

AN APPROACH TO REDUCE TOXIC CHEMICALS PRESENT IN WASTEWATER

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Abstract: Nowadays many water resources are polluted by anthropogenic sources including household and agricultural waste and industrial processes. Public concern over the environmental impact of wastewater pollutions has been increased. Industrial dumping, pesticide runoff, leaky storage tanks have created big problems. In many developing countries the bulks of domestics and industrial wastewater are discharged without any treatment or after primary treatment only. Let's take a look at some of the contaminated water that may be released from industries which can be treated through this. Traditional water/wastewater treatment technologies remain ineffective for providing adequate safe water due to increasing demand for water coupled with stringent health guidelines and emerging contaminants. The aim of the present study is to review the possible applications for the removal of pollutants or toxic chemicals from wastewater. Finally, recommendations are made based on the current practices of nanotechnology applications in wastewater treatment for a stand-alone water purification unit for removing some types of contaminants partially from wastewater.

Keywords: Reduction, Tannery, Hexavalent Chromium, Treatment, Wastewater, Toxic Chemicals.

1. INTRODUCTION

In many parts of the world, the economic and social problem arise following rapid industrial development and urbanization, resulting in adverse effect on quality of life. Wastewater obtained from industries are generally much more polluted are the domestic or even commercial wastewater. The main objective of industrial wastewater treatment is generally to allow industrial effluent to dispose of without danger to human health or unacceptable damage to the natural environment. In many developing countries the bulks of domestic and industrial wastewater are discharged without any treatment or after primary treatment only. In several industries discharged wastewater after primary treatment still contains contaminants present in it. So with the current emphasis on wastewater treatment, it is generally to allow industrial effluents to be disposed to the resource by curing it. Treatment of water thus aims at reduction toxic chemicals of receiving water bodies and prevention of biomagnification of a toxic substance on food chain and prevention of disease due to pathogenic organisms present in the wastewater. The purpose of wastewater treatment is to partially remove /reduce toxic chemicals.

1.1 Chromium

Chromium is a lustrous, brittle, hard metal. Its color is silver-gray and it can be highly polished. It does not tarnish in air, when heated it burns and forms the green chromic oxide. Chromium is unstable in oxygen, it immediately produces a thin oxide layer that is impermeable to oxygen and protects the metal below.

1.2 Applications

Chromium main uses are in alloys such as stainless steel, in chrome plating and in metal ceramics. Chromium plating was once widely used to give steel a polished silver mirror coating. Chromium is used in metallurgy to impart corrosion resistance and a shiny finish; as dyes and paints, its salts color glass an emerald green and it is used to produce synthetic rubies; as a catalyst in dyeing and in the tanning of leather; to make molds for the firing of bricks. Chromium (IV) oxide (CrO₂) is used to manufacture magnetic tape.

1.3 Chromium in the environment

Chromium is mined as chromite (FeCr₂O₄) ore. Chromium ores are mined today in South Africa, Zimbabwe, Finland, India, Kazakhstan and the Philippines. A total of 14 million tonnes of chromite ore is extracted. Reserves are estimated to be of the order of 1 billion tonnes with unexploited deposits in Greenland, Canada e USA.

1.4 Health effects of chromium

People can be exposed to chromium through breathing, eating or drinking and through skin contact with chromium or chromium compounds. The level of chromium in air and water is generally low. In drinking water, the level of chromium is usually low as well, but contaminated well water may contain the dangerous chromium(IV); hexavalent chromium. For most people eating food that contains chromium(III) is the main route of chromium uptake, as chromium(III) occurs naturally in many vegetables, fruits, meats, yeasts, and grains. Various ways of food preparation and storage may alter the chromium contents of food. When food in stores in steel tanks or cans chromium concentrations may rise.

Chromium(III) is an essential nutrient for humans and shortages may cause heart conditions, disruptions of metabolisms and diabetes. But the uptake of too much chromium(III) can cause health effects as well, for instance, skin rashes.

Chromium(VI) is a danger to human health, mainly for people who work in the steel and textile industry. People who smoke tobacco also have a higher chance of exposure to chromium.

Chromium(VI) is known to cause various health effects. When it is a compound in leather products, it can cause allergic reactions, such as skin rash. After breathing it in chromium(VI) can cause nose irritations and nosebleeds.

Other health problems that are caused by chromium(VI) are:

- i. Skin Rashes
- ii. Upset stomachs and ulcers
- iii. Respiratory problems
- iv. Weakened immune systems
- v. Kidney and liver damage
- vi. Alteration of genetic material
- vii. Lung cancer
- viii. Death

The health hazards associated with exposure to chromium are dependent on its oxidation state. The metal form (chromium as it exists in this product) is of low toxicity. The hexavalent form is toxic. Adverse effects of the hexavalent form on the skin may include ulcerations, dermatitis, and allergic skin reactions. Inhalation of hexavalent chromium compounds can result in ulceration and perforation of the mucous membranes of the nasal septum, irritation of the pharynx and larynx, asthmatic bronchitis, bronchospasms, and edema. Respiratory symptoms may include coughing and wheezing, shortness of breath, and nasal itch.

Carcinogenicity- Chromium and most trivalent chromium compounds have been listed by the National Toxicology Program (NTP) as having inadequate evidence for carcinogenicity in experimental animals. According to NTP, there is sufficient evidence for carcinogenicity in experimental animals for the following hexavalent chromium compounds; calcium chromate, lead chromate, chromium trioxide, strontium chromate, and zinc chromate. International Agency for Research on Cancer (IARC) has listed chromium metal and its trivalent compounds within Group 3 (The agent is not classifiable as to its carcinogenicity to humans.) Chromium is not regulated as a carcinogen by OSHA (29 CFR 1910 Subpart Z). ACGIH has classified chromium metal and trivalent chromium compounds as A4 not classifiable as a human carcinogen.

1.5 Environmental effects of chromium

There are several different kinds of chromium that differ in their effects upon organisms. Chromium enters the air, water and soil in the chromium(III) and chromium(VI) form through natural processes and human activities.

The main human activities that increase the concentrations of chromium (III) are stolen, leather and textile manufacturing. The main human activities that increase chromium(VI) concentrations are chemical, leather and textile manufacturing, electropainting and other chromium(VI) applications in the industry. These applications will mainly increase concentrations of chromium in water. Through coal, combustion chromium will also end up in the air and through waste disposal chromium will end up in soils.

Most of the chromium in the air will eventually settle and end up in waters or soils. Chromium in soils strongly attaches to soil particles and as a result, it will not move towards groundwater. In water, chromium will absorb into sediment and become immobile. Only a small part of the chromium that ends up in water will eventually dissolve.

Chromium(III) is an essential element for organisms that can disrupt the sugar metabolism and cause heart conditions when the daily dose is too low. Chromium(VI) is mainly toxic to organisms. It can alter genetic materials and cause cancer.

Crops contain systems that arrange the chromium-uptake to be low enough not to cause any harm. But when the amount of chromium in the soil rises, this can still lead to higher concentrations in crops. Acidification of soil can also influence chromium uptake by crops. Plants usually absorb only chromium(III). This may be the essential kind of chromium, but when concentrations exceed a certain value, negative effects can still occur.

Chromium is not known to accumulate in the bodies of fish, but high concentrations of chromium, due to the disposal of metal products in surface waters, can damage the gills of fish that swim near the point of disposal.

In animals, chromium can cause respiratory problems, a lower ability to fight disease, birth defects, infertility and tumor formation.

II. TESTING CONDUCTED ON SAMPLE

2.1 pH TESTING

Apparatus: pH meter, standard flask, bottle with the water sample, funnel, beaker.

Reagents: standard buffer solution with pH - 4, 7, and 9.2 distilled water.

Procedure:

1. Set the temperature knob to the room temperature. Dip the electrode in 9.2 pH solution.
2. Set the display value in the 9.2 pH by turning calibration knob (kale nob). Dip the electrode in the 7pH solution about washing with distilled water.

3. Set the display to 7pH by turning the calibrating knob. Dip the electrode in the pH solution after washing it with distilled water. Set the display to 4pH by rotating the calibrating knob.
4. the Instrument is ready for measurement of any solution. connect the pH electrode to the instrument input
5. Dip the pH electrode in the solution under test and set the temperature knob to the room temperature.

Result: The pH value of the project sample is **8.2**

2.2 TOTAL DISSOLVED SOLIDS (TDS)

Requirements:

1. Membrane filter with funnel
2. Gooch crucible, 25-mL to 40-mL capacity, with Gooch crucible adapter.
3. Filtration apparatus with a reservoir and coarse (40- to 60- μm) fritted disk as filter support.
4. Suction flask of sufficient capacity for sample size selected.
5. Drying oven, for operation at $180 \pm 2^\circ\text{C}$.
- 6) Common chemical balance.

Procedure:

1. Stir the sample with a magnetic stirrer.
2. Pipet a measured volume onto a Whatman filter paper with applied vacuum.
3. Wash with three successive 10-mL volumes of reagent-grade water and continue suction for about 3 min after filtration is complete.
4. Transfer total filtrate (with washings) to a weighed evaporating dish.
5. Evaporate to dryness on a steam bath or in a drying oven.
6. Dry evaporated sample for at least 1 hr in an oven at $180 \pm 2^\circ\text{C}$.
- 7) Cool in a desiccator to balance temperature and weight.

Result: The TDS of project sample value is **160 ppm**

2.3 TOTAL SUSPENDED SOLIDS

Apparatus:

1. Glass microfiber filters discs, 47 mm, without organic binder, Whatman type GF/F (0.7 μm).
2. Disposable aluminum dishes
3. Tweezers
4. Suction flask, 1000 mL
5. 47 mm glass microanalysis filter holder (funnel, clamp, and base)
6. Magnetic stir plate with a stir bar and stir bar retriever
7. Drying oven for operation at 103-105OC
8. Desiccator
9. Analytical balance, capable of weighing to 0.1 mg
10. Milli-Q reagent grade water (ASTM Type I water), Millipore Corp, Bedford, MA

Procedure:

1. Preparation of the glass fiber filter disk: Insert the filter disk onto the base and clamp on the funnel. While the vacuum is applied, wash the disk with three successive 20 mL volumes of Milli-Q water. Remove all traces of water by continuing to apply vacuum after water has passed through. Dry in an oven at 103-105OC for one hour in aluminium dish. When needed, remove the dish from the oven, desiccate, and weigh in the dish.
2. Re-dry and re-weigh filter until weight change is less than 4% of previous weight or 0.5 mg.
3. Select a sample volume (max. of 200 mL) that will yield no more than 200 mg of total suspended solids.
4. Place the filter on the base and clamp on the funnel and apply vacuum. Wet the filter with a small volume of Milli-Q water to seal the filter against the base.
5. Stir sample continuously while sub-sampling and quantitatively transfer the sample to the filter using a 100 mL graduated cylinder. Remove all traces of water by continuing to apply vacuum after the sample has passed through.
6. Rinse the graduated cylinder onto the filter with 3, 20 mL portions of Milli-Q water. Remove all traces of water by continuing to apply vacuum after water has passed through.
7. Carefully remove the filter from the base. Dry at least one hour at 103-105OC. Cool in a desiccator and weigh. 6.8 Re-dry and re-weigh filter until weight change is less than 4% of previous weight or 0.5 mg.

Result: total suspended solids present in the project sample **260gm/l**

2.4 TURBIDITY(using nephelometric turbidity meter)

Apparatus: nephelometric, sample tube, standard flask, funnel.

Reagents: standard turbidity suspension, a blank solution of distilled water.

Procedure :

1. Take 1gm of hydrazine sulfate and dilute it in 100 ml of deionized water (distilled). Name it as solution 1.
2. Take 10gms of hexamethylenetetramine and dilute it in 100 ml of deionized water (distilled). Name it as solution 2.
3. Pipette 5ml of sol. 1 and 5ml of sol. 2. Then mix it together in a standard flask and keep it under rest for 24hrs (after 24hrs, cloudiness forms in solution).

4. Add 10ml of cloudiness solution into 90ml of deionized water.
5. On the other hand, switch on the turbidity meter at least 30 mins before the test.
6. Now take the prepared solution in the turbidity container and place it in the nephelometric turbidity meter. Place the container in such a way that the mark on the container coincides with the mark in the turbidity meter.
7. Close the lid and calibrate to 400NTU. After calibrating the standard turbidity solution, then place the unknown sample to be tested for turbidity.
8. Note down the readings.

Result: The turbidity of the project sample value is **160NTU**

2.5 TESTING OF DO (Dissolved Oxygen)

Apparatus: BOD – Bottle of 300ml capacity, burette, pipette, conical flask, measuring cylinder.

Reagents: 0.25N sodium thiosulphate, concentrated sulphuric solution, alkaline iodine oxide reagents, starch iodine oxide reagents, starch indicator.

- i. Burette Solution: sodium thiosulphate
- ii. Pipette solution: sample + manganese sulfate, alkali iodide azide (sodium hydroxide, potassium iodide, sodium azide) and sulphuric acid.
- iii. Indicator: starch
- iv. Endpoint: 1. lemon yellow to pale yellow
2. blue (starch) to colourless

Procedure:

1. Take the standard BOD bottle of 300ml and fill sample in it.
2. Add 2ml of manganese sulfate and also add 2ml of alkali iodide azide in the sample bottle.
3. Using the stopper invert the BOD bottle for 15 times. Then after sometimes Precipitate settle at the bottom and clear supernatant at the top.
4. Add 2ml of conc. sulphuric acid above the solution shake well and take 200 ml of it and titrate it to the burette solution until the color change from lemon yellow to pale yellow.
5. Add 20ml of starch solution to the sample and it will become dark blue and continued the titration until the color changes from dark blue to colorless.

Result: The dissolved oxygen in the sample were determined is **6mg/l**.

2.6 CHROME TESTING (CR +6)

Apparatus:

1. Colorimetric equipment: One of the following is required Spectrophotometer, for use at 540 nm, with a light path of 1 cm or longer.
2. Filter photometer, providing a light path of 1 cm or longer and equipped with a greenish yellow filter having maximum transmittance near 540 nm.
3. Separatory funnels, 125-mL, Squibb form, with glass or TFE stopcock and stopper.

Reagents: Use redistilled water to prepare reagents.

- i. Stock chromium solution: Dissolve 141.4 mg K₂Cr₂O₇ in water and dilute to 100 mL; 1.00 mL = 500 µg Cr.
- ii. Standard chromium solution: Dilute 10.0 mL stock chromium solution to 100 mL; 1.00 mL = 5.00 µg Cr.
- iii. Nitric acid, HNO₃, conc.
- iv. Sulfuric acid, H₂SO₄, conc. e. Sulfuric acid, H₂SO₄, 1 + 1. f. Sulfuric acid, H₂SO₄, 6N. g. Sulfuric acid, H₂SO₄, 0.2N: Dilute 17 mL 6N H₂SO₄ to 500 mL of water. h. Phosphoric acid, H₃PO₄, conc. i. Methyl orange indicator solution.

Procedure:

1. Preparation of calibration curve: To compensate for possible slight losses of chromium during digestion or other analytical operations, treat chromium standards by the same procedure as the sample. Accordingly, pipet measured volumes of standard chromium solution (5 mg/mL) ranging from 2.00 to 20.0 mL, to give standards for 10 to 100 µgCr, into 250-mL beakers or conical flasks. Depending on pretreatment used in 1! b below, proceed with subsequent treatment of standards as if they were samples, also carrying out cupferron treatment of standards if this is required for samples. Develop color as for samples, transfer a suitable portion of each colored solution to a 1 cm absorption cell, and measure absorbance at 540 nm. As the reference, use distilled water. Correct absorbance readings of standards by subtracting absorbance of a reagent blank carried through the method. Construct a calibration curve by plotting corrected absorbance values against micrograms chromium in 102 mL final volume.
2. Treatment of sample: If the sample has been filtered and acidified and only hexavalent chromium is desired, proceed to 11 4e. If total dissolved chromium is desired and there are interfering amounts of molybdenum, vanadium, copper, or iron present, proceed to % Ac. If interferences are not present, proceed to II 4d. If the sample is unfiltered and total chromium is desired, digest with HNO₃ and H₂SO₄ as in Section 3030G. If interferences are present, proceed to 11 4c, 4c/, and 4e. If there are no interferences, proceed to 11 4c and 4e.
3. Removal of molybdenum, vanadium, iron, and copper with cupferron: Pipet a portion of the digested sample containing 10 to 100 µg Cr into a 125-mL separatory funnel. Dilute to about 40 mL with distilled water and chill in an ice bath. Add 5 mL ice-cold cupferron

solution, shake well, and let stand in the ice bath for 1 min. Extract in the separatory funnel with three successive 5-mL portions of CHCl_3 ; shake each portion thoroughly with the aqueous solution, let layers separate, and withdraw and discard CHCl_3 extract. Transfer extracted aqueous solution to a 125-mL conical flask. Wash separatory funnel with a small amount of distilled water and add wash water to a flask. Boil for about 5 min to volatilize CHCl_3 and cool. Add 5 mL HNO_3 , and 3 mL H_2SO_4 . Boil samples to the appearance of SO_3 fumes. Cool slightly, carefully add 5 mL HNO_3 , and again boil fumes to complete decomposition of organic matter. Cool, wash sides of the flask, and boil once more to SO_3 fumes to eliminate all HNO_3 . Cool and add 25 mL water.

4. Oxidation of trivalent chromium: Pipet a portion of a digested sample with or without interferences removed and containing 10 to 100 (Jig Cr, into a 125-mL conical flask. Add several drops of methyl orange indicator, then add cone NH_4OH until the solution just begins to turn yellow. Add 1 + 1 H_2SO_4 , dropwise until it is acidic, plus 1 mL (20 drops) in excess. Adjust volume to about 40 mL, add a boiling chip, and heat to boiling. Add 2 drops KMnO_4 solution to give a dark red color. If fading occurs, add KMnO_4 dropwise to maintain an excess of about 2 drops. Boil for 2 min longer. Add 1 mL NaN_3 solution and continue boiling gently. If the red color does not fade completely after boiling for approximately 30 s, add another 1 mL NaN_3 solution. Continue boiling for 1 min after the color has faded completely, then cool. Add 0.25 mL (5 drops) H_3PO_4 .

5. Color development and measurement: Use 0.2N H_2SO_4 and a pH meter to adjust the solution to $\text{pH } 1.0 \pm 0.3$. Transfer solution to a 100-mL volumetric flask, dilute to 100 mL and mix. Add 2.0 mL diphenyl carbazide solution, mix, and let stand 5 to 10 min for full-color development. Transfer an appropriate portion to a 1-cm absorption cell and measure its absorbance at 540 nm. Use distilled water as the reference. Correct absorbance reading of sample by subtracting absorbance of a blank carried through the method (see also note below). From the corrected absorbance, determine micrograms chromium present by reference to the calibration curve.

Note: If the solution is turbid after dilution to 100 mL in II e above, take an absorbance reading before adding carbazide reagent and correct absorbance reading of final colored solution by subtracting the absorbance measured previously.

Result: The amount of hexavalent chromium present in project sample is **1.5 mg/l**

III. REDUCTION PROCESS OF CHROMIUM IN THE WASTEWATER BY ADSORBENTS METHOD

3. Reduction Process By Potato Peels

Adsorption remains one of the most economical and widely used methods for the removal of toxic pollutants from wastewater and the most widely used Cr(VI) sorbent is activated carbon although it is expensive and has high running costs since it requires regeneration after sorption. Therefore the potential exists for Cr(VI) removal by a lower cost biosorbent.

This study investigated the use of potato peels which are widely available in many countries as a biosorbent for a low-cost Cr(VI) removal technology. The Langmuir and Freundlich isotherms were employed to analyze the equilibrium data. The Elovich, pseudo-first-order, and pseudo-second-order kinetic models were used for the kinetic interpretation of the adsorption data. The effects of varying concentration of the chromium, contact time, and adsorbent dose were investigated.

3.1 Preparation Of Biosorbent

Potato peels, referred to as biosorbent, were collected from a local food chain free of charge and washed in deionized water and then rinsed in 0.1 M HCl. In acidic media, the surface of the sorbent is expected to be protonated to a large extent resulting in a stronger attraction for chromium oxyanions in the solution (in acidic media Cr(VI) exists in the form of oxyanions such as HCrO_4^- , CrO_4^{2-} , $\text{Cr}_2\text{O}_7^{2-}$, $\text{Cr}_3\text{O}_{10}^{2-}$). The biosorbent was left to dry at approximately 103–110°C overnight in an oven. The dried biosorbent was then ground to 100% passing 75 μm and stored in airtight plastic bottles prior to batch tests.

3.2 Effect Of Adsorbent Dose

Absorbent dose, varied from 0.5 to 4.0 g/L, was added to 100 mL of 1.5 mg/L Cr+6 solution in 100 mL volumetric flasks. The pH was adjusted to 2.5 using 0.1 M HCl. Approximately 10 mL of solution for analysis was withdrawn from each flask at 24-minute intervals and filtered. The filtrate from each flask was then analyzed for residual Cr(VI) concentration.

3.3 Effect Of Initial Cr(VI) Concentration With Time

The initial concentration of the project solution was varied from 1.5 to 2 mg/L. A constant adsorbent dose of 4 g/L was used for this set of experiments. The pH was adjusted to 2.5 using 0.1 M HCl. The equilibrium curve was plotted from Cr(VI) percentage removal obtained after a time period of 148 minutes.

3.4 Result Of The Process Conducted

That the amount chromium (Cr +6) present in the solution after the process conducted is 1.245mg/l .where the partial amount of chromium Cr(VI) adsorption onto potato peel powder. As per result concern that the amount of chromium has been reduced to the partial amount of present in chromium solution

4. Reduction Process By Chemically Activated Carbon Prepared From Locally Available Waste Of Bamboo

Adsorption by activated carbon is one of the effective techniques for Cr(VI) ion removal from wastewater because of the high surface area, highly porous character, and relatively low cost of the adsorbent. Activated carbon is especially known for the effective removal of organic chemicals, inorganic and heavy metal ion pollutants from wastewater in the laboratory as well as in various industries.

Activated carbon can be synthesized by physical treatment, in which the surface of the carbonaceous material is exposed to a stream of gases at high temperature or chemical one where the carbonaceous material is exposed to activation agents such as acids, hydroxides, and zinc chloride at low temperature. The major raw materials for the production of activated carbon are wood coal, nutshells, and fruit stones. The main disadvantage of activated carbon is the weak mechanical properties of its surface and that it is easily burned at high operating temperature.

Some low cost activated carbons used for removing of Hexavalent Chromium ions such as groundnut husk, agro waste, neem leaves, sawdust, wheat bran, rice bran, sago waste, green coconut shell, hazelnut shell, olive stone, gingelly oil cake, and peanut shell have all been reported as useful for preparing adsorbents.

Activated carbons derived bamboo wastes have shown great potential for the removal of organic and inorganic waste from the aqueous solution. In the present research, we have used bamboo waste to develop activated carbon by chemical activation method using KOH for the removal of Hexavalent Chromium ion.

4.1 Preparation Of Bamboo Waste Activated Carbon (BWAC)

Bamboo (*Oxytenanthera abyssinica*) waste was collected from Hosanna furniture manufacturing house, which is 230 Km from Addis Ababa (Ethiopia). The waste was air-dried for one month before use. Then it was cut into pieces approximately $1 \times 1 \text{ cm}^2$ in size. It was washed with distilled water and dried at 378 K for 12 hrs. This bamboo precursor was immersed in a potassium hydroxide solution (25% by weight/volume). The mixture was dried in an oven overnight at 378 K. The dried bamboo/KOH mixture then was put on a crucible placed in an electrical furnace (Model Nabertherm (R)) for carbonization. The heating rate of carbonization was $10^\circ\text{C}/\text{min}$ and continues until the final temperature of 1078 K was reached and it was kept at this temperature for 3 hrs. The produced activated carbon was then cooled down to room temperature. To remove remaining impurities such as ash, the synthesized BWAC was washed with 5% aqueous solution of HCl, followed by washing with distilled water several times until the pH of the washing solution was neutral. Prior to adsorption study, HCl-treated activated carbon then was dried at 378 K for 12 hrs and ground into a fine particle of $150 \mu\text{m}$ (sieve size).

4.2 Characterization Of The Adsorbent

Fourier transform infrared (FT-IR) spectra of dried unloaded BWAC and Hexavalent Chromium loaded BWAC were recorded at $400\text{--}4000 \text{ cm}^{-1}$ using Spectrum 65, Perkin Elmer model FT-IR spectrophotometer, to determine the surface, functional groups. Proximate analysis of total ash content, moisture content, volatile matter, and fixed carbon was also performed.

4.3 Adsorption Study

The adsorption study was carried out by contacting 0.25 g of the activated carbon with 25 mL of the metal ion solution under different conditions for a period of time in a boiling tube. The adsorption studies are conducted at 300 K using a thermostated water bath to determine the effect of pH, contact time, and initial metal ion concentration on the adsorption. The residual metal ion was analyzed using atomic absorption spectrophotometer. All experiments were carried out in triplicate, and the concentrations given are average values. The initial metal ion concentration in the test solution and the adsorbent dosage were varied to investigate their effect on the adsorption kinetics. The percentage removal of Hexavalent Chromium solution was calculated by using the following process where and are the initial and equilibrium concentration hexavalent chromium ion in solution.

4.4 Effects Of Contact Time On Adsorption

The adsorptions of the metal ions by activated carbon were studied at various time intervals (3–120 min) and at a concentration of 100 mg/L. that the chromium uptake is fast for the first 3–20 min, respectively, and, thereafter, they proceed at a slower rate and finally attain saturation. The initial fast reaction may be due to the increased number of vacant sites available at the initial stage; as a result, there exists increased concentration gradient between adsorbate in solution and adsorbate in the adsorbent. Generally, by the time adsorption involves a surface reaction process, the initial adsorption is fast. Then, a slower adsorption would follow the available adsorption site which is gradually decreased. This is due to the fact that a large number of vacant surface sites are available for adsorption during the initial stage, and after a lapse of time, the remaining vacant surface sites are difficult to be occupied due to repulsive forces between the solute molecules on the solid and bulk phases. Maximum percentage of adsorption (15 % in 100 mg/L of solution) occurs at 20 min; after that, the percentage adsorption remains uniform.

4.5 Effect On The Initial Concentration On The Adsorbents

The effect of initial Hexavalent Chromium concentration on the adsorption efficiency of BWAC under optimum conditions of pH and contact time. The adsorption efficiency increased from 92.87 to 15% for Hexavalent Chromium with increasing initial concentration from 25 to 150 mg/L but the solution reached equilibrium at 100 mg/L and after that, no significant change occurred in adsorption.

The adsorption capacity increases from 0.255 to 0.358 mg/g for Hexavalent Chromium as the initial metal ion concentration increased from 25 to 150 mg/L. This is because a higher initial concentration enhanced the driving force between the aqueous and solid phases and increased the number of collisions between metal ions and adsorbents. However, the actual percentage adsorption of the metal ions from solution increased with the increase in the initial metal ion concentrations. This may be due to the fact that, at lower concentrations, adsorption of the metal ions occurred slowly and further increase in initial metal ion concentration led to a competition for available binding sites on the BWAC surface by the metal ions and thus increased adsorption. Similar adsorption procedures have also been

reported by other researchers. The adsorption capacity of an adsorbent which is obtained from the mass balance equation on the adsorbate in a system with solution volume is often used to acquire the experimental adsorption isotherms.

IV.COMPARISON OF HEXAVALENT CHROMIUM ADSORPTION WITH BOTH ADSORBENTS

The adsorption capacity of the adsorbents for the adsorption of Hexavalent Chromium has been compared with those of others reported in the literature and the values of adsorption capacity as presented in Table. The experimental data of the present investigation were compared with reported values.

Adsorbents	Adsorbent Capacity (Mg/g)	Remarks
BWAC (bamboo waste activated carbon)	0.142	It is also quite well in the reduction
Biosorbents potato peels	0.255	Hence it is work comparative well

Results of our investigation revealed that potato peels sorbent has the highest percent adsorption and adsorption capacity.

V. CONCLUSION

The amount of hexavalent chromium can be reduced by the bio- adsorbents method .which that in some methods chromium can be reduced to minimize or partially reduced to the extent we required. comparative we have used a method to reduce the chromium contents in wastewater. Even a wastewater we need to treat with some basic process to reduce the content toxic present in it. In the effective process is using the adsorbent method. Comparing both the process which used to reduce the hexavalent chromium hence there are effective in the way of they used. But comparing the resulting case we can see hexavalent chromium content can be reduced effectively in potato peels adsorbent method were other one reduction level is less in amount. Here we are able to say that the reduction was conducted in the fewer cost adsorbents were we used in both cases. Hence the possibility of the amount hexavalent chromium can be used to reduce by adsorbents method.

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