

Recovery of gold from plant/dump liquors, Gadag Gold Fields, Karnataka, India

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ABSTRACT

The tailings disposal from the gold concentrators to the tailing dams contains about 70% solids and 30% water or liquor. After discharging the solids the liquor portion of pulp is reclaimed to the extent maximum 50%. Recovery is tested throughout the year and it is found that recovery varies seasonally, affecting the grade of the reclaimed solution.

The reclaimed liquor from the tailing dams and the plant waste waters are passed through settler tanks or thickener. The clear liquor is passed through the activated carbon columns (C-I-S). The gold content of the liquor is adsorbed on to the carbon, the tail liquor is reused in the process. The gold loaded carbon is eluted and continuously electrowon, with the help of continuous re-circulation of hot caustic cyanide solution at +93°C. The gold loaded cathodes are acid treated, smelted with fluxes to produce gold bullion. The carbon from the elution system is reused in the process after thermal regeneration.

Keywords : Recovery of gold, Tailing disposal, Activated carbon, Gadag Gold Fields, Dump liquors.

INTRODUCTION

The occurrence of gold reefs in Gadag-schist belt, Karnataka (15°10'-15°25'N latitude and 75°35'-75°45' E longitude) is known since last 100 years. A detailed investigations by Geological Survey of India (GSI) and Mineral Exploration Corporation Limited (MECL) is carried out in 1980's. Bharat Gold Mines Ltd (BGML) and Hutti Gold Mines Ltd., (HGML) have been actively engaged in mining and processing of ore for gold recovery in Hosur- Champion /Mysore mines and Kabuliyatkatti, Attikatti and Sangli mines. BGML worked from 1988 to 1996 and HGML, from 1992 to 1994. The plant tailings, after processing and recovering gold are pumped to tailing dam. The ore is processed by crushing and

grinding (Ball mill) in close circuit with hydrocyclone. Hydrocyclone overflow is blanket tabled. The blanket table concentrate is taken for gold recovery. The tailings of blanket table is pumped to thickener. The pulp from thickener is taken for flotation. The flotation concentrate is reground, cyanided and treated by Carbon-in-pulp (C-I-P), and the flotation tailings are pumped to tailings thickener for water recovery and the solids are pumped to tailings dams at 1.7 pulp density.

In the present work the authors have studied the recovery of gold from the reclaimed liquors from the tailing dam for 12 calendar months regularly.

Experimental Procedure and Results

The flotation plant tailings and plant cleanings and carbon-in-pulp (C-I-P) plant tailings (contain residual cyanide) are pumped to tailings thickener. The thickener underflow, is thick pulp at 1.7 pulp density and thickener overflow is clear liquor. The table 1 shows details of underflow and overflow of the tailings thickener.

Table 1 : Chemical analysis of tailings thickener overflow and underflow

Thickener Overflow - Clear Liquor						
Residual Cyanide (In %)	pH	Chemical Analysis (Au in gm/t, Ag, Cu, CaO in %)				
		Au	Ag	Cu	CaO	
0.0001	8	0.1	0.08	0.004	16	Liquor from main concentrate
0.001-0.01	8.5	0.01	0.04	0.006	10	Liquor from cyanide/slimes plant and C-I-P.
Thickener underflow - Pulp density - 1.6 - 1.7 (Thick pulp : approx.70% solids and 30% liquor)						
0.001	8	0.25	0.09	0.004	20	
0.01	8	0.3	0.08	0.004	25	

The reclaimed liquor from the tailings dam taken to thickener or to settlers to clarify the liquor from suspended solids. The clear liquor is pumped to overhead solution stock tank to provide the gravity flow, to carbon-columns. There are solution bunds on the tailing dams wherein the liquor portion from the tailing pulp is collected after solid portion settled on the tailing dams. It is observed that there is slight improvement in gold values and the quantity of liquor reclaimed.

This may be due to the residual cyanide in C-I-P tailings which might have leached the flotation tailings or it may be due to the leaching of the oxidised tailings from the tailing dam by the residual cyanide.

The chemical analysis of reclaimed liquor is Au: 0.14 gms/t, Ag: 0.05%, Cu: 0.0065%, CaO: 10%, pH : 7.5

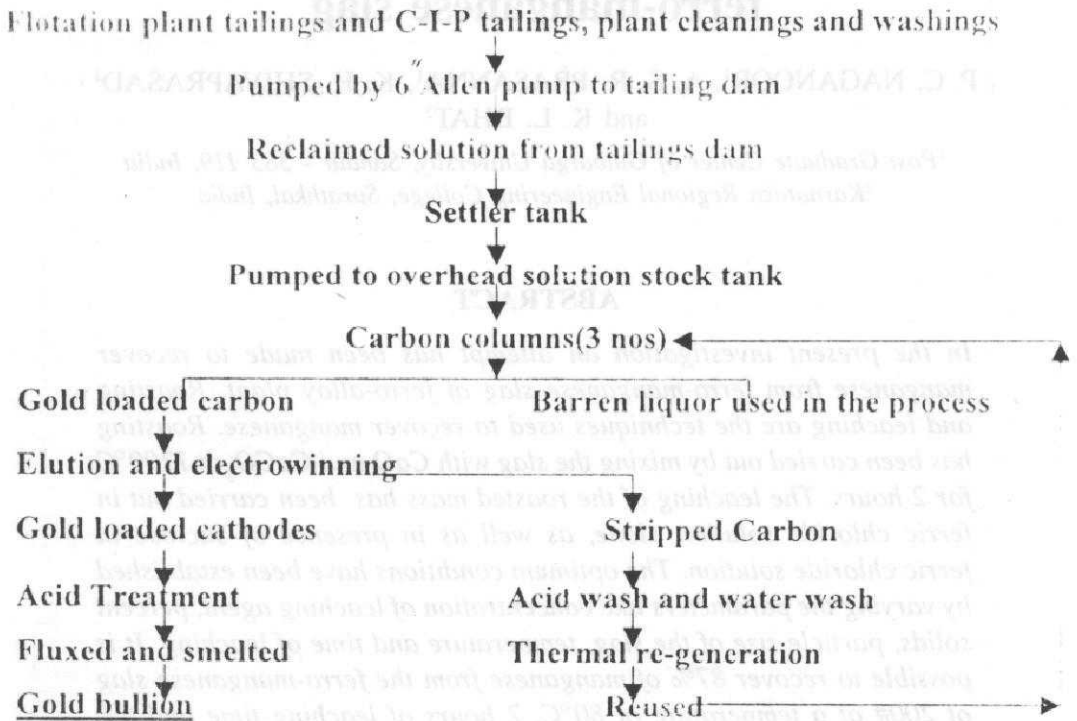
The table 2 shows variation in the quantity of liquor recovered from the tailing dam monthwise for one calendar year. The table 2 clearly indicates the fluctuation in the quantity of the liquor reclaimed from the tailings dam. During summer months (February, March, April, May) the gold recovery is low and during monsoon months(June, July, August, September) the recovery is high. Both these liquors (summer and monsoon) have fluctuating gold values. The clarified reclaimed liquor is pumped to overhead stock tank. The solution passed through three carbon columns by gravity. Each carbon column is 3 meters height and 1.5 meters diameter hold about 500 kilograms of activated carbon. The gold from the liquor is adsorbed onto activated carbon. The tail liquor going out of the carbon columns is reused in the process. The feed liquor to C-I-S columns analyse gold 0.1 to 0.14 grams/ton of liquor and carbon columns tail liquor

Table 2 : Variation in the quantity of liquor recovered from the tailing dam month wise for a calendar year

Month	Amount of tailings pumped to tailing dam						Amount of liquor reclaimed from tailing dam		
	Solids (Dry)	Liquor (Tons) (Approx)	Gold (Gm/MT)		Pulp Density	pH	Gold		
Solids			Liquor	Tons of Liquor			pH	(gms/MT Soln.	
January	4800	1300	0.9	0.09	1.70	8.0	500	7.50	0.10
February	4000	1400	0.9	0.06	1.65	7.5	400	7.00	0.09
March	4000	1400	0.9	0.10	1.70	7.5	400	7.00	0.14
April	4500	1600	1.0	0.09	1.65	7.5	500	6.50	0.10
May	4500	1600	0.8	0.09	1.70	8.0	400	6.00	0.10
June	4000	1400	1.0	0.10	1.70	8.0	700	6.00	0.13
July	4500	1300	1.0	0.10	1.70	8.0	750	7.00	0.12
August	3800	1150	1.0	0.10	1.70	8.0	650	7.50	0.10
September	4000	1400	1.0	0.09	1.65	7.5	750	7.00	0.13
October	4500	1600	0.9	0.10	1.65	7.5	800	7.50	0.14
November	4000	1400	1.0	0.10	1.70	8.0	500	7.00	0.13
December	4500	1600	1.0	0.10	1.70	8.0	750	6.80	0.14

analyse gold 0.001 grams/ton. The carbon is advanced once in six months between columns. Actually 350 to 400 grams of gold is recovered in six months.

The flow sheet for the gold recovery from plant tailings is given below :



CONCLUSION

The liquor reclaimed from the tailing dams contain low gold values. The liquor reclamation varies seasonally because of evaporation and percolation loss and also due to breaches on the tailing dams. The gold recovery can be further improved by improving the reclaimed liquor quantity, by proper management of tailing dam and solution reclamation system. The reclaimed quantity of the liquor during monsoon months is high, which may be due to contamination of rainwater. This lowers the gold content in reclaimed solution.