

6.6 Pilot Plant Testwork

Introduction

Laboratory work to test the fuming concept for purification of arsenic trioxide was originally undertaken for Giant by Falconbridge Metallurgical Laboratory in 1980. Using current production baghouse dust as feedstock, a purified product grading 99.7% As₂O₃ was readily produced using homemade laboratory fuming apparatus. Encouraged by the results, and by the relatively modest capital estimate as compared to a hydrometallurgical process, Giant began planning for pilot scale testwork in late 1987.

Instead of conducting pilot testing in a specially built plant at Giant, it was decided to have Research Productivity Council conduct the tests in their Fredericton, New Brunswick test facility. A number of modifications to plant configuration and equipment were made and testing began in June of 1988.

The 6" fluosolids reactor in the pilot plant is sized for a typical feedrate of 10 kg/h and approximately 15 tons of baghouse dust from a variety of sources was shipped from Giant for testing. The attached schematic flowsheet shows plant layout.

Discussion

Right from the beginning it was clear that a high purity product could be produced in the pilot plant and assays of 99.7% As₂O₃ were experienced in the initial 31 hour production run. Condenser design problems resulted in a lengthy plant shutdown however and the second production run was delayed by over a month. In late July, 1988, the second run produced results that confirmed the earlier test results, that good purity product could be produced from current production feedstock. Average product quality during this 11 day run was as follows:

<u>As₂O₃</u>	<u>Fe</u>	<u>Sb</u>	<u>Insol</u>
99.55	0.022	0.139	0.307

The next production run was designed to test the process using low grade feed from underground storage. The feed selected for this test was from B2-35 stope, which was filled during the early 1960's. This feed contained 2.74% antimony as compared to 0.196% antimony in the current production feed. It was expected that a high proportion of the antimony would report to the final product, as determined by the earlier run and by the FML experience and indeed, that is what occurred. Due to feeding problems using the low grade feed, the dust was later blended to an average 30:70 blend with current production to give an antimony concentration in the feed of 0.96%. Average concentration of Sb in the product was 0.58%.

The final test originally planned, was to develop roasting techniques to improve product purity, especially with regard to antimony elimination.

Tests using various temperatures and operating pressures conducted over a period of three days were only partially successful. It was demonstrated that antimony could be reduced in the final product by operating the roaster and the hot baghouse at temperatures below 300 deg.C. Unfortunately a high proportion of arsenic was captured in the hot baghouse under these conditions. Another solution was necessary.

Additional Testwork

Deporment of antimony in the gas stream is not clearly understood, though it is theorized that it may occur as extremely fine particulate, passing directly through the hot baghouse and providing nucleation sites for the formation of arsenic trioxide crystals in the condenser. Also, recent lab work has shown that when mixtures of arsenic trioxide and antimony trioxide with a high proportion of arsenic are purified by sublimation, gaseous polymeric compounds are formed, an effect that greatly enhances the volatilization of antimony. Both of these theories have been tested at RPC during late September, 1988.

Test Results

The fine particulate theory was tested by passing a portion of the gas stream through a .3 u borosilicate filter. Though the particulate captured on the filter assayed about 50% Sb, the weight of particulate was less than 10% of what was expected. 90% of the Sb passed through the filter with the fume. This does not prove that Sb occurs as a vapour but limitations of the test equipment have limited the value of the data collected.

The volatile polymer theory was also tested, by adding a number of air inlets to the freeboard of the roaster. The theory states that these polymeric compounds can be decomposed between 400 and 600 deg.C by adding oxygen (air) to the off gases of the roaster, to oxidize the antimony to SbO_2 and Sb_2O_3 , which are both solid compounds below 450 deg.C. These solid compounds formed in the freeboard of the roaster should then be able to be captured in the hot baghouse.

Early test results did not offer much encouragement and finally the hot baghouse filter bags blinded, causing the test to be terminated. Assay results from the period just before the plant was shut down are quite interesting however, and do offer some hope for success in developing a method for antimony elimination.

Using feed from B2-35 stope having an antimony grade of 2.65%, a cold baghouse product having an antimony concentration of only 0.33% was produced. Hot baghouse product assayed 5.54% during the same period, confirming that the antimony was indeed collected in the hot baghouse. Other test results from this period were as follows:

Time	CBH	HBH	Oxygen	Temp deg.C
03:00	0.86	3.74	12%	350
05:00	0.39	4.83	12%	350
08:00	0.33	5.54	12%	350

These good antimony eliminations took place as the hot baghouse filter bags were blinding. Is it possible that the improved Sb elimination is due to reduced bag porosity during this period, or is it due to formation of Sb particles through oxygenation? The former case would probably be best for Giant, as the use of an electrostatic precipitator downstream of the hot baghouse would purify the arsenic while collecting a saleable antimony oxide product. Separating the antimony from the hot baghouse product (in the second case) would probably be quite a bit more difficult.

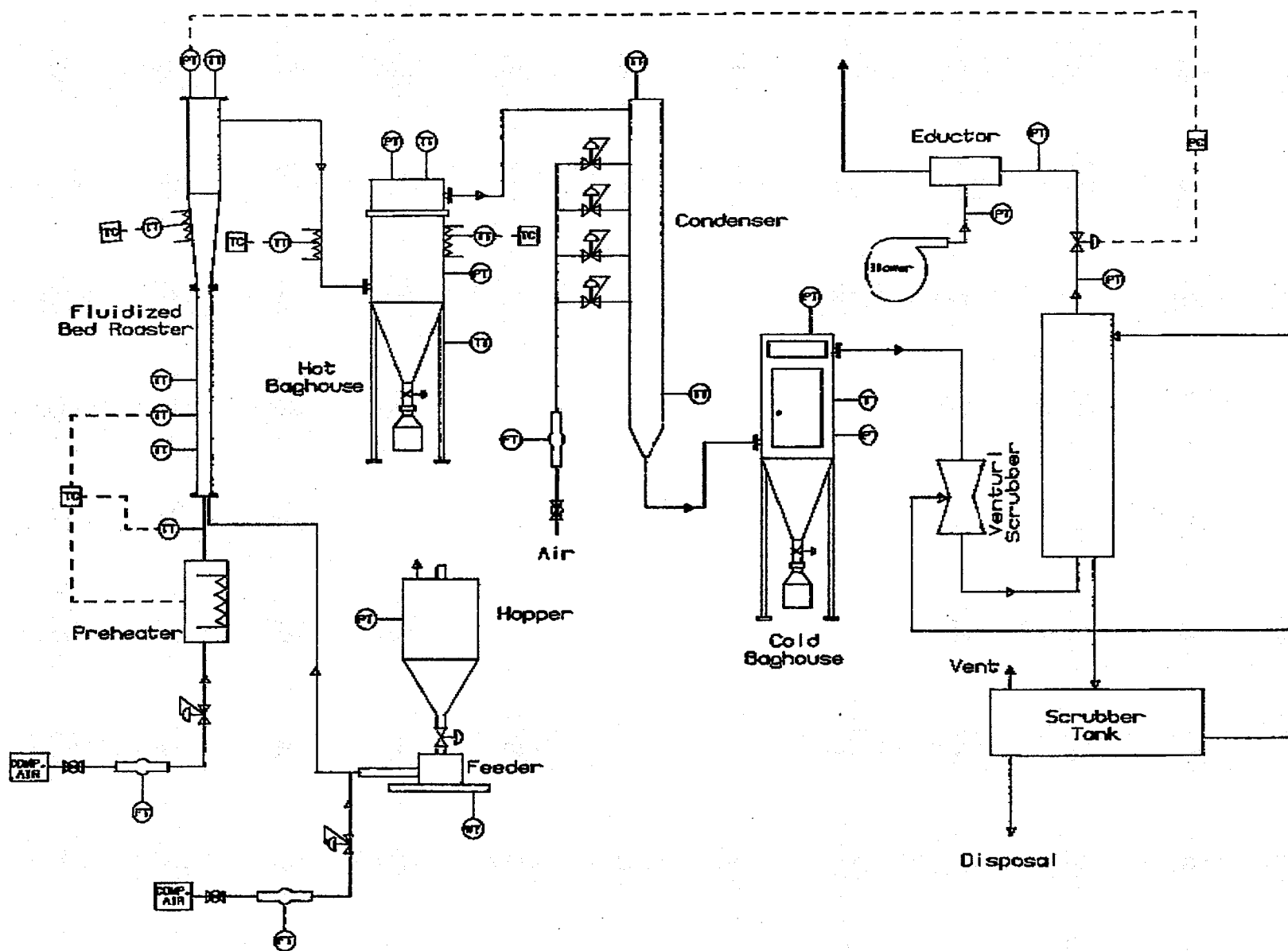


FIGURE 2 : SCHEMATIC FLOWSHEET OF PILOT PLANT