

THE INSTITUTE OF PAPER CHEMISTRY, APPLETON, WISCONSIN

DEVELOPMENT OF A MANUFACTURING PROCEDURE FOR LOW-LITHIUM,
LOW-URANIUM CONTENT FILTER PAPER

Project 3101

Report Two

A Status Report

to

DEPARTMENT OF THE AIR FORCE
1155th TECHNICAL OPERATIONS SQUADRON (HQ. COMD.)
McCLELLAN AFB, CALIFORNIA

November 10, 1972

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Appleton, Wisconsin

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SUMMARY

Uranium and lithium analyses were obtained for stacks of circles of dry-lapped pulp which had been leached with hydrochloric acid and ammonium carbonate. The average for uranium was approximately 0.15 ng./g. and that for lithium 0.7 ng./g. of pulp. The level for uranium is substantially below the level sought and the level for lithium is substantially above.

DISCUSSION

The analysis of the second shipment of samples was completed by the Laboratory at McClellan AFB. As summarized in Table I, the data are in general agreement with earlier results (1). A stock of thirteen circles cut from dry-lapped pulp (Hercules PS-57 linters [3101-001]) was leached with 2% hydrofluoric acid and 2% ammonium carbonate.* Except for the top circle, low and comparatively uniform levels of uranium and lithium were found. The uranium content was approximately 0.15 ng./g. with an 8/5 ratio of 129-136. These data are well within the objective of the project. The data for lithium, although they are uncorrected for a blank, are approximately twice the level required.

Attempts to exchange magnesium ions for lithium and uranium ions were unsuccessful (Table I, Samples 3101-024 and -025) and no further experiments with magnesium compounds are planned.

Through an inspection of the data (Report One, Table I) for the uranium contents of pulps, filtrates, and process water, it was observed that two 8/5 ratios were involved. The ratio in the original linters as received is 116 and that in the process water is 137. Also, it was noted that the hydrofluoric acid filtrate from pulp Sample 3101-004 carried an amount of uranium approximately equal to the total amount present in the original linters, and that the 8/5 ratio was nearly identical (118). Furthermore, the 8/5 ratio of the uranium in the purified linters was nearly the same as that in the process water. These observations suggested that perhaps the hydrofluoric acid was removing the uranium quantitatively from the pulp and that the residual uranium was really a partial

*The details of these experimental procedures were included in Project 3101, Report One, p. 10-12.

TABLE I

ANALYSIS OF PULP SAMPLES (2ND SHIPMENT) FROM THE IPC^a

Sample	Uranium		Lithium, ng./g.
	8/5 ^b	ng./g.	
Stack of 13 circles of dry-lapped pulp leached with 2% hydro- fluoric acid and 2% ammonium carbonate			
3101-018 A (Circle 1, top)	137.3	2.27	11.22
	B (2) 134.1	0.15	0.85
3101-018 A (7)	128.2	0.11	0.72
	B (8) 132.4	0.13	0.71
	C (9) 130.8	0.082	1.29
3101-023 A (12)	135.6	0.18	0.84
	B (13) 130.5	0.13	0.67
Pulp leached with 2% hydrofluoric acid and magnesium bicarbonate			
3101-024 A (4)	135.3 ^c	7.97 ^c	4.08
	B (5) 138.0	0.64	4.89
	C (6) 137.4	0.42	2.51
Pulp leached with magnesium bicar- bonate, only			
3101-025 A (4)	131.0	0.61	3.52
	B (5) 126.6	0.45	4.44
	C (6) 128.0	0.49	3.14

^aAll analytical data were obtained at the McClellan AFB, MCL-C, and enclosed in a letter dated October 31, 1972, from Capt. Frank Grasso to E. E. Dickey.

^bWeight ratio of the isotopes, U-238/U-235.

^cAverage of two analyses.

replacement from the traces present in the process water. Efforts are underway to prevent, as far as practicable, such possible replacements of cations.

The data for lithium appear to be less informative than are those for uranium; the patterns of removal and possible replacement are more obscure. In an effort to learn more about the removal of lithium we have procured 1.0 g. of lithium-6 as the carbonate, >99% enrichment.

The data summarized in Table II were obtained with samples of pulp and IPC-1478 paper, and were processed in the Laboratories at McClellan AFB. The levels of lithium and uranium in the pulp samples suggest that hydrochloric acid and ammonium carbonate, respectively, under mild conditions are effective in removing much of these substances. Furthermore, the 8/5 ratios (118) for the residual uranium suggest that this element occupies some sites which are inaccessible to the leaching agents. Otherwise, the 8/5 ratio might have approached that (136) found for the uranium in the process water. The results for the IPC-1478 filter paper circles are somewhat less definitive.

TABLE II

URANIUM AND LITHIUM CONTENT OF TREATED PULP
 (HERCULES PS-57) AND IPC-1478 FILTER PAPER

MCL Samples^a

MCL Sample Number	Uranium		Lithium, ng./g.
	8/5	ng./g.	
Control ^b	115.9	1.26	2.37
Pulp leached with hydrochloric acid at pH 3			
012-5535 A	117.5	0.55	0.42
B	118.7	0.57	0.89
C	117.0	0.56	0.55
D	117.4	0.57	0.64
Pulp leached with ammonium carbonate at pH 9			
012-5536 A	117.5	0.23	0.92
B	119.9	0.14	0.92
C	119.1	0.21	0.59
D	120.5	0.24	0.52
Stack of circles of IPC-1478 filter paper, with Kronisol, leached with hydrochloric acid at pH 3 and ammonium carbonate at pH 9			
012-5537 A (control)	126.1	0.32	4.68
B	135.7	0.35	2.67 (top circle)
C	131.5	0.27	(6.35)
D	130.6	0.27	3.32
E	132.4	0.30	3.00
F	132.6	0.30	2.85
G	133.9	0.35	3.51
H	132.3	0.34	2.12
I	132.3	0.26	2.04
J	130.3	0.23	1.42
K	132.6	0.22	1.78 (bottom circle)

^aThese data were obtained from experiments performed by the McClellan AFB, MCL-C, and were enclosed in a letter dated October 31, 1972, from Capt. Frank Grasso to E. E. Dickey.

^bAverage of four samples of Hercules PS-57 linter pulp analyzed under the IPC number 3101-001 (see Project 3101, Report One).

FUTURE WORK

Based on the data presently in hand, the following experiments are being planned.

1. Attempt to elucidate the patterns of removal and replacement of lithium through the use of lithium-6, >99% enrichment.
2. Explore the pattern of uranium and lithium removal with hydrofluoric acid over the range of pH 0 to 3. Eventually, hydrochloric and nitric acids may be studied over this range of pH.

Within the next report period, Report Three, November and December, 1972, analytical data may be obtained for samples of reagents, filtrates, and pulps which have been sent to McClellan AFB from the IPC on this project. The results may modify and extend the plans for "Future Work" as listed above.

EXPERIMENTAL

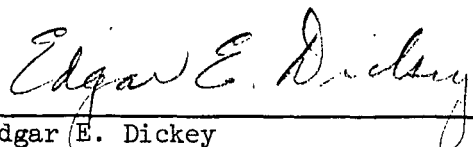
The details of the experimental procedures used in the preparation of samples listed in Table I were reported in Project 3101, Report One, dated September 29, 1972. The detailed procedures for the samples listed in Table II may be procured from McClellan AFB, MCL-C.

In future reports we plan to include the detailed experimental procedures and the corresponding analytical data in the same document.

LITERATURE CITED

1. Project 3101, Report One, September 29, 1972.

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