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DATE
For the Atomic Energy Commission June 9, 1945

RAYMOND A. CARPENTER Cu
for the
Chief, Declassification Branch

TO: J. J. Nickson, M.D.

FROM: E. R. Russell

Monthly Summary: Analytic Group, Section H-3
For the month ending June 8, 1945

J. J. Nickson, M.D. - Section Chief
E. R. Russell - Group Leader

Problem Assignment: 249-MLH-3501 - Detection of Product in Urine
J. Jackson - E. R. Russell

Routine ~~product~~ plute assay of the urine of the Chicago personnel has continued. No significant change in the overall picture has been observed. In addition to the Chicago specimens, samples has benn assayed from other sites.

1. Total number of individual specimens analyzed 101
   a. Chicago 61
   b. Other Sites 40
2. Total number of analyses 163
3. Individual specimens (Chicago) with high activity . . . 0

Problem Assignment: 249-MLH-3502 - Development of Methods for Product in Urine J. Schubert - D. Revinson - E. R. Russell

Properties of the Citrate Complex of ~~Product~~ Plutonium

Using cation-exchange techniques, a study of the stability of the complex formed by product with citric acid has been made over the pH range of 7-0.5. It is found that with 0.05 M citric acid in isotonic salt solution the ~~product~~ plute is strongly complexed but begins to break up sharply at about pH = 2. No complex exists at pH = 1.

A quantitative study of the composition and dissociation constant of the ~~product~~ plute-citrate complex at pH 7.3 is in progress. Preliminary data of a fragmentary nature indicates that the complex consists of one molecule of ~~product~~ plute in combination with one molecule of the tertiary citrate ion, giving a dissociation constant of 7×10^{-3} at an ionic strength of 0.16.

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Chicago Case #1
RER 12/19/72

Problem Assignment: 249-MLH-3501, 3502 E. Motta - R. Lesko

Analysis of Urine of MX-100

The urine of MX-100 was wet ashed by the nitric acid-hydrogen peroxide procedure. The inorganic residue was dissolved in 4 N HNO_3 and a LaF_3 analysis carried out on an aliquot portion. Of course an SO_2 reduction was required before the LaF_3 could be precipitated.

At first each individual urine sample was analyzed; later twelve hours samples were analyzed and finally twenty-four hour samples were used. The following results indicate the amount of product excreted in the urine. The amount of product originally injected into MX-100 was 6.7 ug. The analyses are still continuing. Up to the last result recorded, MX-100 had excreted a total of 3.88 % of the amount injected.

Individual Samples

Date and time of Sample	Volume in ml.	Specific gravity	Total activity in c/m	c/m per 100 ml urine	Total ug excreted	% of Inj.
4-26-45 3:30 P.M.	152	1.011	9960	6550	.145	2.23
4-26-45 5:00 P.M	218	1.010	776	355	.0114	.175
4-26-45 7:45 P.M.	325	1.006	145	45	.0021	.023
4-27-45 12:30 A.M.	245	1.006	160	65	.00234	.036
4-27-45 3:00 A.M.	414	1.004	154	37	.00226	.035
4-27-45 7:35 A.M.	182	1.011	143	78	.0021	.032
4-27-45 1:15 P.M.	108	1.019	149	138	.00218	.033
4-27-45 7:55 P.M.	73	1.013	100	137	.00145	.022
4-27-45 10:45 P.M.	97	1.015	92	95	.0013	.020
4-28-45 1:15 A.M.	148	1.012	136	92	.00198	.030
4-28-45 5:30 A.M.	160	1.013	107	67	.00157	.024
4-28-45 7:30 A.M.	108	1.011	109	100	.00159	.024

12-hour Samples

Date and Time of Sample	Volume in ml	Specific gravity	Total activity c/m	c/m per 100 ml urine	Total ug Excreted	% of Injected *
4-28-45 9:30 A.M. to 4-28-45 9:00P.M.	258	1.013	200	77	.00296	.045
4-28-45 9:30 P.M. to 4-29-45 9:30 A.M.	415	1.019	170	41	.00250	.039
4-29-45 9:00 A.M. to 4-29-45 9:00 A.M.	630	1.012	340	54	.005	.085
4-29-45 9:00 P.M. to 4-30-45 9:00 A.M.	540	1.010	210	39	.0031	.048
4-30-45 9:50 A.M. to 4-30-45 9:00 P.M.	515	1.010	52	10	.00076	.012
4-30-45 9:00 P.M. to 5-1-45 9:00 A.M.	430	1.011	91	20	.0013	.020
5-1-45 9:00 A.M. to 5-1-45 9:00 P.M.	660	1.010	97	15	.0014	.012
5-1-45 9:00 P.M. to 5-2-45 9:00 A.M.	485	1.010	77	16	.0011	.017
5-2-45 9:00 A.M. to 5-2-45 9:00 P.M.	600	1.010	63	10.5	.00092	.014
5-2-45 9:00 P.M. to 5-3-45 9:00 A.M.	380	1.010	42	11	.00061	.0094
5-3-45 9:00 A.M. to 5-3-45 9:00 P.M.	920	1.010	60	6.5	.0009	.013
5-3-45 9:00 P.M. to 5-4-45 9:00 A.M.	895	1.006	45	5	.00063	.0095

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24-hour Samples

Date and Time of Sample	Volume in ml	Specific gravity	Total activity c/m	c/m per 100 ml urine	Total ug Excreted	% of Injected
5-4-45 to 5-5-45	2510	1.006	126	5	.0018	.027
5-5-45 to 5-6-45	3250	1.005	153	4.7	.0022	.034
5-6-45 to 5-7-45	3275	1.005	216	6.6	.0031	.047
5-7-45 to 5-8-45	2320	1.005	120	5/2	.0018	.028
5-8-45 to 5-9-45	1490	1.004	81	5.4	.0012	.018
5-9-45 to 5-10-45	2635	1.004	150	5.7	.0022	.034
5-10-45 to 5-11-45	2480	1.003	117	4.7	.0017	.026
5-11-45 to 5-12-45	2560	1.005	54	2.1	.0008	.012
5-12-45 to 5-13-45	2650	1.000	120	4.5	.0018	.028
5-13-45 to 5-14-45	2920	1.000	117	4.0	.0017	.026
5-14-45 to 5-15-45	3300	1.000	70	2.1	.001	.015
5-15-45 to 5-16-45	3060	1.000	173	5.6	.0025	.038
5-16-45 to 5-17-45	3470	1.000	147	4.2	.0022	.034
5-17-45 to 5-18-45	3100	1.000	120	3.9	.0018	.027
5-18-45 to 5-19-45	3500	1.000	136	3.9	.0020	.030
5-19-45 to 5-20-45	1440	1.000	77	5.3	.0011	.017
5-20-45 to 5-21-45	2640	1.000	684	26.0	.010	.15
5-21-45 to 5-22-45	800	1.005	113	14.0	.0017	.026
5-22-45 to 5-23-45	3080	1.000	405	13.0	.006	.090
5-23-45 to 5-24-45	2920	1.000	154	5.3	.0023	.035
5-24-45 to 5-25-45	3350	1.000	96	3	.0014	.021
5-25-45 to 5-26-45	2930	1.000	112	3.8	.0016	.024
5-26-45 to 5-27-45	3830	1.000	126	3.3	.0018	.027
5-27-45 to 5-28-45	2440	1.000	92	3.8	.0013	.020
5-28-45 to 5-29-45	2940	1.000	49	1.7	.0007	.010
5-29-45 to 5-30-45	1340	1.001	30	2.2	.0004	.006
5-30-45 to 5-31-45	2880	1.000	42	1.5	.0006	.009
5-31-45 to 6-1-45	3400	1.000	64	1.9	.0009	.014
6-1-45 to 6-2-45	3250	1.000	45	1.4	.0007	.010

Efficiency of the IR-4H method of analyzing for excreted ~~product~~ plate in human urine containing only a few c/m of this excreted Pu:

A series of ~~product~~ plate analyses using the IR-4H resin batch-test method were carried out. The human urine used contained only a few c/m of excreted Pu and thus closely approximated the conditions under which the mthod would be applied. Two different forms of the IR-4H resin were studied. One set of runs was made with the HCl form and another set with the H_3PO_4 form. Each type of resin was prepared by treating the carbonate form which comes from the manufacturer with the appropriate acid.

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In each analysis the urine was made .1 N in HCl and one gram of IR-4H resin was added for each 100 ml of urine. The mixture was now shaken for two hours. The urine was then carefully decanted off and the resin washed into a M sintered glass funnel. Now 40 ml of 4 N HCl were allowed to percolate slowly through the resin and into a 50 ml centrifuge tube. This solution was then analyzed by the LaF_3 method. The results obtained were compared with those obtained using the wet ashing--LaF_3 procedure. It is apparent that at these low activities the IR-4H resin method gives results which are of the same order as those of the wet ashing--LaF_3 method. However, there are substantial variations when one considers these results on a percentage basis. Undoubtedly some of these variations arise from lack of efficiency in the IR-4H analysis. However, since the activities are so low, the wet ashing--LaF_3 method is also subject to variations. This is borne out by some of the higher results which one obtains with the IR-4H technique; e.g. samples 41, 44, and 46.

In general, the time saved by using the IR-4H method amounts to many hours when one contrasts it to the wet ashing--LaF_3 procedure. Since the IR-4H method permits analysis of 500 to 1000 ml samples of urine, it is more desirable. However, one must not forget that at these very low activities the method gives rather variable results and is consequently inferior to any method which will give precise determinations.

c/m of Product per 500 ml of Urine from MX-100

Sample	Wet-ashing LaF_3 method	IR-4H HCl form	% of w.a.-- LaF_3 method	IR-4 H_3PO_4 form	% of W.A.-- LaF_3 method
27	9	10	110%	——	——
27	9	7	78%	——	
34	13	——	——	7	54%
38	54	46	85%	37	69%
40	12	9.5	79%	10.5	87%
41	16	15	94%	20	125%
43	16	14	88%	16	100%
44	7	7.5	107%	12	170%
46	6.4	6	94%	7	109%
47	8	4	50%	6	75%

* w.a. is wet-ashing