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TECHNOLOGY — FEED MATERIALS

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TO: F. L. Steahly
FROM: A. C. Jealous
SUBJECT: Final Slurex Runs

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For The Atomic Energy Commission

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January 30, 1952

1. Slurex Extraction Studies

Following the Slurex extraction runs carried out with the aqueous phase continuous (reported in ORNL Central Files memo 51-12-36), a series of tests were conducted with the organic phase continuous. These tests were made to determine the effect of operating with the organic phase continuous on column capacity, on uranium recovery, and on the collection of black insoluble waste at the interface.

Flooding studies using a 12 ft. extraction section, with the organic phase continuous, 3/16" diameter plate perforations, and using a semi-square pulse wave revealed that throughputs in excess of 2,000 gal./sq. ft.-hr. could be obtained. Under the same conditions, with the aqueous phase continuous, the maximum throughput was in the 1300 to 1600 GSFH range. With the organic phase continuous, there was little or no carry-over in the product stream of the black insoluble waste which collected at the interface. All solids passed out the bottom of the column in the aqueous underflow stream. Previously, when the aqueous phase was continuous, up to 24 inches in depth of black material collected at the interface, most of which eventually passed over the organic product.

Less than 0.02% uranium loss was obtained in two runs at 2,000 GSFH, with the organic continuous and using 3/16" diameter plate perforations in a 2 in. I. D. x 12 ft. extraction section. Under the same conditions, except with aqueous continuous and about 1600 GSFH, the uranium loss was about 0.05%; and an earlier run with 1/8" diameter plate perforations, 1,000 GSFH, and aqueous continuous, gave a uranium loss of 0.06%.

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(See Table I) Thus operation with the organic phase continuous yielded slightly higher uranium recovery and appeared to eliminate the problem of carry-over of insoluble waste in the organic product.

Whether or not the black substance which collects at the interface would accumulate over a period of several days even with the organic phase continuous to the extent that it would again carry-over in the organic product stream remains to be determined in a continuous run of 2 to 5 days duration. The possibility of such carry-over does not seem great and a long run in the Unit Operations column is not scheduled.

The feed and discharge flow control systems worked out by the equipment development group, and consisting of a Vanton pump driven by a variable-speed Graham drive which was controlled by a Kellex magnetic induction flowmeter, functioned very smoothly. The feed rate was maintained to a $\pm 5\%$ variation.

2. Slurex Stripping Studies

Using the extract collected from the extraction runs, several test runs were made in the course of stripping the uranium from the organic phase. Flooding and efficiency data were collected for three types of plates and two plate hole sizes: stainless steel, Teflon, and Teflon-coated stainless steel plates having $1/8"$ diameter perforations, and stainless steel plates having $3/16"$ diameter perforations, all incorporating 23% free area. All runs were made at room temperature and with the organic phase continuous. Maximum operable total flowrates for stripping were obtainable with the stainless steel plates: up to 1100 GSFH when

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using 3/16" hole plates. Uranium recoveries of 99.8% and better were obtained at 700 GSFH with both the stainless steel plates (both hole sizes) and also the Teflon-coated (under-or organic-side) stainless steel plates (See Table II).

The experimental results indicate for stripping with the organic phase continuous that: (1) under identical pulse conditions, the total capacity through both the Teflon-coated stainless steel plates and Teflon plates was about one-third of the capacity of 700 gal/sq.ft.-hr. through uncoated stainless steel plates; however, by moderating the pulse conditions the capacity of the Teflon-coated plates was increased from 200 back to 700 gal/sq.ft.-hr.; (2) the uranium stripping efficiency using pulse conditions which permitted operation at 700 gal/sq.ft.-hr. for both the stainless steel and also the Teflon-undercoated stainless steel plates was essentially the same (i.e., ~0.2% uranium loss in either case), thus indicating little advantage for the Teflon coating; and (3) little difference may be expected in the performance of Teflon plates vs. stainless steel plates coated on one side with Teflon. Tests are scheduled for stripping performance with the aqueous phase continuous, primarily to recheck the effect of using plates coated on the under side (organic side) with Teflon.

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TABLE I

Slurex Extraction Studies

Column: 2 in. I. D. true-bore glass pipe
12 ft. extraction section
8 ft. scrub section

Plates: 3/16 in. diameter perforations
23% free area
2 in. spacing

Pulse generator: Air-driven bellows unit

Pulse conditions: 1.0 in. amplitude; 60 cycles/minute

Feed: Slurry of pitchblende received from St. Louis

Extractant: 22.5% TBP in Amsco washed and acidified

Feed control system: Vanton plastic liner pump speed-controlled by
Kellex magnetic induction flowmeter

Flow ratio: 1 feed:2.8 extractant:0.22 scrub

Continuous Phase	Plate Hole Size (in.diam.)	Max. Operable	Uranium Loss (% of feed)
		Total Flow Rate (In ext. sect.) gal./sq.ft.-hr.	
Organic	3/16	2,000	0.01-0.02
Aqueous	3/16	1,600	0.05
Aqueous	1/8	~1,300	0.06 (@ 1000 GSFH)

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TABLE II

Slurex Stripping Studies

Column: 2 in. I. D. true-bore glass pipe
12 ft. stripping section

Plates: 2 in. spacing
23% free area
(see below)

Feed: Extract from extraction runs:
~60 g. U/l; 22.5% TBP in Amsco

Flow ratio: 5 aqueous:4 organic

Organic phase continuous

Plates		Pulse Conditions		Pulse Characteristic	Max. Operable Total Flow Rate gal./sq.ft.-Hr.	U loss (% of feed)
Material	Hole Size in. diam.	Amplitude in.	Frequency c/m			
S/S	1/8	1.0	60	Semi-Square	700	0.1
S/S	3/16	1.0	60	Semi-Square	700	0.1
S/S	3/16	1.0	60	Sine	1100	
Teflon	1/8	1.0	40	Semi-Square	200	0.2
Teflon-coated S/S (bottom side only)	1/8	1.0	40	Semi-Square	200	
Teflon-coated S/S (bottom side only)	1/8	0.7	40	Sine	700	0.2

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