

Nov. 24, 1979

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Subject: Recovery of Arsenious Oxide by the Pressurized Hot Water
Leach Process

Pressure tests conducted by R. Hatch at F.M.L. indicate that As_2O_3 solubilities of 177 gm/l can be attained at 154°C . The rate of As_2O_3 dissolution was also observed to be greater than that attained in the conventional hot water leach process (80 % of the As_2O_3 was reported to be in solution within 5 minutes). Crystals produced during this test were within market standards: $> 98\%$ As_2O_3 , < 0.02 wt % Fe, and 0.02 to 0.08 wt. % Sb.

Application of the pressurized hot water leach process should improve solution efficiency by 56.94 %, i.e., the same amount of As_2O_3 can be recovered by treating 56.94 % less solution. For example;

Solution Requiring Treatment
for the production of 1 lb of As_2O_3

Conventional hot water leach :	15.245 lbs. of sol'n.
Pressurized hot water leach :	6.565 lbs. of sol'n.

It follows that heat energy input will be reduced by a minimum of 56.94%. Actual energy input should be reduced even further due to;

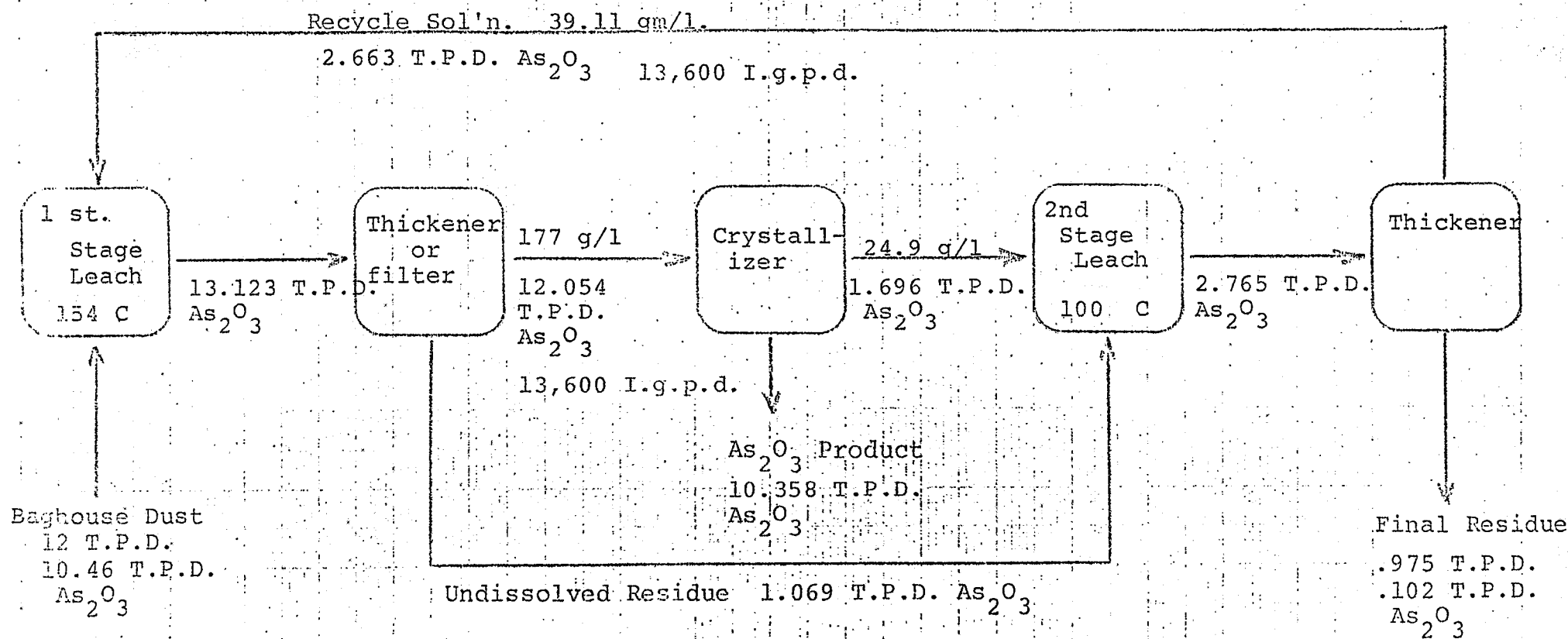
- A) Reduced radiation and convection heat loss from the leach tanks due to the shorter retention times required.
- B) Reduced radiation and convection heat loss from all tankage due to the smaller volume required for the pressure leach process.

Two variations of the pressure hot water leach flowsheet were balanced by combining the new solubility data with recovery data obtained from the pilot plant. It was assumed that the basic chemistry would remain constant under the pressure scheme.

Option A) Forced Cooling during Crystallization - Figure 1.

Solution efficiency can be improved by close to 57% by recovering As_2O_3 from Giant baghouse dust using a pressure leach to replace the conventional 1st stage hot water leach.

Figure 1: Pressurized Hot Water Leach Process - Cooling Crystallizer.



A saturated solution of 177 gm/l As_2O_3 is obtained by pressure leaching baghouse dust in a recycled solution. The solution is both separated from the undissolved residue and clarified under pressure. The clarified saturated solution is then transferred to a crystallizer operating at atmospheric pressure. The solution is cooled to 15°C crystallizing As_2O_3 . The stripped solution is then used to re-leach the undissolved residue from the first stage in either a conventional or pressure leach. The undissolved residue from this second leach would be washed in the cottrell washing circuit as previously planned while the leach solution would be recycled to mix up the next batch of baghouse dust.

The only gain from using a pressure vessel in the second stage leach is in the reduced tankage volume corresponding to the reduced retention time required for As_2O_3 dissolution.

Heat removed during crystallization should be recovered and reused to insure energy efficiency.

Option B) No Forced Cooling during Crystallization-Figure 2

The process is identical to that described above with the exception of the crystallizer. In the second flowsheet the saturated solution is not cooled below 100°C (cooling to 100°C will be instantaneous upon the release of saturated solution to atmospheric pressure). In this case the second stage leach must be under pressure to attain any further dissolution of As_2O_3 from the first stage leach residue. The solution efficiency of this second flowsheet is only 39.84% over the conventional hot water leach process.

Recommendations

From both a capital and operating cost standpoint, the first pressure leach option is the most efficient presented to date. However this flowsheet does present some problems which will have to be overcome, possibly in pilot plant scale:

- A) Can the saturated As_2O_3 solution be separated from the undissolved residue under pressure (2 Kg/cm^2)
- B) Can the saturated As_2O_3 solution be clarified under pressure.
- C) Will super-nucleation of crystals occur in the saturated solution, upon the instantaneous release of the pressure on the saturated solution.
- D) Will the basic As_2O_3 purification chemistry remain constant at the higher pressure, i.e. will the solubility of impurities also increase.

Figure 2: Pressurized Hot Water Leach Process—Two Stage Pressure Leach.

