US EPA ARCHIVE DOCUMENT

CASE GS238 METIRAM STUDY 6 PM —

CHEM 014601 Metiram/ETU

BRANCH EAB DISC —

ACTIVE INGREDIENT-^{14}C-Ethylene labeled ETU of 10.08 mCi/mmole and 97.8% radiochemical purity.

FICHE/MASTER ID 404661-03
M. Carpenter. 1987. Hydrolysis as a function of pH at 25°C of ^{14}C-Ethylenethiourea. Unpublished study prepared by ABC laboratories for Roam and Haas and received Jan. 18, 1988 in response to the Mancozeb Registration Standard. Acc. 404661-03.

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CONCLUSION:

Hydrolysis:

1. This study is acceptable and along with study 4 on metiram together satisfy EPA Hydrolysis Data Requirement on ETU and metiram for Registration.

2. No detectable degradation of ETU occurred at pH 5, 7, and 9 in 30 days. Therefore, no breakdown of ETU due to hydrolysis is expected in the environment.

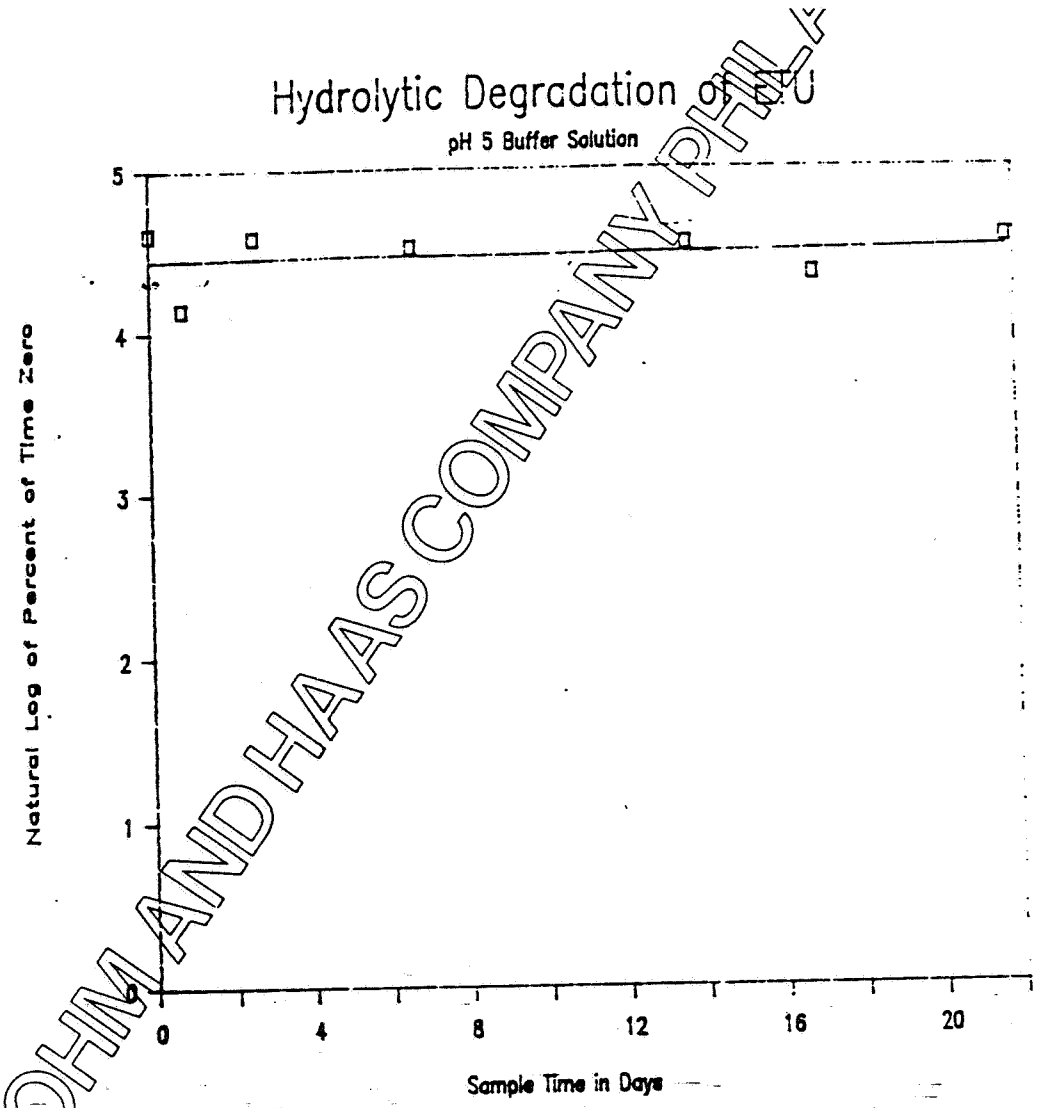
MATERIALS AND METHODS:

A primary stock solution of 97.8% pure ^{14}C labeled ETU in methanol contained 4.35×10^7 dpm/ml (1.94×10^3 ug/ml) was used.
The following sterilized buffer solutions were prepared (water and equipment were sterilized before use):

200 ml pH 5: 14.8 ml of 0.2 M acetic acid + 35.2 ml of 0.2 M NaAc + water
1000 ml pH 7: 22.2 ml of 0.01 M N-2-hydroxyethylpiperazine-N'-2-ethanesulfonic acid + 0.2 M KOH until a pH 7 was reached.
1500 ml pH 7: 75 ml of 0.2 M tris(hydroxymethyl)aminomethane + 70.5 ml of 0.2 M HCl + water
200 ml pH 9: 23 ml of 0.2 M boric acid + 32 ml of 0.2 M borax solution + water.

The test solutions of pH 5, 7 and 9 were prepared by adding 0.498 ml of the ^{14}C-ETU stock solution to each flask, evaporating the solvent and then 100 ml of the appropriate buffer was added. Each flask was placed in a box at 25°C. Samples were taken after 0 (blank), 1, 2, 3, 7, 14, 17, 22, and 30 days and analyzed by LSC for total radioactivity and by TLC and HPLC in reference to authentic samples of parent and potential degradates.

REPORTED RESULTS:



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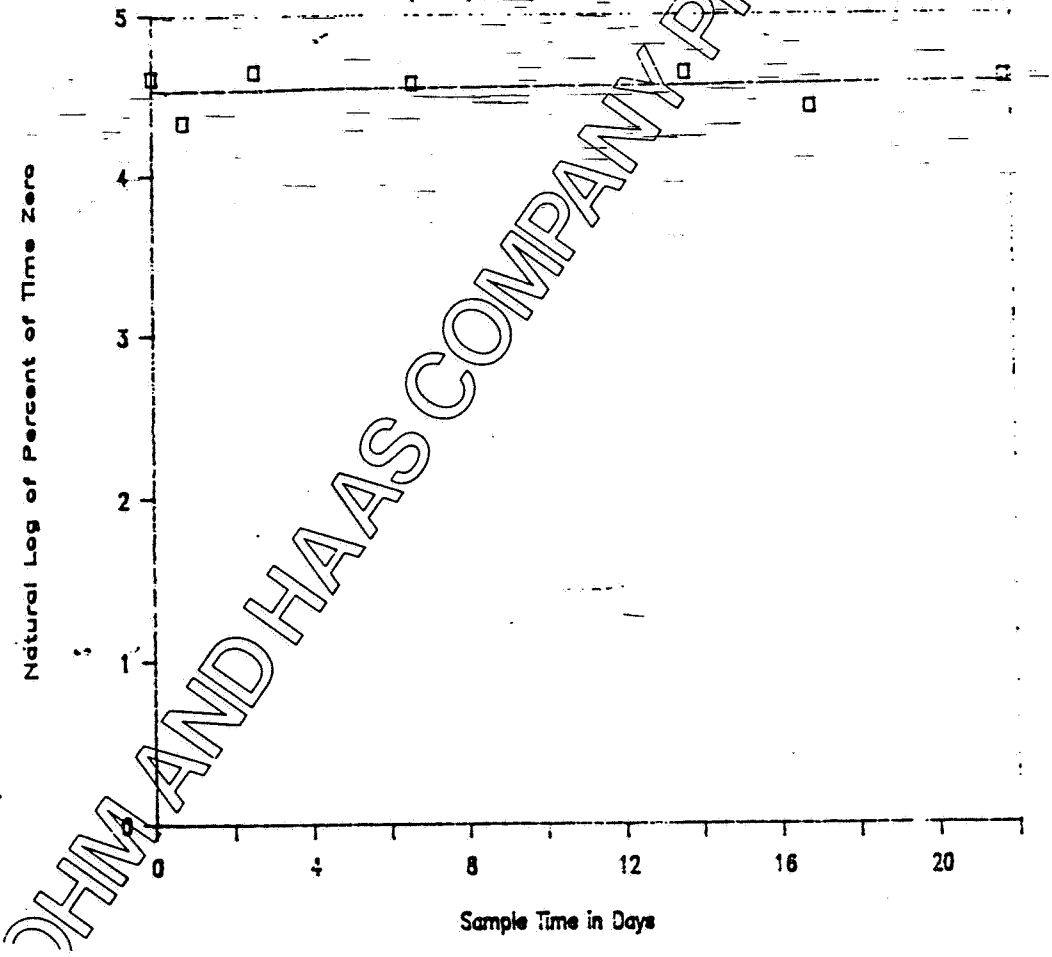
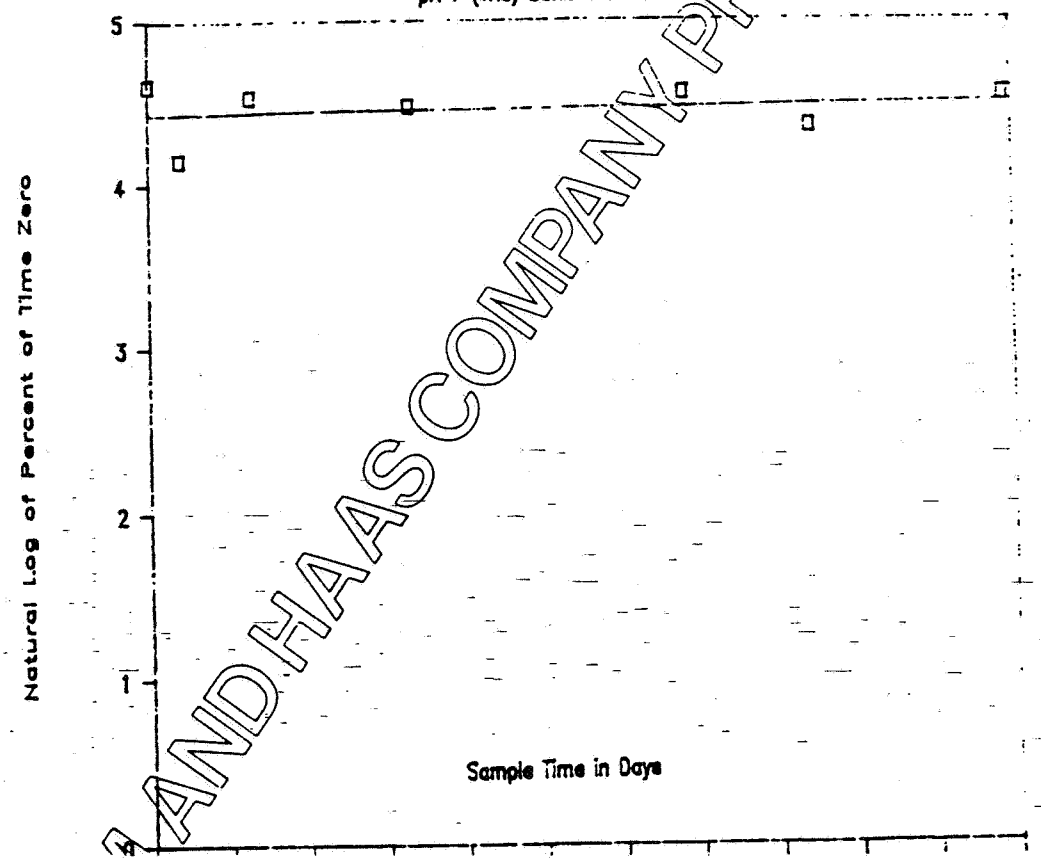
Hydrolytic Degradation of BTS

pH 7 (HEPES) Buffer Solution



pH 7 (Tris) Buffer Solution



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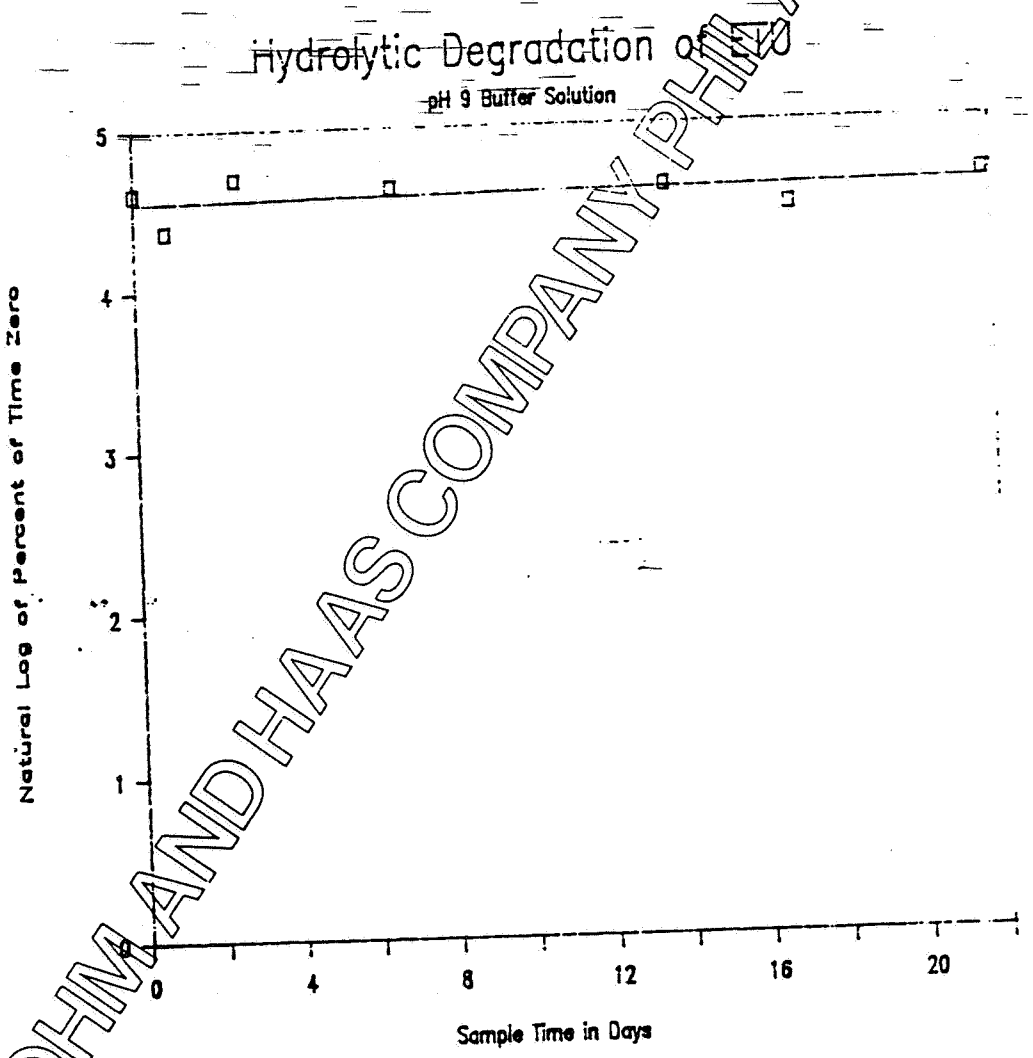

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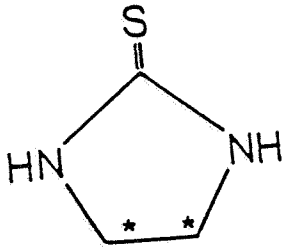
DISCUSSION:

1. Degradation observed on the TLC plates was attributed to photodegradation due to exposure to the UV detector light and was observed with all samples of ETU.

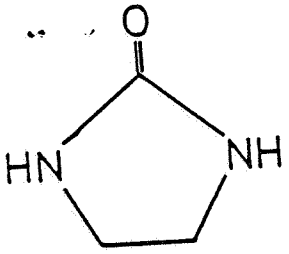
2. Recoveries accounted for over 96.8% of the applied radioactive material.

FIGURE 1

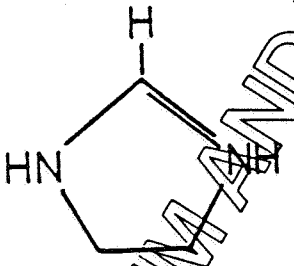
Structure and Nomenclature of ^{14}C-Ethylenethiourea and Expected Degradation Products



^{14}C-Ethylenethiourea



Ethyleneurea



2-Imidazoline

*Denotes ^{14}C-labeling.

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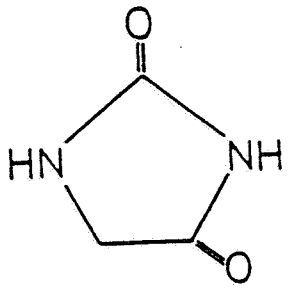
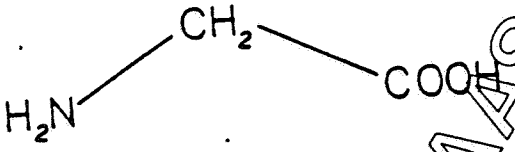
FIGURE 1 (Continued)

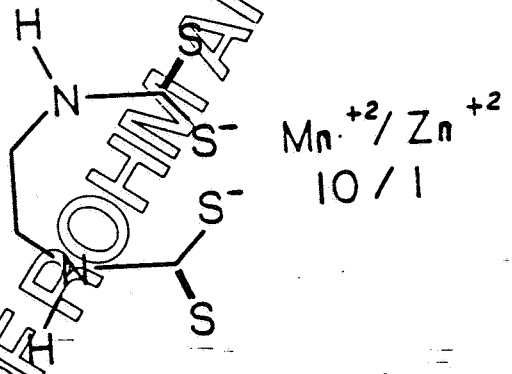
Structure and Nomenclature of ^{14}C-Ethylenethiourea and Expected Degradation Products



Hydantoin



Glycine



Ethylene bis Dithio-Carbamate

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TABLE II

Definitive Hydrolysis of ^{14}C-Ethylenethiourea in pH 5 Buffered Solution

pH 5 Samples

Sample Day	µg/ml as Parent Equivalents	% as Parent As Determined by RTLC	µg/ml as Parent Compound	Percent of Time Zero	ln of Percent Time Zero
0	9.04	86.0	7.77	100.0%	4.61
0.79	8.67	56.4	4.89	62.9%	4.14
2.61	8.76	86.8	7.60	97.8%	4.58
6.67	8.75	81.0	7.09	91.2%	4.51
13.7	8.63	83.9	7.24	93.1%	4.53
16.9	8.70	68.5	5.96	76.7%	4.34
21.8	8.70	85.3	7.42	95.5%	4.56
29.7	9.11	78.9	7.19	92.5%	4.53

Regression Output	
Constant Y Intercept	4.45
Std. Err. of Y Est.	0.167
R Squared	0.0321
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)[1]	0.00260
Std. Err. of Coef.	0.00583

[1] Positive slope indicates no significant degradation occurred. Data precludes calculation of rate constant and half-life.

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TABLE III

Definitive Hydrolysis of ^{14}C-Ethylenethiourea in pH 7H Buffered Solution

pH 7H Samples							
Sample Day	µg/ml as Parent Equivalents	% as Parent As Determined by RTLC	µg/ml as Parent Compound	Percent of Time Zero	ln of Percent Time Zero	Regression Output	
0	9.22	81.3	7.50	100.0%	4.61	Constant Y Intercept	4.53
0.79	8.97	63.4	5.69	75.9%	4.33	Std. Err. of Y Est.	0.124
2.62	8.98	87.4	7.85	104.7%	4.65	R Squared	0.0493
6.67	8.93	81.3	7.26	96.9%	4.57	No. of Observations	8
13.7	9.02	86.3	7.78	103.8%	4.64	Degrees of Freedom	6
16.9	9.05	68.5	6.20	82.7%	4.42	X Coefficient(s)[1]	0.00241
21.8	8.74	85.8	7.50	100.0%	4.61	Std. Err. of Coef.	0.00432
29.7	9.10	83.3	7.58	101.1%	4.62		

[1]Positive slope indicates no significant degradation occurred. Data precludes calculation of rate constant and half-life.

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TABLE IV

Definitive Hydrolysis of ^{14}C-Ethylenethiourea in pH 7T Buffered Solution

pH 7T Samples

Sample Day	µg/ml as Parent Equivalents	% as Parent As Determined by RTLC	µg/ml as Parent Compound	Percent of Time Zero	ln of Percent Time Zero
0	9.02	91.5	8.25	100.0%	4.61
0.79	9.10	57.6	5.24	63.5%	4.15
2.62	8.93	85.5	7.64	92.5%	4.53
6.67	9.03	80.2	7.24	87.7%	4.47
13.7	9.07	86.0	7.80	94.5%	4.55
16.9	9.19	69.2	6.36	77.1%	4.34
21.8	8.92	85.8	7.65	92.7%	4.53
29.7	9.21	81.4	7.50	90.8%	4.51

Regression Output

Constant Y Intercept	4.48
Std. Err. of Y Est.	0.155
R Squared	0.0377
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)[1]	0.00262
Std. Err. of Coef.	0.00541

[1] Positive slope indicates no significant degradation occurred. Data precludes calculation of rate constant and half-life.

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TABLE V

Definitive Hydrolysis of ^{14}C-Ethylenethiourea in pH 9 Buffered Solution

pH 9 Samples							
Sample Day	µg/ml as Parent Equivalents	% as Parent As Determined by RTLC	µg/ml as Parent Compound	Percent of Time Zero	ln of Percent Time Zero	Regression Output	
0	9.68	73.9	7.15	100.0%	4.61	Constant Y Intercept	4.55
0.77	9.35	60.6	5.67	79.2%	4.37	Std. Err. of Y Est.	0.109
2.61	9.33	83.1	7.75	108.4%	4.69	R Squared	0.0991
6.67	9.37	77.5	7.26	101.5%	4.62	No. of Observations	8
13.7	9.40	76.5	7.19	100.5%	4.61	Degrees of Freedom	6
16.9	9.38	67.4	6.32	88.4%	4.48	X Coefficient(s)[1]	0.00309
21.8	9.25	81.7	7.56	105.6%	4.66	Std. Err. of Coef.	0.00380
29.7	9.24	81.4	7.52	105.1%	4.66		

[1]Positive slope indicates no significant degradation occurred. Data precludes calculation of rate constant and half-life.

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TABLE VI

Mass Balance of ^{14}C-Ethylenethiourea Hydrolysis Study Samples

Sample Day	µg/ml pH 5	Percent of to pH 5	µg/ml pH 7H	Percent of to pH 7H	µg/ml pH 7T	Percent of to pH 7T	µg/ml pH 9	Percent of to pH 9
0	9.04	100.0%	9.22	100.0%	9.02	100.0%	9.68	100.0%
0.79	8.67	95.9%	8.97	97.3%	9.10	100.9%	9.35	96.6%
2.62	8.76	96.9%	8.98	97.4%	8.93	99.0%	9.33	96.4%
6.67	8.75	96.8%	8.93	96.9%	9.03	100.1%	9.37	96.8%
13.7	8.63	95.5%	9.02	97.8%	9.07	100.6%	9.40	97.1%
16.9	8.70	96.2%	9.05	98.2%	9.19	101.9%	9.38	96.9%
21.8	8.70	96.2%	8.74	94.8%	8.92	98.9%	9.25	95.6%
29.7	9.11	100.8%	9.10	98.7%	9.21	102.1%	9.24	95.5%
	Mean =	97.3%	Mean =	97.6%	Mean =	100.4%	Mean =	96.8%

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