

Silver Extraction from Waste Water of Silver Cluster

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Abstract: The paper explains the extraction of silver from waste water of silver cluster. In this paper Identification of presence of silver contents in waste water of the silver cluster is done. Different chemical processes are done on the waste water to identify presence of silver. After the confirmation of the presence of silver, identified a process of extraction of silver from waste water. This paper presents the different methods of silver extraction from waste water. The processes used are chemical as well as electrical. Electrolysis process is used to get silver.

Keywords: Silver Extraction, Electrolysis Process, Volhard's Method and Mohr's Method.

1. Introduction

The present method of extracting silver is traditional, which is by means of sun rays with drying water at surface. This method is not so reliable. The method which is presented in paper is much reliable than traditional.

The extraction of the silver is done using different chemicals such as Hydrochloric acid, Ammonia etc. The whole extraction process depends upon the different reactions done on waste water. Similarly, for identification of presence of silver, chemical Methods are used.

The waste water treatment by chemical reactions is further filtered through different sized sieve and then electrolyzed. Finally the silver is extracted on cathode plate.

2. Problem Definition

There are many processes in silver ornament industries like silver cluster in which the wastage of silver is more. Polishing is main process where pure silver is used. During the polishing many processes are done with silver ornaments. Electroplating, sterilization, washing ornaments with distilled water are some of processes on the silver ornaments.

During the electroplating, pure silver plates are used. Hence in this process some amount of silver is

wasted. Though the wastage is in small amount, but the polishing process takes place repeatedly hence it becomes larger in amount.

Also the problem of pollution may occur if this silver get burned in environment. Hence it become necessary to extract this silver from the waste which is the main requirement of silver ornament industries.

3. Testing of waste water

The waste water obtained from silver cluster contains different impurities which should be analyzed. For the analysis different tests are done on waste water from silver cluster.

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There are two methods to find presence of silver in the waste water with impurities. These two methods are **Volhard's Method** and **Mohr's Method**. Volahrd's method is generally used. The method used for the testing of waste water from silver cluster is volhard's method. There are some another impurities present in the waste water except silver. The sample tested by **Automatic Absorption Process**. The methods is explained as below:

A. Volhard's Method:

The volhard's method is one type of titration method. This method uses potassium thiocyanate to determine the concentration of chloride ions in a solution. This method is performed only in acidic medium. In this practical ferric alum acts as an indicator. Its end point is brick red color and this red color indicates that the presence of silver in the solution. The process is as follows:

1. First take 50 ml of industrial water then take 0.76 molar potassium thiocyanate this and dilute with 50 ml water.

2. Then this solution is added into the industrial waste water white precipitate are occurred.
3. Then take 0.1 gram ferric alum and dilute with normal water.
4. This solution acts as indicator solution and titrate with the precipitated solution.
5. When there is red color then there is a presence of silver in that solution.
6. At low PH solution this method is performed.
7. This method gives accurate results. It is also useful for the determination of Halides, Anions like phosphate, chromate, and sulphide.
8. But disadvantage of this method is that it is time consuming and sometimes for Ag ions it is failed to determine the end point.



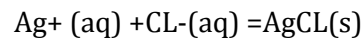
Solution obtained by Volhard's Process

Sr. No.	Parameter	Unit	Sample1	Sam ple2
1	Ph	---	10.72	11.20
2	EC	usec /cm	6120	6230
3	TDS	Mg/l	3100	1740
4	Total Hardness	Mg/l	160	260
5	Chloride	Mg/l	72	95
6	C.O.D	Mg/l	5400	3600
7	Cadmium(Cd)	Mg/l	4.833	2.837

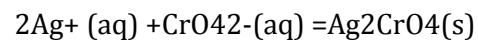
B. Mohr's Method:

The Mohr's method is used to determine the chloride ion concentration of sample solution by titration. This method is used to determine the chloride ion concentration of industrial waste

water or river water. For this process the solution to be neutral. Potassium chromate is used as indicator. The aqueous silver nitrate is slowly added in the solution, a precipitate of silver chloride forms. The chemical equation as follows:



Now the end point of the titration is when the chloride ions are precipitated. Then silver ions reacts with chromate ions which form a brown color precipitate of silver chromate.



After the titration process if the color sample solution is red then there is presence of silver.

C. Automatic Absorption Spectroscopy:

Automatic emission spectroscopy is a process used for the determination of quantitative chemicals element. The process is done by using absorption of optical radiation that means using light with free atoms in gas state. In AAS determination of concentration of particular element in a sample is analyzed. AAS can determine near about 70 different element in sample solution. The determination can be done on solid or liquid sample solutions. The quantitative and qualitative analysis can be done using AAS.

The different chemicals components can be found by AAS from different sample solution. The process is done on sample waste water from silver cluster to determine chemicals components in the sample waste water. The determination is required for the further process of silver extraction. The parameters included in sample waste water are determined these parameters are PH, Electrical Conductivity, TDS, Total Hardness, COD, Cadmium. Their amount obtained by AAS process is as below:

4. Determination of silver:

In the next part it was necessary to determine the presence of silver in the waste water. By the Volhard's method we didn't get actual output that is presence of silver.

The waste water solution is totally alkaline solution hence the ph. was high and the method was not working properly. Hence we decided to go for automatic absorption machine method which is

held only in Shivaji University Kolhapur. But at Shivaji University the part named cold silver evaporation was defected, so there machine for silver was not in working condition.

By adding 'nitric acid' (HNO₃) we can check the presence of silver from color of solution. If the color of solution becomes brown then silver is present in solution.

Add 5 to 7 drops of HNO₃ in waste water sample then its color become brown. Also by adding HNO₃ reduced ph. of required solution is obtained.

When the color of solution is brown then the ph. is 7 that means solution is neutral. But for electrolysis process we require acidic solution.

Hence add more 2 to 3 drops of HNO₃ to make it acidic having ph. about 4 to 5. At that time white precipitate are generated at the base.

5. Procedure to obtain silver:

After the analysis of water it is known that composition of other chemical like chloride, cadmium, its hardness, PH, Biochemical oxygen demand(BOD), chemical oxygen demand(COD) are within the limit.

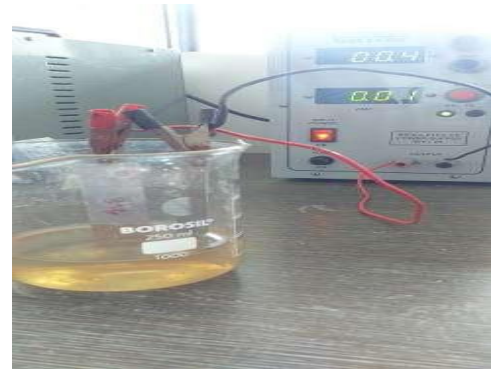
This means that no further reaction will occur. After adding other chemicals into it. To obtain the silver there one method which is as follows:

1. First take 50 ml of industrial water then add 11ml dilute HCL into it.

$$N_1 \cdot V_1 = N_2 \cdot V_2$$
2. To obtain dilute HCL add following proportion
 - For the 25ml of industrial water =6.25HCL +Industrial water
 - For the 50ml of industrial water =12.5HCL + Industrial water
3. When dilute HCL is added, the precipitates are occurred but clear solution is required.
4. To obtain this add ammonia into it until the red litmus paper turns blue. This solution is base.
5. For electrolysis process acidic solution is required. To make the solution acidic again add dilute HCL until blue litmus paper turns into red.

6. Electrolysis Process:

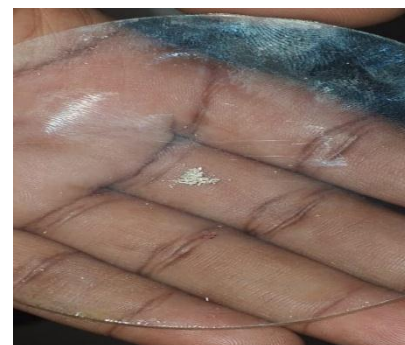
Now this solution is ready for electrolysis process. Steel plates are used as electrodes as anode and cathode. The distance between the two plates is kept as 2cm. The standard electrode potential of silver is 0.4volts. By giving 0.4volts the process is done. The duration of the process is 4 hours. After some time silver is obtained on cathode plate.



7. Results

It is concluded that this method of silver extraction by using dilute HCL and ammonia will meet the recovery from waste water of silver cluster.

Hence for 50ml of sample solution of waste water from silver cluster 0.1gm of powdered silver is obtained. If quantity of solution is increased then proportional increment in silver can be achieved.



Obtained Silver on Cathode plate



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9. Conclusion:

It is concluded that extraction silver from waste water of silver cluster can be easily done by using simplest method and nearly 50ml of waste solution from cluster 0.19m of silver is obtained if quantity of solution increase then extraction of silver will be more.

10. References:

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