in River Godavari at Nanded.

CHAPTER 2 LITERATURE REVIEW

1. Biological iron removal from ground water

Iron is generally removed from ground water by the process of aeration or chemical oxidation followed by rapid sand filtration. Different mechanisms (physic chemical and biological) may on tribute to iron removal in filters but the dominant mechanism depends on the physical and chemical characteristics of the water and process conditions applied. Nowadays, there are increasing numbers of publications on methods of biological iron removal which are reported to be much more efficient and cost effective than conventional physicochemical iron removal. However, the biological iron removal mechanism is not fully understood and there are still controversies about whether the mechanism of iron removal infilter should be solely biological or whether the presence of iron oxidising bacteria supplements the physicochemical iron removal mechanisms under certain specific conditions. This paper reviews the theoretical background of biologically mediated iron removal, the process conditions required, the advantages and limitations of the method and a few case studies. A literature review revealed that biological iron removal is not suitable when pH and oxygen concentrations are high and/or NH4 +, H2S and Zn are present Physicochemical removal mechanisms can achieve the same removal efficiency under the conditions that are reported to be favorable for biological iron removal. Biological iron removal is likely to be supplementary to conventional physicochemical iron removal.

Groundwater is the major source of drinking water throughout the world. Iron being the fourth most abundant element and the second most abundant metal in the Earth's crust (Silver 1993; WHO 1996), it is a common constituent of ground water. There are no health-based guidelines for the concentration of iron in drinking water. However, it is undesirableasitcausesseveralaestheticandoperationalproblemsincludingbadtaste, discoloration, staining, and deposition in distribution systems leading to after growth and incidences of high turbidity. Based on taste and nuisance considerations, the World Health Organization (WHO) recommends that the iron concentration in drinking water should be less than 0.3mg/l (WHO1996).The EC directive recommends that the iron in water supplies should be less than 0.2 mg/l (EC 1998). In the Netherlands, several water supply companies are aiming at an iron level of ,0.05 mg/l in order to minimize the distribution system maintenance costs. Several methods, namely oxidation–precipitation– filtration, lime softening,ion-exchange,sub-surfaceironremovalandmembraneprocesses, have been employed for iron removal from groundwater. Stabilization with phosphate or silicates is applied as well to avoid the oxidation or precipitationofiron. Among the different techniques mentioned above, aeration or chemical oxidation followed by rapid sand filtration is most widely used(O'Connor1971;Wong1984;Salvato1992;Twortetal. 2000; Sommerfeld 1999). A sedimentation step sometimes precedes the rapid filtration for solid liquid separation, especially when iron concentration is very high, in order to reduce the load on subsequent rapid filters. Aeration–rapid sand filtration is the preferred method in developed as well as in developing countries because, compared to other methods, this methodismoreeconomical,lesscomplicatedandgenerallyavoidstheuseofchemicals, whichisnotusuallywelcomeinthewaterindustry.Differentmechanisms(physicochemical and biological) may contribute to iron removal in filters but the dominant one depends on the physical and chemical characteristics of the water and process conditions (Lerk 1965; Rott1985;Hatva1988,1989;Mouchet1992;Michalakoset al.1997;Søgaardetal.2000). In the commonlyapplied oxidation– precipitation–filtration method (physicochemical iron removal process) two mechanisms can be identified (Figure 1), namely: † Oxidation–floc formation (floc filtration), in which iron(II) is first oxidised to iron(III) by oxygen or chemical oxidant, which upon hydrolysis and agglomeration forms iron hydroxide flocs.Theseflocsaresubsequentlyremovedinrapid(sand)filters.†Adsorption–oxidation (adsorptive filtration), which involves the adsorption of iron(II) onto the surface of

the filter media and its subsequent oxidation in the presence of oxygen or other oxidant to form a new iron oxide layer. This oxide layer (coating) enhances the adsorption and oxidation of iron(II) and facilitates the process. Oxidant concentration and pre-oxidation time have to be limited to avoid the oxidation–floc formationmechanism to occur. Theadsorption–oxidationmechanismofironremovalhasseveraladvantages,e.g.:

† it allows higher filtration rates and longer filter run lengths, since the specific volume of iron oxide adsorbed/-precipitated on the sand grains is much lower than that of iron hydroxideflocs,†itshighfiltratequality.Inconventionalironremovalplantsbothofthese physicochemicalremovalmechanismsoccursimultaneously.Thedominantmechanism

under given conditions depends on the water quality and process conditions applied; specifically, low oxygen concentration and a short pre-oxidation time in the supernatant of the filters reduces the role of the “oxidation–floc formation” mechanism and as a consequence the “adsorption–oxidation” mechanism will be dominant. At high pH values, the rate of oxidation of iron(II)is higherwhichisinfavourofthe“oxidation–flocformation” mechanism. This paper focuses on the role of the biological iron removal mechanism.

2. Sindhudurg District Mineral Wealth

Geologically, the district exposes rocks ranging inage from Archaeans to Quaternaryperiod. The Archaeans arerepresented by Granite gneiss and is seen in southern part of the district near Vengurla Sawantwadi. The Paleo to meso-proterozoic rocks represented by Dharwar Supergroup overlie the Archeans and occupy major part of the area comprises psammatic meta sediments consisting of Metagabbro,quartz chlorite amphibolites schist and ferruginous phyllite.The Kaladgis are noticed as comparatively smaller exposures. They strike NW-SE with dips of 15 to 30 towards west. Three phases of folding seen in the area and a major synform with itsaxistrendingin NNW-SSE is noticed in the southern portion of the district. The Deccan basalt flow which occupies the northern part of the district is divisible in to two formations viz. the Purandargarh formation and the overlying Mahabaleshwar Formation. Purandargarh form ationmostly consists of aphyrictofewfeldsparphyric flows. Basic dykes of Doleriticcompositionarenoticedat few places.Lateriticspreadsare noticed in the northern part of the district as isolated patches. It varies in thickness from 25 to 75 mts.Quaternarysedimentsarerepresentedbybeachsandsandsandyloams.TheGeological formations in the area investigated are Archaeans, Kaladgis, Deccan Trap, Tertiary and Secondary laterite and recent formations. The archaean rocks represented by Dharwarian MetaSedimentsandgranitegneisseswithmaficandultramaficintrusiveoccupymajorpart of the area. Kaladgis rest unconfirmably over the archaeans comprises of conglomerates, grits,ortho-quartzitesshalesandstandinreliefasnarrowridges.Deccantrapsoccupysmall area in thenorthern and eastern partofthe area formingisolatedpatches separated byriver valleys. Sedimentary beds comprising carbonaceous, pyritic and ferruginous shales are noticed below lateritis in well sentions and dissected valley sections along the

coast near Malvan & Kaluswadi, Laterites both primary and secondary occupy extensive areas in low lying platens and coastal track in the West as well as East. Beach sand along narrow coastal strip and along the banks of rivers is recent formations in the area.

1. Mineral Potential of Sindhudurg

Outofeighttalukas,onlytwotalukasareoutsidetheextentoftheESAboundaryasperthe draft Notification S.O.2435 (E) dated 04.09.2015. A major portion of the other six talukas is under the draft ESA under the Western Ghats. There were numerous stone quarries, laterite & basalt mainly in the talukas of Devgad, Vengurla and Sawantwadi which were operational in these areas which were closed down after the imposition of moratorium and theseareas wereidentified as ESA‟s.Efforts arebeing made to excludethesevillages from theESAareafromthegrassrootlevel.Therearenosandmining leasesgiveninthedistrict for excavation of sand. Presently permission is given for excavation of sand to clear the navigational channel as per the policy of State Government. The sand excavation is done manually by means of “Hathpati” by coastal communities. The main purpose of sand excavationistoclearnavigationalchannelsforsmoothmovementoffishingandcoastguard movements. Ground Water Resource Estimation figures as a whole for Sindhudurgdistrict indicatesthatNetGroundWaterAvailabilityis26196.06hamandExistingGroundWater Draft for all uses is 7262.86 ha-m. After making provision for Domestic and Industrial Supplyfor next 25 Years as 3651.19 ha-m, Ground Water Availabilityfor future Irrigation is 17107.6 ha-m. Over all Stage of Ground Water development of the district is 27.73% indicating there is ample scope for ground water development in the district.

All Talukas of Sindhudurg district are categorized under “Safe Category” where there is scope for future development of ground water resources in Sindhudurg district.

Taluka wise ground water resources figures of Sindhudurg district are given below in

2. **Assessment of Quality of Water Resources in Radhanagar**i:

This paper contains the water quality evaluation of the water resources available in the town of Radhanagari. Assessment of water quality is the general method of assessing

The physical, chemical and biological nature of water. In this research work, we surveyed the village of Radhanagari and selected 15 surface and groundwater sample sites. We calculate the water sample's physical, chemical and biological parameters as pre-monsoon andpost-monsoonseasonandrepresenttheseasonalvariationsoftheseparameters.Itis vital to explore the consistency of water from time to time to ensure good water quality as environmental fact orscontinueto change,thusaffectingthequalityofwater.Basedonthis examination, we realized that the available water sources are appropriate for drinking purposesornot.WatermaybeaprofitableandlimitedassetonSoil.Water amountas well asqualityarebecomingdominantissuesinnumerousnations.Watercouldbeararevaluable source which is the essential prerequisite for presence of all living things. The operations included in water quality analysis are a lot of complicated. Water quality appraisal is the around the world handle of assessment of the physical, chemical and natural nature of the water, through water quality checking is the gathering of the significant data. Thus, numerous nations have significant problems concerning not as it were extreme water shortage but moreover destitute water quality.

Soil and surfacewaterthat arethemost sources ofnewwaterfordrinking purposes, water system and different other uses, speak to as little division of water burden on soil.

It is pointed out that as it were 30% of the freshwater (3% of the full volume of water onSoil is groundwater). Yet, streams are the fundamental water hotspots for household, modern, and farming water system purposes. In a local, stream water quality is one among vital factors legitimately in regard to with soundness of mankind and living creatures.Inthismanner,itisessentialjustasfundamentaltohavetrustworthyinformation on water quality attributes for practical defilement control and water resource organization. study area radhanagari would be a village and the central command of radhanagari tehsil inside the radhanagari subdivision in the indian territory of kolhapur of maharashtra.thegeocoordinateofthescope16.40571andthelongitude73.9662898radhanagari.it’splacedonthebankofbhogawatiRiver,closetotheLaxmiTalavDamand theradhanagariforest.RadhanagarigetsdailyresponsefromsurroundingvillagesasRadhanagari is a taluka. Main attraction of Radhanagari is Laxmi Talav for the visitors as Radhanagari has a beauty of nature in all 3 seasons. So that thousands of visitors visits the village which has full of natural environment. In 2011, Radhanagari village's literacy rate was84.01percentcomparedtoMaharashtra's82.34percent.AsBytheconstitutionofIndia andthePanchayatiRaajAct,thevillageofRadhanagari’sSarpanchisadministered(Village Head) who is chosen illustrative of the town.

Fig.2.1 Surrounding Area Of Radhanagari Dam

3. **Iron and Manganese Contents in Godavari River Water at Nanded, Maharashtra.** The study describes assessment of iron and manganese in surface waters of Godavari river. The results were compared with the standard permissible limits of WHO, ISI, ICMR (i.e., 0.3mg/L and 0.1mg/L respectively) and it was found that the concentration ofFeandMnwasbelowthepermissiblelimits.Onanaverage,thehighestconcentration of iron and manganese was present in March and lowest in October.
Untreated domestic sewage and industrial effluents when released in surface water bodies createseriouswaterpollutionproblemsastheycontainsignificantamountofheavymetals, which bioaccumulate in the environment and reach man through food chains. Iron occurs relatively abundantly (5%) in the earth's crust, and manganese about 0.085%.Manganese and iron are often found together in water. The two have similar chemical make-up and appear in water that travels through soil and rocks. Well water is particularly affected with manganese contamination. Iron and manganese are transition metals, which rarely exceed 1mg/L in natural waters. The common sources of iron and manganese in water are natural such as weatheringof iron and manganese bearing minerals and rocks, industrial effluents, acid-mine drainage, sewage and landfill leachate. Iron (Fe) and manganese (Mn) can be present in water in one of three basic forms like dissolved: ferrous (Fe^{2+}) and manganous (Mn^{2+}),particulate:ferric(Fe^{3+})andmanganic(Mn^{4+}),andcolloidal:verysmallparticles (difficult to settle and filter).

CHAPTER: 03

FINDINGS FROM LITERATURE REVIEW

Literature review explained me that In some of the areas of the Maharashtra the percent of iron and manganese is present more than the permissible limit, it may entered into that water Naturally means by Erosion of the rock present in that area or by the excessive pollution in that area, means when industrial wastewater is drained into freshwater source like River that Particular river water showed raised percentage of these metals that is Iron and Manganese Removal of the excessive iron and Mn content from the water can be carried out with the Help of the Batch adsorption and by the Column adsorption is possible in that area. For this we can use the Adsorbent as the Natural adsorbent which is prepared from the locally available but medicinal properties carrying trees.
Which can get rid of the Excess iveiron and Manganese contentfromit efficiently?

3.1 GAPS IDENTIFIED

In case of Rural Villages in Mostly Chandrapur and Bhandara districts which is renowned astribalareawherethe wealthof Iron and Manganeseisavailableinplentyamount,but It willeasily mix with groundwater water, the people staying in this area mostly uses Cloth for removing out theimpurities from the water, then that all will use that turbid water for the Drinking purposeand other utility purposes, The techniques invented up to now are quiteadvancedand thepeoplesaren'tabletouseitortisalsonotaffordableforthemalso he peoples residing in the Kolhapur districts from the Shahuwadi and rdhanagari taluka , VengurlatalukafromSindhudurgdistrict,GodavririveratheareaoftheHenceweneedto developsuchasystemofTreatmentwhichwillremoveouttheIronandManganesecontent efficiently by using the activated charcoal prepared from the Locally available trees and plants, which is easy to prepare to those group of peoples for their use.

3.2 NEED FOR RESEARCH WORK

For this particular locality, any professional need to develop such a system ofTreatment which will remove out the Iron and Manganese content efficiently byusing the activated charcoal prepared from the Locally available trees and plants,which is easy to prepare to those groupofpeoples fortheiruse. So that what happensthepeoplein that area werenot get affected by the ill effects of these Minerals inwater, we know those ill effects are of Temporary type and Permanent type also

CHAPTER: 04

AIM AND OBJECTIVES

4.1 Aim:To investigate the potential of the low cost adsorbents prepared from Babul (Vachellia nilotica) for

effective removal of the Fe and Mn from the water.

4.2 Objectives:

1) To identify water bodies where Fe and Mn concentration have exceeded above acceptable levels.

2) To conduct water sampling and analysis to determine Fe and Mn concentrations in various water bodies in Radhanagari, Shahuwadi from Kolhapur district of maharashtra.

3) To compare the performance and the cost effectiveness of the developed system with the existing market solutions.

4.3 SCOPE AND IMPORTANCE

1. This system of removal of Iron and Manganese from the ground water, which is available to peoples in low cost. It will get rid of metallic ions of Fe and Mn.
2. This system can be prepared easily with cost effectiveness.
3. This system may keep Health fall peoples safe. Free from disease caused by the excessive amount of Fe & Mn ions in groundwater.CHAPTER:05

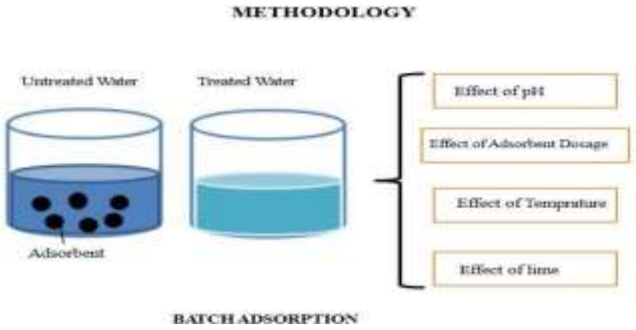

Fig.5.1 Batch Adsorption

Fig.no.5.2 Prepared charcoal mould for Column adsorption

Fig.No.5.3 Column Adsorption assembly

Table No. 5 Reading from Column adsorption system

SAMPLE NO.	MOULD WEIGHT TAKEN (GRAMS)	WATER TAKEN(LIT)
1	250	20
2	250	20
3	250	20
4	250	20
5	250	20

Fig.5.4 Filter for removal of the Fe And Mn

Table No. 6 Reading from Column adsorption of filter system in Market

SAMPLENO.	WATER TREATED(LIT)	IRON(PPM) BEFORE TREATMENT	IRON(PPM) AFTER TREATMENT
1	40	6.3	0.7
2	40	7.1	0.9
3	40	7.5	0.7
4	40	7.9	0.8
5	40	9.8	0.6

5.1 Batch Adsorption Study: The Effect of pH

Along with contact time, effect of pH is alsocriticalinadsorptionprocess.Fromareported study,theyhighlightedthatpercentageofmetalionsadsorptionwasaffectedbythesolution pH.DestacarriedoutadsorptionusingActivatedTeffStraw(ATS)asadsorbenttoremove metalionsbyvaryingitspHfrompH1topH11.TheoptimalpHforadsorptionwasnoted at pH 6.5 where the removal percentage was the highest. Beyond pH6.5, the percentage of adsorptionexperienceasuddendropduetodecreasingelectrostaticforcebetweenadsorbent andadsorbate.OtherstudyoneffectofpHonremovalofCopperionsbyZeoliteNaXwas demonstrated by Pandey et al.They conducted the experiment at pH range of 3 to 8 and the result was significant. At pH 6, Copper ions was removed efficiently by the adsorbent but at acidic condition of less than pH 4.5, the removal efficiency was found to be low. Meenaetal. Stated that pH below than 4.5is not suitable for zeolites. Also, lower efficiency of adsorption at low pH is due to collapse of zeolites structure.

Initial pH of Selenium ions with concentration, $C0=100\mu g/L$ was pH 6.46. However, after adding RHA, the pH changes.They conducted study of Selenium removal at pH2to10and recorded the percent of removal at equilibrium. Ion molecules found in the solution are selenite,.This is due to predominantion having positive charge which is selenious acid that containH+.ion with negative charges are dominant at pH range of 3.5to 9.0 while further increase in pH makes selenite species to be the predominant ions in the solution.

Table No 7 Readings for pH of water taken at Radhanagari

SAPMLE	pH BEFORE TREATMENT	pH AFTER TREATMENT
1	9	6.5
2	9.9	7.4
3	8.5	7.0
4	11	6.9
5	12.5	7.7

5.1 Batch Adsorption Study: The Effect of Temperature

Destar carried out investigation on effect of temperature to the adsorption performance of ATS. It was done in five different temperatures; 298, 308, 318, 328 and 343 K. They concluded that increase in temperature also lead to increment in adsorption efficiency. Similar conclusion was reported by Pandeyet al. where they conducted study on removal of Copper ions (25ppm) at different temperature. Higher temperature resulted in higher adsorption. Next, Gulipalli et al., performed laboratory scale adsorption by varying temperature from 293 K to 323 K using RHA. Equilibrium metal uptake of the metal ions tested was found to be increasing when the temperature.

Table. No 8 Readings taken for temperature before the treatment

SAMPLE	TEMPBEFORETREAT.	TEMPAFTERTREAT.
1	343K	299K
2	328K	294K
3	318K	297K
4	308K	295K
5	298K	296K

5.2 Batch Adsorption Study: The Effect of Adsorbent Dose

Removal percentage of metal ions increased when adsorbent dosage increases. Desta increased the amount of adsorbent AT Sin adsorption of five different types of heavy metals. Results from the experiment revealed that Nickel ions adsorption was 88%, Cadmium ions 82.9%, Copper ions 81.5%, Chromium ions74.5%and Lead is the lowest compared to other heavy metals with removal percentage of 68.9%. Study on RHA adsorbent to remove selenium ion showed an optimum potential when adsorbent dosage is 6g per litre of ions solution[58].However, performance enhance mentis only for several additions in adsorbent dosage, and after certain value the performance will gradually become constant and does not have notable increment. Increase in adsorbent dosage indicates more surface area available for adsorption and greater adsorption sites. When adsorbent dosage is below the optimum value, the removal of metal ions is low due to lower binding sites available for adsorption.

TableNo.9 Reading from Batch adsorption system

SAMPLE NO.	PACTAKEN (GRAMS)	WATER TAKEN(LIT)
1	50	4.5
2	50	4.5
3	50	4.5
5	50	4.5
5	50	4.5

Fig No.5.5 Sample at Radhanagari Kolhapur

Adsorption is a technique for separating substances from gas or liquid phase onto surface of adsorbent. This is one of the methods for selective separation mechanisms in which it adsorbs one or more components from the mixture on a surface. Materials used to adsorb components are called as adsorbent while adsorbate is the component that being adsorbed. Adsorbent can be classified as synthetic adsorbent, natural adsorbent and semi-synthetic adsorbent. Synthetic adsorbent is most popular adsorbent used for researcher because of high adsorption capacities but, highly in cost production. Natural adsorbent such as plant, flower and leaf give very low cost production but also give low adsorption capacity. While the semi-synthetic adsorbent that can be define as natural material combining with chemical that possess high adsorption capacity and low cost compared to synthetic adsorbent. In adsorption, it can be categorizing as physical adsorption and chemical adsorption, where it is classified according to the bonding forces between the adsorbent and adsorbate. Physical adsorption is happening due to the attraction force of weak Van der Waal while chemical sorption happens due to the chemical bonding between adsorbate and adsorbent. Whenthere

is concentration difference between adsorbate and adsorbent, the adsorbate molecules in solution move and bind on to surface of adsorbate. To simplify, adsorption involves bonding of molecules between adsorbent and adsorbate. Generally, most solid have adsorbent characteristics but the performance of adsorption differs according to their functional groups. Currently, adsorption technology is adopted in treating textile effluents which contains several mixtures of dyes and heavy metals.

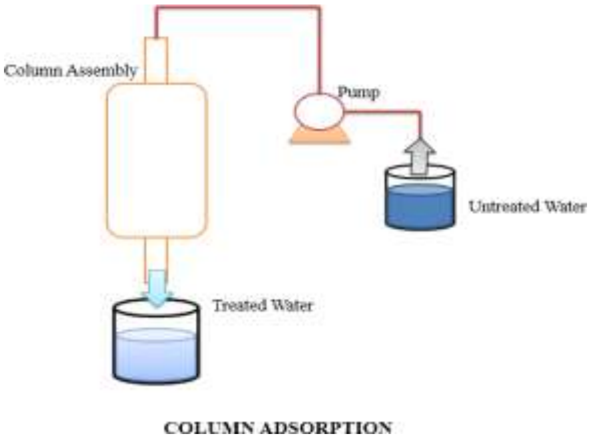

Fig No.5.6 Column Adsorption Assembly

5.3 Experimental Procedure for Column Study

Column study can be done in many ways but usually, researchers applied similar methodology for their work. Figure 2 show the basic design for column adsorption experiment. Nwabanne and Igbok we performed their packed bed column experiments by using 300 mm length of glass column having internal diameter of 30mm.Their adsorbents which was activated carbon(diameterrange0.425mm to0.6mm)were packed insidethe

Column. Before, the column was layered with glass wool upon the loading of adsorbent. Bed height was varied to 50 mm, 100 mm and 150 mm. Similarly, Meghna et al.,packed the column with glass wool but instead of a layer, they prepared two layer of glass wool at the bottom of column and adsorbent was filled in between the layer.Other researchers prepared adsorbent NCS/SA/MC bead in ratio 2:8:1 in a glass column of 30 cm length. Next, ion solution was fed through the column filled with adsorbent and continuously flow until final concentration approached initial concentration. They studied three different parameters which were influence of bed height, flow rate and initial ion concentration to column adsorption performance. Lin et al. evaluated isothermal performance of their packed bed column for removal of butanol using KA-Iresins. They utilized a glass column of 200 mm Length and 30mm diameter which can accommodate upto100g of resins adsorbent.Water jacket was installed to their adsorber column so that the temperature can be kept constant. At several time intervals, effluent samples were collected for further analysis using gas chromatography.
In many years, an industry always looking for the low-cost operation, high availability of the material used and environment friendly for the water treatment. But unfortunately, adsorption processs till eadsto high cost operation and higher solid waste adsorbent[131,132]. However, for the huge water treatment process, column adsorption become a choice compared to batch adsorption. Industry demand for efficient operation of water treatment make a researcher need to come with high quality of result for maximum adsorption capacity for the adsorbent used. From all the literature reviewed, we conclude that, all researcher searching for the maximum adsorption capacity for different adsorbent, adsorbate, to fit with isotherm model and kinetic model.Column adsorption study revealed that it is better, simple and economical for removal of heavy metal compared to batch study. All the important parameter for batch adsorption, i.e., contact time, pH, temperature, adsorbent dosage, initial concentration and column adsorption, i.e., inlet ion concentration, flow rate, bed height also have been discussed clearly.

CHAPTER:06

EXPECTED OUTCOME

1) Water Treatment for Removal of the Fe and Mn will be Economical. Hence consumption of water in that area does not cause any harmful impact on human health in that area.
2) Water treatment will become easier and cost effective.
3) Babul (Vachellia nilotica) will be utilized in Activated charcoal making for adsorption process.
4) Make prediction about the Fe and Mn Content in intermediate areas of sample stations.

CHAPTER: 7

RESULT AND DISCUSSIONS

Readings taken for determination of various parameter of the water are as follows.

Table 10 : pH LEVELS BEFORE AND AFTER TREATMENT

SR.NO	DESCRIPTION OF SAMPLE STATION	pH BEFORE TREATMENT
1	Kagal Tehsil Sample No. 1	5.8
2	Kagal Tehsil Sample No. 2	5.6

Table 11: TOTAL DISSOLVED SOLIDS LEVELS BEFORE AND AFTER TREATMENT

SR.NO	DESCRIPTION OF SAMPLE STATION	TDS BEFORE TREATMENT (mg/lit)
1	Kagal Tehsil Sample No. 1	580
2	Kagal Tehsil Sample No. 2	590

Table 12: **DISSOLVED OXYGEN LEVELS BEFORE AND AFTER TREATMENT**

SR.NO	DESCRIPTION OF SAMPLE STATION	DO BEFORE TREATMENT (mg/lit)
1	Kagal Tehsil Sample No. 1	6.9
2	Kagal Tehsil Sample No. 2	6.8

Table 13: **IRON LEVELS BEFORE AND AFTER TREATMENT**

SR.NO	DESCRIPTION OF SAMPLE STATION	Fe BEFORE TREATMENT (mg/lit)
1	Kagal Tehsil Sample No. 1	0.5
2	Kagal Tehsil Sample No. 2	0.5

Table 14: MANGNESE LEVELS BEFORE AND AFTER TREATMENT

SR.NO	DESCRIPTION OF SAMPLE STATION	Mn BEFORE TREATMENT (mg/lit)
1	Kagal Tehsil Sample No. 1	0.40
2	Kagal Tehsil Sample No. 2	0.45

Table 15: pH LEVELS BEFORE AND AFTER TREATMENT

SR NO	Activated Charcoal (grams)	Hydrated lime (grams)	Alum (grams)	Water (lit)	pH BEFORE TREATMENT (mg/lit)	pH AFTER TREATMENT (mg/lit)
1	300	30	10	100	**4.4**	6.5
2	350	40	15	100		6.9
3	450	50	20	100		7.4
4	300	30	10	100	**4.7**	6.6
5	350	40	15	100		6.8
6	450	50	20	100		7.6
7	300	30	10	100	**5.8**	6.2
8	350	40	15	100		6.5
9	450	50	20	100		6.9
10	300	30	10	100	**5.6**	6
11	350	40	15	100		6.5
12	450	50	20	100		6.7

Table 16: TDS LEVELS BEFORE AND AFTER TREATMENT

SR NO	Activated Charcoal (grams)	Hydrated lime (grams)	Alum (grams)	Water (lit)	TDS BEFORE TREATMENT (mg/lit)	TDS AFTER TREATMENT (mg/lit)
1	300	30	10	100		290
2	350	40	15	100		275

3	450	50	20	100	**1100**	255
4	300	30	10	100	**1060**	274
5	350	40	15	100		258
6	450	50	20	100		246
7	300	30	10	100	**580**	180
8	350	40	15	100		176
9	450	50	20	100		154
10	300	30	10	100	**590**	188
11	350	40	15	100		160
12	450	50	20	100		157

Table 17: DO LEVELS BEFORE AND AFTER TREATMENT

SR NO	Activated Charcoal (grams)	Hydrated lime (grams)	Alum (grams)	Water (lit)	DO BEFORE TREATMENT (mg/lit)	DO AFTER TREATMENT (mg/lit)
1	300	30	10	100	**2.5**	**6.9**
2	350	40	15	100		**7.2**
3	450	50	20	100		**7.6**
4	300	30	10	100	**2.3**	**6.8**
5	350	40	15	100		**7.4**
6	450	50	20	100		**7.7**

7	300	30	10	100	**6.9**	**9.2**
8	350	40	15	100		**9.6**
9	450	50	20	100		**9.9**
10	300	30	10	100	**6.8**	**8.8**
11	350	40	15	100		**9.1**
12	450	50	20	100		**9.7**

Table 18: Fe LEVELS BEFORE AND AFTER TREATMENT

SR NO	Activated Charcoal (grams)	Hydrated lime (grams)	Alum (grams)	Water (lit)	Fe BEFORE TREATMENT (mg/lit)	Fe AFTER TREATMENT (mg/lit)
1	300	30	10	100	**0.7**	0.4
2	350	40	15	100		0.35
3	450	50	20	100		0.25
4	300	30	10	100	**0.6**	0.35
5	350	40	15	100		0.25
6	450	50	20	100		0.2
7	300	30	10	100	**0.5**	0.2
8	350	40	15	100		0.15
9	450	50	20	100		0.1
10	300	30	10	100		0.3

11	350	40	15	100	**0.5**	0.15
12	450	50	20	100		0.15

Table 19: Mn LEVELS BEFORE AND AFTER TREATMENT

SR NO	ACTIVATED CHARCOAL (grams)	Hydrated lime (grams)	Alum (grams)	Water (lit)	Mn BEFORE TREATMENT (mg/lit)	Mn AFTER TREATMENT (mg/lit)
1	300	30	10	100	**0.8**	0.4
2	350	40	15	100		0.25
3	450	50	20	100		0.15
4	300	30	10	100	**0.8**	0.35
5	350	40	15	100		0.20
6	450	50	20	100		0.10
7	300	30	10	100	**0.4**	0.25
8	350	40	15	100		0.15
9	450	50	20	100		0.10
10	300	30	10	100	**0.45**	0.20
11	350	40	15	100		015
12	450	50	20	100		0.10

CHAPTER: 8

CONCLUSION

1. Kolhapur districts Radhanagari, Shahuwadi areas have selected for Fe and Mn study and carried out experiment on samples of this area, showed good results as compare to existing system.
2. Column adsorption has carried out on the Groundwater found in the areas of the Radhanagari and Shahuwadi from the districts Kolhapur.
3. Compared results with the Existing system for filtration in the market, prepared assembly through these projects proved best.
4. For Determination of the content of Fe and Mn in the Intermediate areas used Nueral Networks.
5. Column Adsorption by using Activated charcoal prepared from Vachelia Nilotica, Hydrated lime, Alum, Aloe Vera is efficient in removal of Excess Iron and Manganese present in ground water. And then after treatment water can be used for drinking and other purposes.

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