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Experimental Investigation for Removal of Heavy Metals from Electroplating Effulent (Ni) in Wastewater Treatment

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ABSTRACT: Electroplating wastewater is more hazardous industrial wastewater with complex composition. the traditional treatment method include chemical treatment and membrane treatment. The electroplating effluent treatment process helps to deposit the thin layer of metals using the chemical flocculation process. It is observed that waste has more BOD/COD, SS, TS, Color, and Turbidity and there is depletion of oxygen. Appropriate treatment has to be rendered for the safe discharge of electroplating effluent. Electroplating wastewater is liable to change in character and alkaline in nature. In this research the electroplating effluent has to be treated in proper Manner. It beneficial in the selection of wastewater treatment method based on the quantity and characteristic of the effulent generated.

KEYWORDS: Electroplating, traditional treatment, chemical flocculation, safe discharge

I. INTRODUCTION

Electroplating is also known as electrodeposition. As the name implies, the process involves depositing material using an electric current. this process results in a thin layer of metals being deposited on to the surface of a workpiece called the substrate. industrial process involves acid pickling alkaline, cleaning, plating, and rinising which produce wastewater in large quantities containg high level of heavy metals, chemical oxygen demand (COD)cyanides, nitrates, and biological oxygen demand (BOD), SS, DS, TS and turbidity. Electroplating wastewater means the water carries some waste from the surface plating operations. The metals is dipped in an electroplating solution of various types of metals and then rinsed. It originates from washing ,rinsing, and batch dumps.

The influent types of aquatic pollutants are dyes and hazardous metal pollutants, which once enter into water than water will not be free from danger and less harm for drinking purpose and it is not easy to break the polluted water. The contamination of hazardous metals has become an important and predicted problem that pollutes the environment and also the health of human beings. In recent years the quality of being poisonous and effect of heavy metals on the environment have attached much considerable and extensive attention. polluted heavy metals are considered as hazardous constituents who can disturb the natural environment at less concentration and it has a propensity to enter in food chain. The presence of impurities in water has to be produced by hazardous metal ions generated from electroplating, mining, coloring, alloys, aviation industries, rubber, petrochemical industries, and voltaic batteries. Nickel is also considered has a most pollution emitted heavy metal ions which are non-capable of being decomposed and present in an aqueous environment.

II. EFFECT OF HEAVY METALS IN ENVIRONMENT

- In large amount cause acute and chronic toxicity.
- Linked to learning disabilities, cancer and even death.
- Heavy metals have harmful effect on the growth of aquatic organisms and cause various seveir upsets in organic waste water treatment plants.
- It serves as great threats to soil and plants growing on such soil with the consumption of such plants by animals and human due to their entry into the food chain leading to server detrimental effects.

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III. BENEFITS OF REMOVAL FOR ELECTROPLATING IN WASTE WATER

- Remove toxic metal particles.
- Improve quality of waste water to dispose.
- Make wastewater has to irrigation purpose.
- High treatment efficiency inspite of expensive chemical reagents.
- The final treated water can be reused for wash out process in the electroplating industry and eject without any environmental hazard effect.

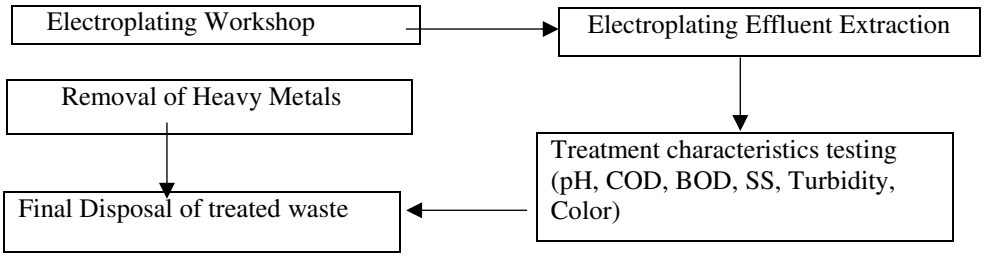
IV. PROCEDURE FOR ELECTROPLATING EFFULENT TREATMENT

STEP 1: Precipitation and coagulation
STEP 2: Flash mix
STEP 3: Flocculation
STEP 4: Clarifier, Inclined plate
STEP 5: Clarifier sludge handling
STEP 6: Sludge dewatering

V. PRINCIPLE PROCESS OF ELECTROPLATING EFFLUENT

The most relevant process for the treatment of electroplating wastewater is compensate for followed by **sedimentation**. This process results in producing large amounts of precipitated handling and cost.

VI. PROCESS OF ELECTROPLATING EFFULENT TREATMENT



VII. TRADITIONAL ELECTROPLATING WASTEWATER TREATMENT TECHNOLOGY

Chemical precipitation method: chemical methods have become generally used in various process in recent years due to improvement of electroplating industry and to improve their developed processes and economical investment.

VIII. CAUSES OF NICKEL IN ENVIRONMENT

Nickel compounds are perceived by various industries are electroporating, electroplating, aerospace industries, rubber, plastics, batteries and mining. They are also used for making jewelry, cast coins and medical purposes. They are various types of causes of nickel pollution in environments are production and preparing of nickel compounds and their product, nickel having waste discharge and reuse of nickel waste products. Nickel is also present in the environment and its species also depend on the source of contamination. Different industrial and anthropogenic sources are disposed of in the form of silicates, oxides, sulphides and some soluble forms. Coal and oil combustion also disposed of nickel in atmospheric emission. The deposition and extraction of rocks also exposed in a consequentials nickel concentration in water and present in dissolved and un-dissolved suspended form. The divalent form of nickel is high in the aquatic environment. Nickel compound depends on pH and inorganic or organic binding sites.

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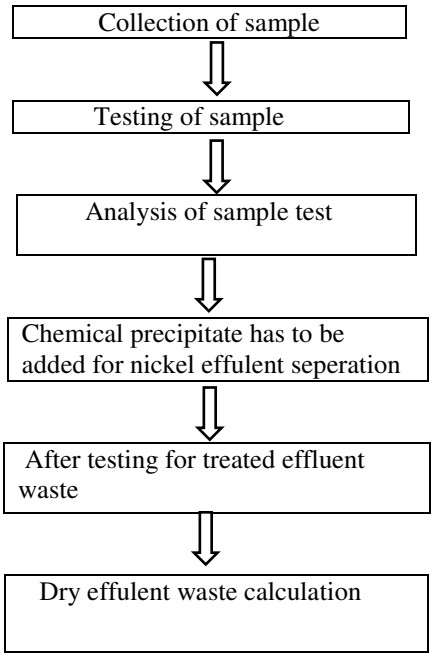
IX. METHODOLOGY



X. BEFORE TREATMENT ANALYSIS

INDEX	UNIT OF MEASUREMENT	SAMPLE
pH	-	11
SS	mg/dm	382
BOD	mg/dm	130
COD	mg/dm	220
Total iron	mg/dm	607.5
Turbidity	ppm	20
Colour	ppm	20

XI. ADVANTAGES OF SULFIDE PRECIPITATION IN HEAVY METALS

- In heavy metals removal technology the sulfide precipitations are mostly used because it has a rapid reaction rate and low volume of sludge produced.
- It can be used in lower pH value and shorter reduction time and also used for smaller sludge volume.
- Sulfide precipitate are not amphoteric so it can achieve a high degree of metal removal in a shorter time over a wide pH range compared with hydroxide precitation.
- Precipitated sludge has better settling properties.

X. DISADVANTAGES OF SULFIDE PRECIPITATE IN HEAVY METALS

- Very Low solubility of metal sulfides, high sensitivity of the process to the dosing of the precipitation agents.
- In sulfide precipitation we must to know the solution form has soluble or insoluble .
- If the negative effects of chemical reactions is the environmental pollution.

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- Dosing of sulfide and process control might be challenging due to the sensitivity of the process.

XI. SPECIAL FEATURES OF SULFIDE

It is the high reactivity of sulfide with metals and the characteristics of the precipitates. This emphasizes the needs for process control and optimization as well as the choice of suitable solids or liquids separation techniques. Due to the possibility of hazardous gaseous emissions, the occupational safety is carefully considered.

When chemical nickel electroplating wastewater is indicate nickel plating wastewater is not included nickel, being first want contact break, can considered when contact break to oxidize with sodium hydrochloride, then adding agent of recapturing and carry out chelation treatment, agent of recapturing can capture nickel ion, forms with it precipitation, nickel is removed. if contact break is difficult to carry, it may be considered that with efficiently not includeds nickel agent carries out chelating precipitation process, efficiency except nickel agent is a kind of microcosmic macromolecular organic compound, by reacting except nickel based compound and nickel particle, after condensation, flocculation, precipitation, nickel particle being removed technics comparing is simple effectiveness comparison is better.

XII. MATERIALS AND METHODS

- Sulfide precipitation tests were performed in pyrex-reactor.
- The treated volume of nickel-rich effulent was 500Ml and 100mg/l of Ni^{2+}
- Nickel-rich water were prepared from $NiCl^2$ $6H_2O$. sodium sulfide salts were used as the source of sulfide ions and added to the volume of nickel rich solution.
- The mixture was stirred at moderate speed with the magnetic stirrer.
- The pH adjustment was carried out with 0.1M hydrochloric acid or 0.1 M sodium hydroxide.
- All the chemicals were of analytical grade supplied water.
- The effect of the pH of the mixture (nickel-rich solution and sulfide solution)with stoichiometric ratio between nickel and sulfide solution(1:1)ratio of the nickel removal.
- The effect of sulfide ions concentration on the nickel removal.
- During, a test 20 mL of sample has to taken for every 20min, for the first 10 min of the reaction then every 5 min for the next 30 min and every 15 min for the last 30 min.
- The samples were filtered using a membrane filter (0.45micrometer) and stored with a drop of concentration nitric acid (60%) (Aldrich)for nickel analysis.

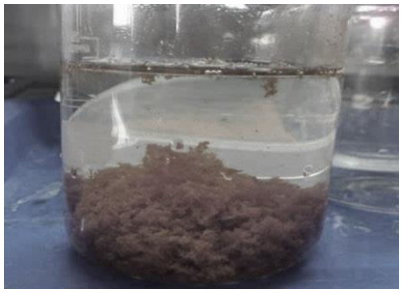

Fig.1 Effulent sedimentation

Fig .2 Effulent filtration process

Fig.3 effluent extraction on a filter paper

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XIII. CALCULATION

The yield of nickel removal can be calculated as follows,

$$R\% = \frac{C_0 - C_f}{C_0}$$

Here, C_0 is the initial concentration and C_f is the final concentration.

Before testing the sample the nickel concentration effulent has,

Co = 450ppm

After testing the sample the nickel concentration effulent has,

C_f=230ppm

Here, the calculation of yield of nickel removal by the desired sample,

The values are taken as percentage,

$$R\% = \frac{C_0 - C_f}{C_0}$$

$$R\% = \frac{450 - 230}{450}$$

R= 48.9%

The sludge genetated from sulfide precipitate at optimal conditions was a powdered whose mass weight is 48.9g.it was filtered and dried is 150°C for 24 hours before characteristics.

XIV. AFTER TREATMENT THE EFFULENT CHARACTERISTICS

INDEX	UNIT OF MEASUREMENT	SAMPLE
pH	-	8
Suspended solids	mg/dm	126
Total iron	mg/dm	200
Turbidity	ppm	10
Colour	ppm	8

The dry effluent (Ni) has to be measured by a oven dry process, the values are approximately calculated as 49 grams.

XV. ACKNOWLEDGEMENT

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XVI. CONCLUSION

Nickel effluents pose very dangerous problems for the environment. Here, in order to improve more environmental conditions, it is necessary to implement multiple treatments for the treatment process namely precipitation, sedimentation, coagulation, flocculation. It is concluded that the paper has to test the sample before and after treatment. (pH, COD, suspended solids, turbidity, colour, total ions). Chemical precipitate has to be applied to the treatment of electroplating effluent (Ni) removal. It is very easy to test the sample and to give a test result accurately. It is a beneficial treatment when compared to other treatment. The process is predictable. In this process the nickel has to be

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precipitated in sulfide precipitation chemical it gives a more probable result for treatment of nickel effluent and moreover the treatment has to increase its adsorption efficiency.

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