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Extraction of Platinum from Spent Catalyst as pt/Al_2O_3 in aqua regia

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Abstract:

Spent catalyst from Biji Refining contained valuable metals such as platin. This study focus on platinum extraction in aqua regia solution. Three factors effecting on the process were study including dissolution temperature, normality of aqua regia and agitation speed. The ideal conditions for process give 0.22 gm platinum extraction in dissolution temperature 80 C^0, normality for aqua regia was 6 and 120 rpm mixing speed for solution.

Keywords: Extraction, Platinum, catalyst.

Paper History:-

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1. Introduction

The worldwide market for catalyst produce surpasses $14 billion and it can be assessed that catalyst induce a business of end products of over $7,500 billion yearly [1].

The extensive variety of platinum group metals iridium, platinum, rhodium, palladium, gold, ruthenium and silver. The platinum could be isolated from aggregate metals and from each other to high purity, yield, and recovery rate [2].

The platinum group metals (PGMs) are the principle dynamic elements of catalyst. Their great particular and movement towards reactants and imperviousness to oxidation at great temperatures make them extremely compelling catalysts. The platinum bunch metals are utilized as the dynamic site of numerous catalysts, as the one employed as a part of the propane dehydrogenation. The deactivated catalysts are supplanted occasionally by new catalysty. The process duration of substitution is generally short as a result of quick lasting deactivation of the impetuses by such instruments as auxiliary changes and metallic poisoning [3]. An expanded overall use of platinum group element (PGE) has been seen amid late decades. High measures of PGE are connected in such territories as compounds industry and gems creation [4].

While refining remains the essential source for PGMs, reusing PGMs can possibly give an else source to these materials. Shockingly appraises for PGM recuperation from different gadgets, for example, energy units, have not been set up, but rather this presents the chance to execute a reusing framework before commercialization. Analysts have investigated this branch, with the general accord being that pyrometallurgical techniques are the most proficient. Much like the extraction process, in any case, the results from these reactors are overwhelmingly dangerous and destructive chemicals, for example, hydrofluoric corrosive [5].

metals in deactivation oil catalyst would be recouped for different pyrometallurgical routes or hydrometallurgial. The

hydrometallu-rgyical process is accepted to be applicable to littler scale plants while the pyrometallurgical process is more appropriate for bigger plants. Fundamentally two method alternatives are generally accessible for the recuperation of pt. and pallad. and more utilizing the hydrometallurgical techniques. In the principal technique, plati. or pallad. is removed straightforwardly from impetus alumina utilizing extract [6].

Lately, look into has been centered around low price adsorbents for the waste material and recuperation of PGMs particles in solution. Horticultural material contains proteins, polysaccharides and lignin which are related with utilitarian gatherings in charge of metal particle adsorption. The inexhaustible regular event and nearness of substantial measure of surface practical gatherings make different agrarian squanders great choices manufactured adsorbents [7].

Suzana Dragulovic,"treatment of platinum group metals (PGMs) recovery from spent car catalyst. leaching of pulverizing and crushing car catalyst scrap in hydrochloric acid, included nitric acid as oxidant, created chloride arrangement of the platinum assemble metals, while impetus substrate oxide alumina stayed constant. Cementation of the drained platinum gather metals from arrangement was made by controlled aluminum with reasonable pH esteems. The accelerate acquired by cementation with Al-powder is blend of the platinum amass metals. It is supposed rough platinum metals of least 99% [8].

General extraction and stripping process "were done at room temperature by reaching break even with volumes of the natural for 30 minutes, by mechanical shaking, embracing a turn speed in the vicinity of 900 and 1000 rpm with impetus. This timeframe has been discovered adequate for the extraction frameworks to accomplish harmony, A. P. Paiva, could the investigation of the arrangements previously, and then after the fact extraction was performed in triplicate.

The coefficient of fluctuation evaluated for the outcomes accomplished from the diverse extraction and stripping tests is around ± 5%". He's improvement of proficient and particular procedures to isolate PGMs from genuine arrangements coming about because of reusing procedures of spent car or modern impetuses [9].

The present a novel realization of the Hirsch geometry in a platinum (Pt) nanostructure, which is an increasingly important material for spin transport electronics applications [10]. The many methods commonly used for the recovery of heavy metal from sample solutions include ion-exchange, extraction, precipitation, and adsorption process [11]. The platinum production mixes with some materials to form some conductive compounds[12]. The need of the times for advanced engineering materials with mechanical and chemical properties [13].

In this work, we experimentally studied the effects of different parameters on nano plati recovery from the pt/Al2O3 by dissolving the catalyst substrates in aqua rigea solution . The effect of temperature, Normality of aqua-regia, and rotating solution speed on the dissolution of the substrate has be investigate. Make that characterization for recovery platinum such X-ray Diffraction XRD and Scanning Electron Microscopy SEM.

2.Experimental

Prepared sample was crushed, the catalyst was burn to remove the oil containing sulfur and carbon for 30 min and 600 C0. 500 g/L platinum solution was prepared from the spent catalyst crashed and dissolved in the different aqua regia -concentrated solution normality (3, 4, 5 and 6), Aqua regia mixture contained nitric and hydrochloric acids (three

to one parts by volume). General separation experiments were carried out at different temperature dissolution (20, 40, 60 and 80 C0) for 30 minutes, by mechanical shaking, adopting a rotation speed between (30, 60, 90 and120 rpm)". After separation of the two phases, the powder crashed in balls crusher to give us Nano platinum, see figure 1

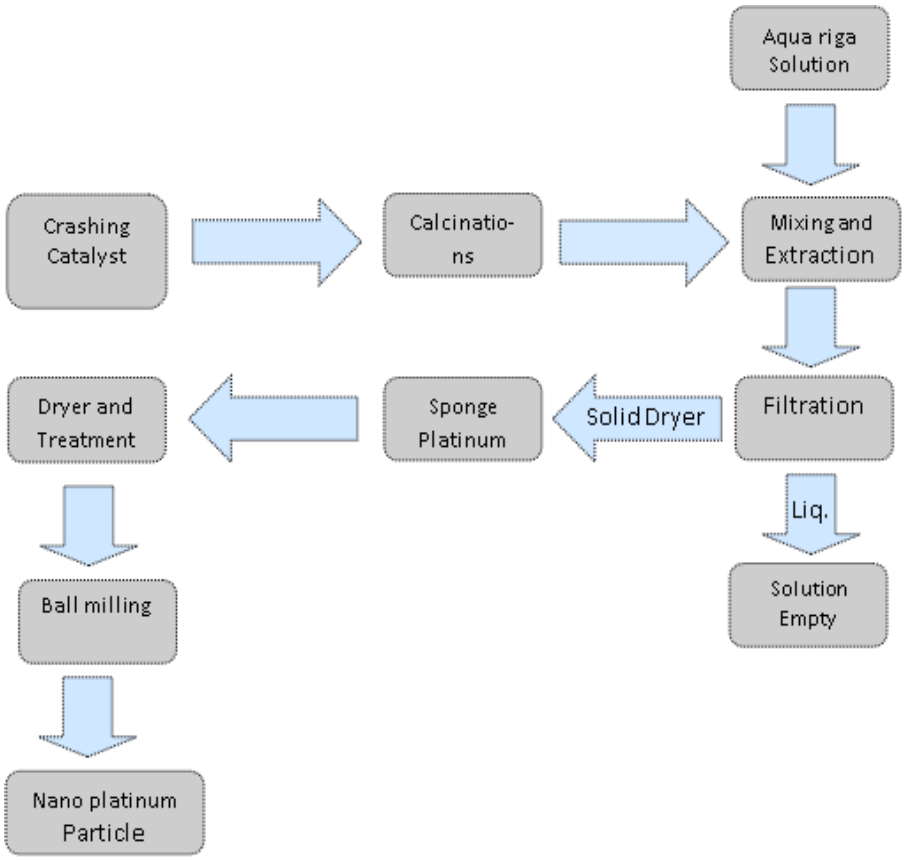

Figure 1: Experimental steps to product Nano-platinum particle

The particle surface morphology of the nanoplatinum extract included in the extract that clear by SEM photo show in Figure 2." The size of the almost particle nanoplatinum is spherical shape. The agglomerated for some particle platinum as show clearly in image after extract process.

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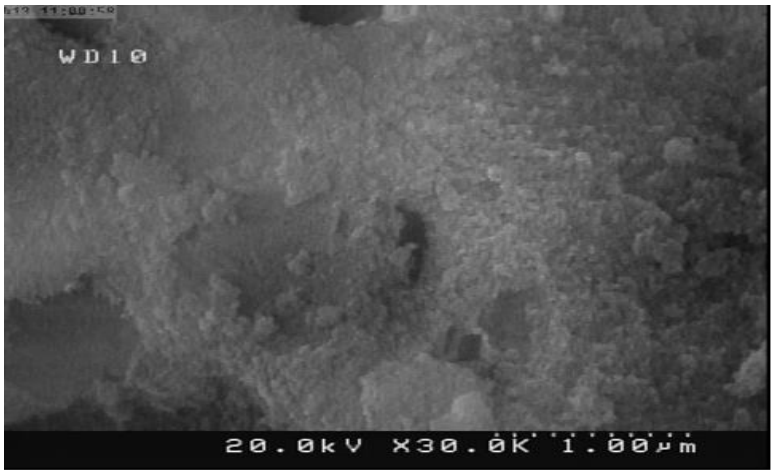

Figure 2: SEM images of platinum after extraction process

The x-ray diffraction XRD patterns for peak phase nano platinum powders extract in figure 3. At 2 Theta is 40 it's the platinum peak that result agree with Min-seuk Kim[6].

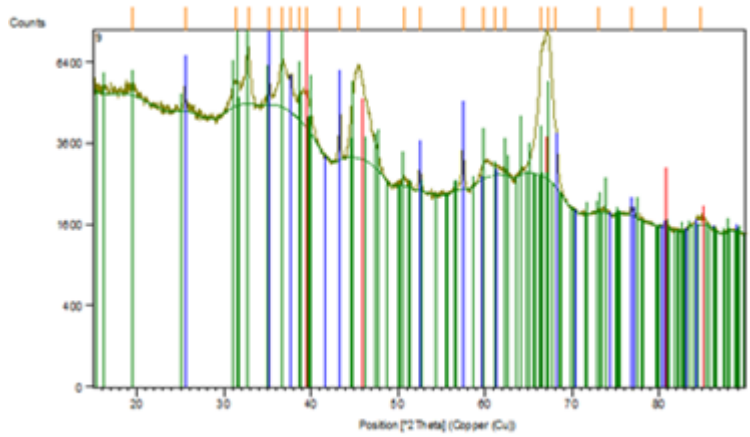

Figure 3 : XRD patterns of platinum recovered from pt/Al_2O_3 catalyst by dissolving alumina catalyst in aqua regia solution.

3. Result and Discussion:

1- Effect of Normality of aqua-riga solution

The normality is a component which is understood to strongly affect the quantity of extraction process. The effect of normality on the percentage metal removal of platinum from aqueous solution with crash catalyst was studied and as shown in figure 4. It is cleaner that the production of platinum to 0.22 gm from aqueous improved with increase normality percentage to 6 because

hydrogen ions are strong competing with oxygen and partly extraction with positive metal ion and partly that the solution concentration influences the chemical speciation of metal ions as platinum [7].

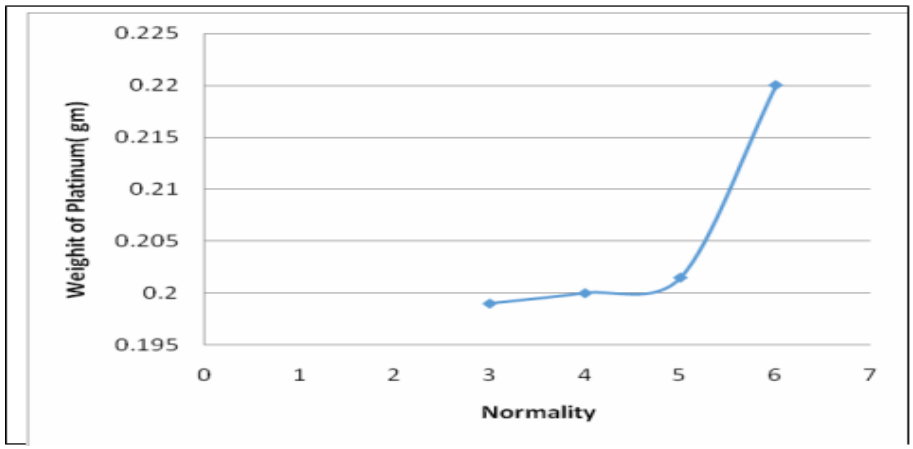

Figure 4 : Explain the effect Normality for solution at constant a rotation speed at 120 rpm and Temperature is 80 C^0.

2- Rotation Speed

The Figure 5 explained showed that rotation speed for high effect on 120 rpm, solution recovery is 0.22 gm at 120 rpm and N=6 at temperature is 80 C0. At N= 3, 4,5 that parameter's is low effect but at N=6 is high effect by find strong ions to extract pt from solution

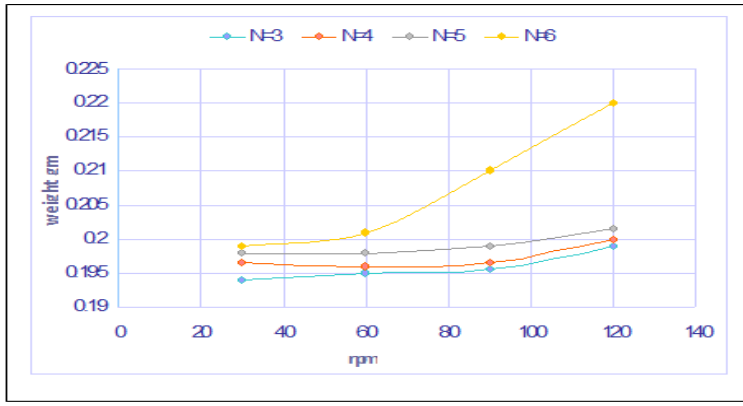

Figure 5: Explain the effect rotation speed dissolution (30, 60, 90 and 120) and different normality for solution at constant temperature at 80^0

3- Temperature Dissolution

The Fig. 6 explains the effect of Temperature solution as a function of extraction ability of Platinum. The outcomes show that the recovery for each metallic ions is speedy The most recovery for Pt is attained in 80 C0. Extraction of crushed catalyst in hot solution at 80 C0 is high effect with mixing gives more 50 % more filtration in room temp. about 20 C0" [8]

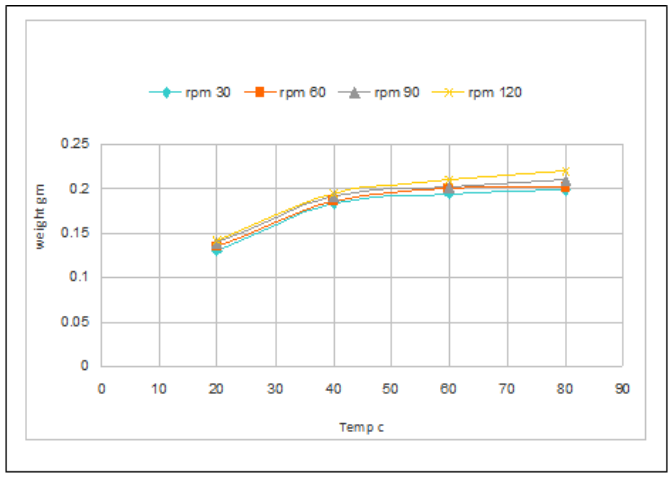

Figure 6: Explain the effect Temperature and different normality for solution at constant rotation speed at 120 rpm.

4.Conclusion

In the present work, by recovery of 0.5 kg spent catalyst of Pt/Al_2O_3 as a raw material, it's possible to acquire in 0.220 gm nano platinum as final result. The aid of this method in comparison with Economy study for supply and treatment of spent catalyst in refineries in Iraq. This method could be extensively utilized for different raw materials with low content of platinum metals (electronic scrap and catalyst from car)[14].

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