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R. S. Brief, Process Development Branch,  
Production Division

MEETING AT THE CHEMICAL CONSTRUCTION CORPORATION PILOT PLANT-JULY 31, 1953

SYMBOL: PP:RSB

Special Review  
Final Determination  
Unclassified

By: K. A. Walter  
Date: Aug. 6, 1980  
T. F. Davis

Summary

Chemico has found two processes, both involving the initial  $H_2SO_4$  leach, satisfactory. One process (rerun) produces a U-Cu precipitate which is releached; the U and Cu can be separated by various methods. The second process (stepwise) precipitates copper and then uranium. Additional laboratory work is being done so that these processes can be compared economically.

Discussion

Messrs. Dasher, Pickens, Prince, Sarkesian, and Atkins of Chemico and Messrs. Brief and Dodge of the AEC met at the Linden Pilot Plant on July 31 to review the most recent development work performed by the Chemico personnel in their study of a process to recover uranium and other base metals from various waste residues.

At a meeting held last month between Chemico and the AEC certain directions were given the Linden personnel in their development program. Chemico then proceeded to show air was as suitable an oxidant as oxygen during the initial leaching; and additional leaching acid over that previously used would give uranium solubilizations in the order of 90% for the R-10(Fe) and P-78 residues. Also, the use of lime instead of  $MgO$  to precipitate cobalt and nickel has reduced the combined cobalt and nickel product from approximately 20% to 15%. Chemico releached the copper-uranium precipitate obtained from pH 5.5. neutralization in an attempt to recover Cu and U, as well as any carry-over cobalt and nickel. In order to get a charge large enough for the autoclave, various Cu-U precipitates were composited. Starting with a 10%  $U_3O_8$  composite, 99.6% uranium recovery was obtained in the releach solution. The solution contained about 12g/l U, 40g/l Cu, 12g/l Co, and 25g/l Ni at pH 0.4 and about 10 lbs. of  $H_2SO_4$  were required per lb. of  $U_3O_8$ . The releach residus contained .05% uranium. The releach solution was then divided into 5 portions.

1. To the first portion at a pH of 3.7 monosodium phosphate ( $NaH_2PO_4$ ) was added and precipitated a 52%  $U_3O_8$  product. By subsequently raising the pH to 7.7 with CaO, copper, cobalt, and nickel can be recovered as the hydroxides.

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2. The second portion was poured into ammonia until definitely ammoniacal. A 30%  $U_3O_8$  product resulted. Copper, cobalt and nickel can then be recovered by adding CaO and driving off the ammonia.
3. Hydrogen peroxide added at pH 2.5 gave a 48.3%  $U_3O_8$  product from the third portion, but gave high barrenness (3.8g/l U).
- 4 & 5.  $H_2S$  quantitatively precipitated a 50% copper product at pH 1 in both the fourth and fifth portions. At pH 2 with  $NaH_2PO_4$  present, sodium hydrosulfite ( $Na_2S_2O_4$ ) precipitated a 53%  $U_3O_8$  product from the fourth portion.  $NaH_2PO_4$  was added to the fifth portion after the  $H_2S$  treatment and (pH 4.1) precipitated a 40%  $U_3O_8$  product. Both cobalt and nickel can be recovered from 4 and 5 liquors after uranium and copper precipitation by the addition of  $H_2O$  or CaO.

Based on the results obtained on rerun portions four and five, Mr. Dasher indicated that a cost evaluation would be necessary to determine if a rerun using  $H_2S$  and  $Na_2S_2O_4$  was warranted over the use of  $H_2S$  and  $NaH_2PO_4$ . The  $Na_2S_2O_4$  is an expensive reagent and would probably require the use of filter aid to make its product reasonably filterable. However, a 50%  $U_3O_8$  can be expected with this reagent. On the other hand, the  $NaH_2PO_4$  requires additional caustic to bring the solution to the slightly higher pH, (pH 4 vs. pH 2) will require hold tankage because of a 24 hour precipitation time and produces a slightly lower grade product, 40%  $U_3O_8$ .

AM-7 cannot be treated directly with  $H_2S$  after digestion because the high nitrate content of the AM-7 would precipitate colloidal sulphur and make the  $H_2S$  reagent costs prohibitive. On the other hand, if the Cu-U precipitate from neutralization at pH 5.5 is rerun, then the nitrates will be eliminated and a direct  $H_2S$  treatment is feasible. An economic evaluation will determine which approach is more desirable.

During the month of August it is expected that pressure filter tests with and without the use of filter aid will be run on various leach slurries resulting from  $Na_2S_2O_4$  addition. AM-7, L-30, and P-78 leach tests will be run with 20% and 40% more water present than normal to see the variation in moisture content of the residues as affects leaching. Lime versus magnesia will be studied regarding the wet and dry weights of the uranium precipitate produced. Thickening and filtration data will be accumulated.

There is a 25 gallon autoclave at Linden which will make it possible to produce large quantities of leach solution which in turn will make it possible to produce enough pH 5.5 uranium precipitate for re-leach tests. The economic studies indicated above might depend on results on this work. The owner of the autoclave is being approached and Messrs. Dodge and Brief assured Chemico that if there was any damage to the autoclave the AEC would repair it.

Final Report  
Unclassified

By K. A. Winer  
Date Aug 6, 1953  
I. F. Davis