OP-59 Revised

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Route List

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AUTHORITY TID-111

Pg 503

PM Eick 11-3-48

Date ~~4-5-45~~

Subject ~~Prod. Test SE-224-T-P1-4~~

Lanthanum Fluoride Precipitation

~~File~~

From ~~K. H. Beaton~~

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P. W. Crane

BEFORE READING THIS DOCUMENT, SIGN AND DATE BELOW:

P W Crane 4-11

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APRIL 5, 1945

PRODUCTION TEST 224-T-PA-4
LANTHANUM FLUORIDE PRECIPITATION

Objective

To shorten LaF_3 by-product and product operations in order to attain practical time cycles of 24 hours or less in Cells D and E.

Basis

A **LaF_3 By-Product.** The present LaF_3 by-product precipitation process involves two 125 mg./l. preformed La strikes in 0.2N HF, centrifuged each time at 1700 G and 5 minutes retention time (110 lbs./min.). The "ideal" time cycle is approximately 23 hours. Stepwise decontamination factors (Beckman meter observations) are 5.0 and 3.0 for the first and second strikes respectively, averaging an overall of 15 for the cycle.

Recycling of 500 mg./l. of La to the first strike from the isolation supernatants has increased the first strike decontamination factor to approximately 10, even when centrifuged at 110 lbs./min. A single strike of 200 mg./l. of La as crystalline LaF_3 in 0.5N HF has produced a decontamination factor of 20, when centrifuged at 70 lbs./min.

Since the present two-strike LaF_3 by-product process has a time cycle too close to 24 hours to be practical, it is proposed that a single-strike process be tested. With present volumes, an ideal single - strike cycle with slow centrifugation would be about 17 hours. The background data presented above indicate that a decrease of not more than 2 in decontamination factor would be expected with flocculent LaF_3 and none for crystalline LaF_3. The reduced process volumes being proposed for reduction of the LaF_3 product cycle time would further reduce the ideal by-product cycle to approximately 13 hours.

B **LaF_3 Product:** The background of the LaF_3 product precipitation and the development of the procedure necessary to maintain the product waste losses (B-3-WS) below the standard of 1.5% have been traced in Production Test 224-T-3-8 and in Memorandum to M.F.Acken by R.H.Beaton on March 29. It is shown therein that it is necessary to make either two 50 mg./l. or three 33 mg./l. La product strikes, followed in each case by three 70 lbs./min. centrifugations (8 minutes retention time) at 1700 G, to maintain low B-3-WS losses. The time cycle for this process is 38-40 hours.

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A preliminary plant test (Run T-5-05-B-6) of the crystalline LaF_3 process being developed by the Process Chemistry and Semi-Works Sections of the 200 Area Technical Group has produced very promising results. A single strike of 100 mg./l. La, centrifuged at 70 lbs./min., left only 4.6% product in the effluent, which was in turn reduced to 0.75% and 0.15% respectively by two additional 50 mg./l. strikes of the regular flocculent LaF_3.

In order to approach the desired practical cycle time of 24 hours for the LaF_3 product precipitation, it is proposed that the Concentration Building process solution volumes be reduced. It has been calculated that the volume of the 17-4-P solution can be reduced to 45% of the present by a series of reductions in Bi concentrations and HNO_3/Bi cake solution ratios. The three-centrifugation process would still take slightly more than 24 hours, however, so it is recommended that Cell B be fitted out for fluoride precipitations. Parallel product strikes on two separate charges at about 15% of the time will make possible a practical 24 hour cycle. Cell B should also be made versatile enough to handle fluoride by-product precipitations as a stand-by for Cell D. It is also proposed that plant investigation of the crystalline LaF_3 be continued with the reduced process volumes, with the objective of developing a still shorter time cycle to permit Cell B to be a stand-by fluoride cell at all times.

Procedure

It is proposed that the test procedures listed in Table I be carried out in the LaF_3 cycle (Cells D and E) of the Concentration Building during the April series of runs in T-Area. This series of tests is aimed at the development of shorter LaF_3 product and by-product cycles without affecting either product losses or decontamination factors appreciably.

The LaF_3 by-product tests are set up as follows:

Test No.	Run Numbers	Main Variable Changes	Objectives and Predictions
1.	T-5-4-B-1 T-5-4-B-2	One 200mg./l. crystalline La strike in .6M HF, cent. at 70 lbs./min. Usual process volumes.	Check runs on T-5-3-B-6 performance, and prep. for crystalline product strikes. No decrease in D.F. expected.
2.	T-5-4-B-3 T-5-4-B-4	One 580 mg./l.* flocculent La strike in 45% of usual volume, cent. at 70 lbs./min.	Efficiency of single, high-concentration strike with regular LaF_3. Decrease in D.F. of no more than 2 expected.
3.	T-5-4-B-5 T-5-4-B-6	One 470 mg./l.* crystalline La strike in 45% of usual volume, cent. at 70 lbs./min.	Direct comparison of crystalline with flocculent LaF_3 (test #2), and prep. for crystalline product strikes.
4.	T-5-4-B-7 T-5-4-B-8	One 235 mg./l. crystalline La strike in 45% of usual volume; cent. at 70 lbs/min.	Preparation for crystalline product strikes and reduction of by-product La.
5.	T-5-4-B-9	Same as Test #2, #3, or #4.	Start of reproducibility tests if choice of process can be made at this time.

* La concentration based on use of same total weight of La in 45% of usual volumes, to be obtained by gradual volume reductions throughout the Canyon Building (221).

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The LaF_3 product precipitation tests involve comparative studies of the crystalline and flocculent types of LaF_3, particularly in the reduced volumes to be obtained from the Canyon Building (221) which in themselves induce lower time cycles. The LaF_3 product tests are set up as follows:

Test No.	Run Number	Main Variable Changes	Objectives
1.	T-5-4-B-1	Two 50 mg./l. crystalline La strikes. 3 centrifugations at 70 lbs./min.	2-strike, 2-cent. Cell 2 process. Third centrifugation for safety.
2.	T-5-4-B-2	One 50 mg./l. crystalline and one 50 mg./l. flocculent La strike; 3 cent. at 70 lbs./min.	Simpler process if first crystalline strike losses low enough for clean-up of flocculent LaF_3.
3.	T-5-4-B-3 T-5-4-B-4	Two 115 mg./l. flocculent La strikes in 45% of usual volume; 3 cent. at 70 lbs./min.	2-strike process with regular LaF_3 with low enough volumes to permit slow centrifuging.
4.	T-5-4-B-5	Two 115 mg./l.* crystalline La strikes in 45% of usual volume; 3 cent. at 70 lbs./min.	Same as Test #3 - comparison of crystalline vs. flocculent LaF_3.
5.	T-5-4-B-6	One 115 mg./l.* crystalline and one 115 mg./l.* strike in 45% of usual volume; 3 cent. at 70 lbs./min.	Same as Test #2, in reduced volumes.
6.	T-5-4-B-7 T-5-4-B-8	One 230 mg./l.* crystalline La strike in 45% volumes; 2 cent. at 70 lbs./min.	Single-strike, single cent. process if test progress promising.
7.	T-5-4-B-9	To be decided from previous tests.	Choice of process, if possible.

* La concentrations based on use of same total weight of La in 45% of usual volume, to be obtained by gradual volume reduction throughout the Canyon Building (221).

Data

The Technical Department Plant Assistance Group III will assist Operations in collecting data and setting up and monitoring process conditions.

Equipment

Since the $Na_2SO_4 \cdot La_2(SO_4)_3$ slurries for the crystalline LaF_3 tests are to be made up by the Semi-Works Section in the 300 Area, no equipment for its manufacture in Building 224-T is needed. A dolly tank and rubber hose jumper connection will be needed for adding the slurries from the control gallery. Both are available. Simple on-the-spot line changes in the pipe gallery are also needed for introduction of the slurries.

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Table I

Proposed Test Schedule LaF_3 Precipitations

Test No.	LaF_3 By-Product HF N	No. Strikes	La mg/l	La Type	La Cent.	No. Rate lbs/min.	LaF_3 Product HF N	No. Strikes	La mg/l	La Type	La Cent.	No. Rate lbs/min.	Remarks
T-5-4-B-1 T-5-4-B-2	1 0.5	1	200	Cryst.	1	70	1 0.5	2	50	Cryst.	5	70	Std. Process Volumes
							2 0.5	2	50	(1)Cryst. (2)Flocc.	5	70	
T-5-4-B-3 T-5-4-B-4	1 0.2	1	320	Flocc.	1	70	3 0.5	2	115	Flocc.	5	70	45% of usual Std. volumes
T-5-4-B-5 T-5-4-B-6	1 0.5	1	470	Cryst.	1	70	4 0.5	2	115	Cryst.	5	70	45% of usual Std. volumes
							5 0.5	2	115	(1)Cryst. (2)Flocc.	5	70	
T-5-4-B-7 T-5-4-B-8	1 0.5	1	255	Cryst.	1	70	6 0.5	1	250	Cryst.	2	70	45% of usual Std. volumes
T-5-4-B-9	To be decided later						To be decided later						45% of usual Std. volumes

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Responsibility

Technical Department Plant Assistance: M.F.Ackan - Area Supervisor
R.H.Beaton - Senior Supervisor, Group III

The experimental runs will be carried out under the usual S-Department supervision.

Estimated Completion

These tests will cover the April series of runs in T-Area and will be completed by June 1, 1945.

Approval

M C Kay	Operating Department	Date 4/7/45
L. Squires	Technical Department	Date 4/6/45
B H Mackey	Assistant Manager	Date 4/7/45

MHB:jd

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