

- T-5869.4

Physical Prop -
Partition Coefficient

REPORT

DETERMINATION OF THE PARTITION COEFFICIENT (N-OCTANOL/WATER) OF
T-5869.4
BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC)

*Summary
Credited
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McFOSEFA*

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3M

TOXICOLOGY

Exhibit
2794

State of Minnesota v. 3M Co.,
Court File No. 27-CV-10-28862

3M_MN01639872

STATEMENT OF GLP COMPLIANCE

NOTOX B.V., 's-Hertogenbosch, The Netherlands

The study described in this report was conducted in compliance with the most recent edition of:

The OECD Principles of Good Laboratory Practice

which are essentially in conformity with:

The United States Food and Drug Administration. Title 21 Code of Federal Regulations Part 58.

The United States Environmental Protection Agency (FIFRA). Title 40 Code of Federal Regulations Part 160.

The United States Environmental Protection Agency (TSCA). Title 40 Code of Federal Regulations Part 792.

Study Director:

Drs. R. de Vries

cka

.....

Date: *June 3, 1994*

QUALITY ASSURANCE STATEMENT

NOTOX B.V., 's-Hertogenbosch, The Netherlands.

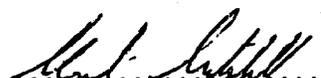
Study procedures were subject to periodic inspections and general non study specific processes were also inspected at periodic intervals.

This report was audited by the NOTOX Quality Assurance Unit and the methods and results accurately reflect the raw data.

DATES OF QAU INSPECTIONS/ AUDITS	REPORTING DATES
25 March 1994	25 March 1994
28 March 1994	28 March 1994
21 April 1994	21 April 1994

Quality Assurance Manager

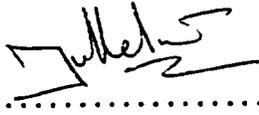
C.J. Mitchell B.Sc.


Date: 09-06-94.

REPORT APPROVAL

STUDY DIRECTOR:

Drs. R. de Vries

c/a 
.....

Date: *June 8, 1994*

MANAGEMENT:

J.A.M.W. van Helvoirt
Section head Physico Chemistry

PP. 
.....

Dr. Wona C. Enninga
Technical Director

Date: *09/06/1994*

PREFACE

Sponsor 3M Belgium - Chemical EBC
Canadastraat 11
B-2070 ZWIJNDRECHT
Belgium

Study Monitor Mr. R.H. Cox

Testing Facility NOTOX B.V.
Hambakenwetering 3
5231 DD 's-Hertogenbosch
The Netherlands

Study Director Drs. R. de Vries

Study plan Start: 30 March 1994
Completed: 07 April 1994

TEST SUBSTANCE

Identification T-5869

Description Cream solid

Batch 2408

Purity 95%

Storage conditions At room temperature in the dark

Stability under storage conditions Stable

Expiry date January 01, 1996

PURPOSE AND PRINCIPLE

The purpose of the study was to determine the partition coefficient of the test substance between n-octanol and water.

The partition coefficient (n-octanol/water) (P_{OW}) is defined as the ratio of the equilibrium concentrations in a two phase system consisting of n-octanol and water.

The retention time of a substance in a reversed-phase High Performance liquid Chromatography (HPLC) chromatographic system is related to its partition coefficient (n-octanol/water).

The HPLC method is useful for $\log P_{OW}$ values between 0 and 6.

Using the HPLC method, impurities are of minor importance. The HPLC method must also be applied if the test substance is a mixture of compounds but is not applicable to strong acids and bases, metal complexes, substances which react with the eluent or surface-active agents.

GUIDELINES

The study procedure described in this report was based on the following guidelines:

Organization for Economic Co-operation and Development (OECD), OECD Guideline for Testing of Chemicals, guideline no. 117: "Partition coefficient (n-octanol/water) High Performance Liquid Chromatography (HPLC) method" (adopted March 30, 1989).

European Economic Community (EEC), EEC-Directive 92/69 EEC, Annex V, Part A, Methods for the determination of physico-chemical properties, A.8: "Partition coefficient". EEC Publication no. L383, December 1992.

ARCHIVING

NOTOX B.V. will archive the following data for at least 10 years: protocol, report, test substance reference sample and raw data.

TEST SYSTEM AND RATIONALE

A High Performance Liquid Chromatograph with a spectrophotometric detector. The stationary phase was bonded silica C₁₈. The mobile phase was 75/25 (v/v) acetonitrile/water. Both HPLC instrumentation and conditions are described in the section "method of chemical analysis".

The test system was recognized by the international guidelines (OECD, EEC).

REFERENCE SUBSTANCES

Six chemicals for which log P_{ow} has been reported were used to calibrate the elution time in units of log P_{ow}. The mixture of reference substances consisted of:

Reference substance	log P _{ow} ¹
- benzylalcohol (p.a., Merck)	1.1
- toluene (p.a., Merck)	2.7
- 1,4-dichlorobenzene (z.s., Merck)	3.4
- fluoranthene (98%, GC, Aldrich Chemie)	4.7
- dibenzyl (99%, GC, Aldrich Chemie)	4.8
- 2,4-DDT (99%, HPLC, Riedel de Haën, Seelze, FRG)	6.2

¹ log P_{ow} values according to the OECD guideline.

PERFORMANCE OF THE TEST

Preparation of the solutions

Solutions of the reference substances were prepared in methanol (HPLC-grade, Labscan Limited Co., Dublin, Ireland) at a concentration of 1.5-2 g/l. A mixture of the reference substances was prepared by adding 125 µl of each solution to a volumetric flask. Subsequently, this flask was made up with mobile phase to a final volume of 25.0 ml.

For the determination of t₀ (retention time of the unretarded component), a solution of formamide (p.a., Merck, Darmstadt, FRG) in methanol was prepared at a concentration of 1.7 g/l and thereafter diluted 10 times with mobile phase.

A stock solution of T-5869 was prepared by dissolving 287 mg test substance in 50.0 ml acetonitrile (2 minutes sonication). The stock solution was diluted 10 times with mobile phase, resulting in the test solution.

Performance of the test

The solutions were injected in the following sequence: the mixture of reference substances, mobile phase, the formamide solution, the test solution (in duplicate), mobile phase, the mixture of reference substances and the formamide solution.

Temperature of measurement

The temperature of the mobile phase was recorded several times during the measurements.

METHOD OF CHEMICAL ANALYSIS

The conditions used for the High Performance Liquid Chromatographic method are described below:

Analysis

Column	LiChrospher 100 RP-18; 125 x 4 (I.D.) mm; d _p = 5 μm (Merck, Darmstadt, FRG)
Mobile phase	75/25 (v/v) acetonitrile (HPLC-grade, Labscan Limited Co., Dublin, Ireland)/Milli-Q water (Millipore Corp., Bedford, MA, USA)
Flow	1 ml/min
Detection	UV at λ = 210 nm
Injection volume	10 μl

Instrumentation

HPLC Pump	Series 410 LC (Perkin Elmer, Norwalk, CT, USA)
Autosampler	ISS-200 (Perkin Elmer)
Detector	SpectroMonitor 3100 (LDC Analytical, Riviera Beach, FL, USA)
Integrator	SP 4290 (Spectra Physics, San Jose, CA, USA)

DATA HANDLING

Using High Performance Liquid Chromatography, especially large log P_{ow} values can be accurately determined from the chromatographic retention data. To this end, the capacity factor (k') was used, since it is proportional to the partition coefficient. The capacity factor was calculated from the retention of the substance concerned (t_r) and the unretarded component (t₀):

$$k' = (t_r - t_0)/t_0$$

From the results of the reference substances, a plot of log P_{ow} (x-value) versus log k' (y-value) was constructed, using linear regression analysis. The log k' value of each component of the test substance was compared with the log k' values of the reference substances with known log P_{ow} values.

RESULTS

Representative HPLC chromatograms of the test solution, the blank (mobile phase), the mixture of reference substances and the formamide solution are shown in Figures 1 to 4.

In the HPLC chromatograms of T-5869, using detection at 210 nm, one large and 2 small test substance peaks were observed. In addition, many small test substance peaks were observed between approximately 1 and 6 minutes. It was assumed that the large peak derived from the major component of test substance whereas the small peaks derived from impurities.

The t_0 was determined to be 0.90 minutes as a mean value of both measurements (i.e. 0.89 and 0.90 minutes).

The mean values of the retention times, k' values, $\log k'$ values, $\log P_{ow}$ and P_{ow} values are summarized in Table 1. The plot of $\log P_{ow}$ (x-value) versus $\log k'$ (y-value) from the reference substances is shown in Figure 5.

Table 1 Results of the test.

Substance	t_r^1	k'	$\log k'$	$\log P_{ow}$	P_{ow}
benzylalcohol	1.14	0.274	-0.563	1.1	
toluene	2.24	1.503	0.177	2.7	
1,4-dichlorobenzene	2.89	2.229	0.348	3.4	
fluoranthene	5.67	5.330	0.727	4.7	
dibenzyl	4.07	3.547	0.550	4.8	
2,4-DDT	9.12	9.190	0.963	6.2	
test substance					
peak 1 (major comp.)	7.75	7.659	0.884	5.6 ²	3.98x10 ⁵
peak 2	6.96	6.777	0.831	5.4 ²	2.51x10 ⁵
peak 3	6.60	6.374	0.804	5.3 ²	2.00x10 ⁵
several small peaks	1 - 6	0.12/ 5.67	-0.93/0.75	-0.7/5.2 ²	0.2/1.58x10 ⁵

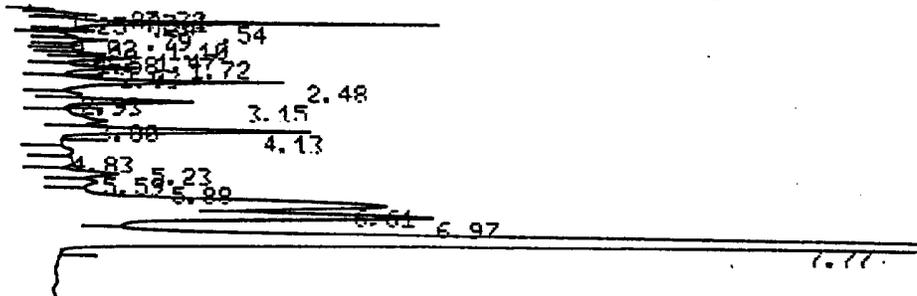
¹ Mean value of the retention times of both chromatograms.

² Interpolated from the regression line: $y = 0.288x - 0.730$ ($r=0.972$, $n=6$)

Note : The calculations were performed using not rounded values.

The temperature of the mobile phase was 20.2-20.6°C during the measurements.

CHANNEL A INJECT 07-04-94 08:03:58 STORED TO BIN # 50



DATA SAVED TO BIN # 50

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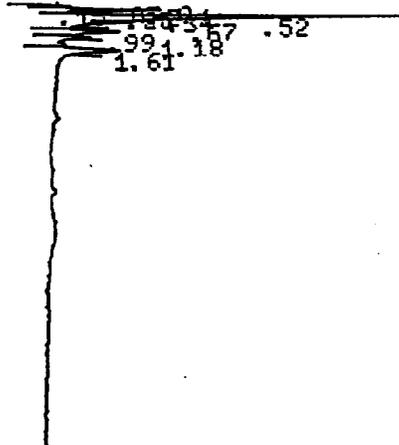
PEAK#	AREA%	RT	AREA	BC
1	0.041	0.15	1321	02
2	0.209	0.25	6658	02
3	0.098	0.34	3122	02
4	3.425	0.54	109239	08
5	0.121	0.79	3874	05
6	0.251	1.02	8011	06
7	0.498	1.1	15893	06
8	0.189	1.29	6033	06
9	0.25	1.47	7978	06
10	0.428	1.58	13648	06
11	0.839	1.72	26774	06
12	0.899	2.03	28669	07
13	3.097	2.48	98772	08
14	0.092	2.93	2936	06
15	1.652	3.15	52708	03
16	1.125	3.8	35886	02
17	4.167	4.13	132925	03
18	0.248	4.83	7895	02
19	0.432	5.23	13795	02
20	1.217	5.59	38811	02
21	0.89	5.88	28393	02
22	13.076	6.61	417083	02
23	11.364	6.97	362494	02
24	55.39	7.77	1766796	03

Figure 1 HPLC chromatogram of the test solution of 574 mg/l T-5869 in mobile phase.

Column LiChrospher 100 RP-18; 125x4 (I.D.) mm; $d_p=5 \mu\text{m}$
 Mobile phase 75/25 (v/v) acetonitrile/Milli-Q water
 Flow 1 ml/min
 Detection UV, at $\lambda = 210 \text{ nm}$
 Injection volume 10 μl

Note: All the peaks between 0 and approximately 1 minute and some of the peaks between approximately 1 and 2 minutes were also observed in the chromatograms of the blank (see Figure 2). Therefore it was assumed that these peaks did not derive from the test substance.

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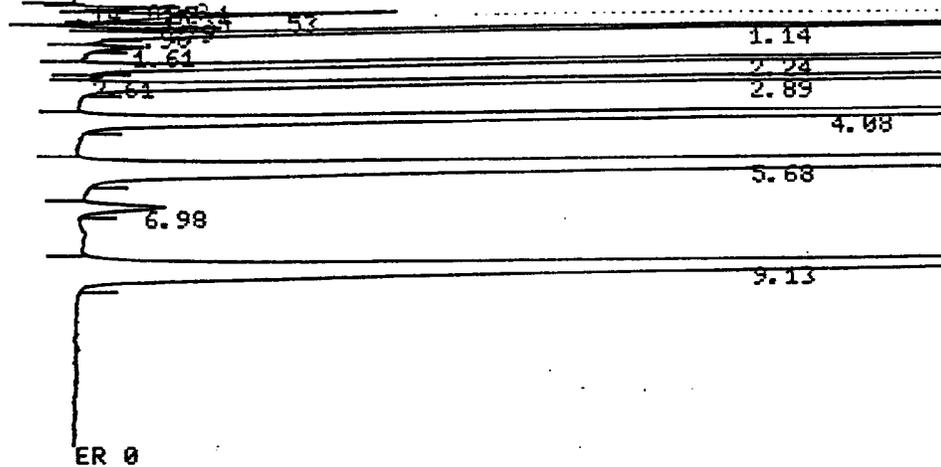
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PK#	AREA%	RT	AREA BC
1	1.543	0.15	877 02
2	10.515	0.25	5976 02
3	3.853	0.34	2190 02
4	55.335	0.52	31449 02
5	7.768	0.67	4415 03
6	6.981	0.99	3922 02
7	2.509	1.18	1426 03
8	11.576	1.61	6579 01
TOTAL	100.		56834

Figure 2 HPLC chromatogram of a blank (mobile phase).

Column LiChrospher 100 RP-18; 125x4 (I.D.) mm; $d_p=5 \mu\text{m}$
 Mobile phase 75/25 (v/v) acetonitrile/Milli-Q water
 Flow 1 ml/min
 Detection UV, at $\lambda = 210 \text{ nm}$
 Injection volume 10 μl

CHANNEL A INJECT 07-04-94 09:50:17 STORED TO BIN # 57



ER 0
DATA SAVED TO BIN # 57

38196/121286 07-04-94 09:50:17 CH= "A" PS= 1.
FILE 1. METHOD 0. RUN 14 INDEX 14 BIN 57
ANALYST: KRH

PEAK#	AREA%	RT	AREA BC
1	0.023	0.14	1131 02
2	0.145	0.25	7039 02
3	0.06	0.34	2917 02
4	0.879	0.53	42751 08
5	0.073	0.79	3542 05
6	0.139	0.96	6771 06
7	8.977	1.14	436774 03
8	0.112	1.61	5460 01
9	11.317	2.24	550640 01
10	0.013	2.61	611 02
11	10.567	2.89	514173 03
12	15.524	4.08	755334 01
13	38.584	5.68	1877339 01
14	0.316	6.98	15361 01
15	13.272	9.13	645770 01
TOTAL	100.		4865613

Figure 3 HPLC chromatogram of the mixture of reference substances in mobile phase.

Column LiChrospher 100 RP-18; 125x4 (I.D.) mm; d_p=5 μm
 Mobile phase 75/25 (v/v) acetonitrile/Milli-Q water
 Flow 1 ml/min
 Detection UV, at λ = 210 nm
 Injection volume 10 μl

CHANNEL A INJECT 07-04-94 07:37:44 STORED TO BIN # 49



DATA SAVED TO BIN # 49

38196/121286 07-04-94 07:37:44 CH= "A" PS= 1.

FILE 1. METHOD 0. RUN 6 INDEX 6 BIN 49

ANALYST: KRH

PEAK#	AREA%	RT	AREA	BC
1	0.35	0.16	2624	02
2	1.189	0.27	8926	02
3	0.79	0.79	5930	02
4	10.44	1.11	78363	08
5	1.884	0.78	14143	06
6	54.548	0.89	409437	08
7	6.246	1.11	779	05
8	0.12	1.42	899	05
9	3.094	1.87	23224	02
10	0.424	2.97	3185	03
11	20.915	3.65	156989	01
TOTAL	100.		750599	

Figure 4 HPLC chromatogram of a formamide solution of 0.2 g/l in mobile phase.

Column LiChrospher 100 RP-18; 125x4 (I.D.) mm; $d_p=5 \mu\text{m}$
 Mobile phase 75/25 (v/v) acetonitrile/Milli-Q water
 Flow 1 ml/min
 Detection UV, at $\lambda = 210 \text{ nm}$
 Injection volume 10 μl

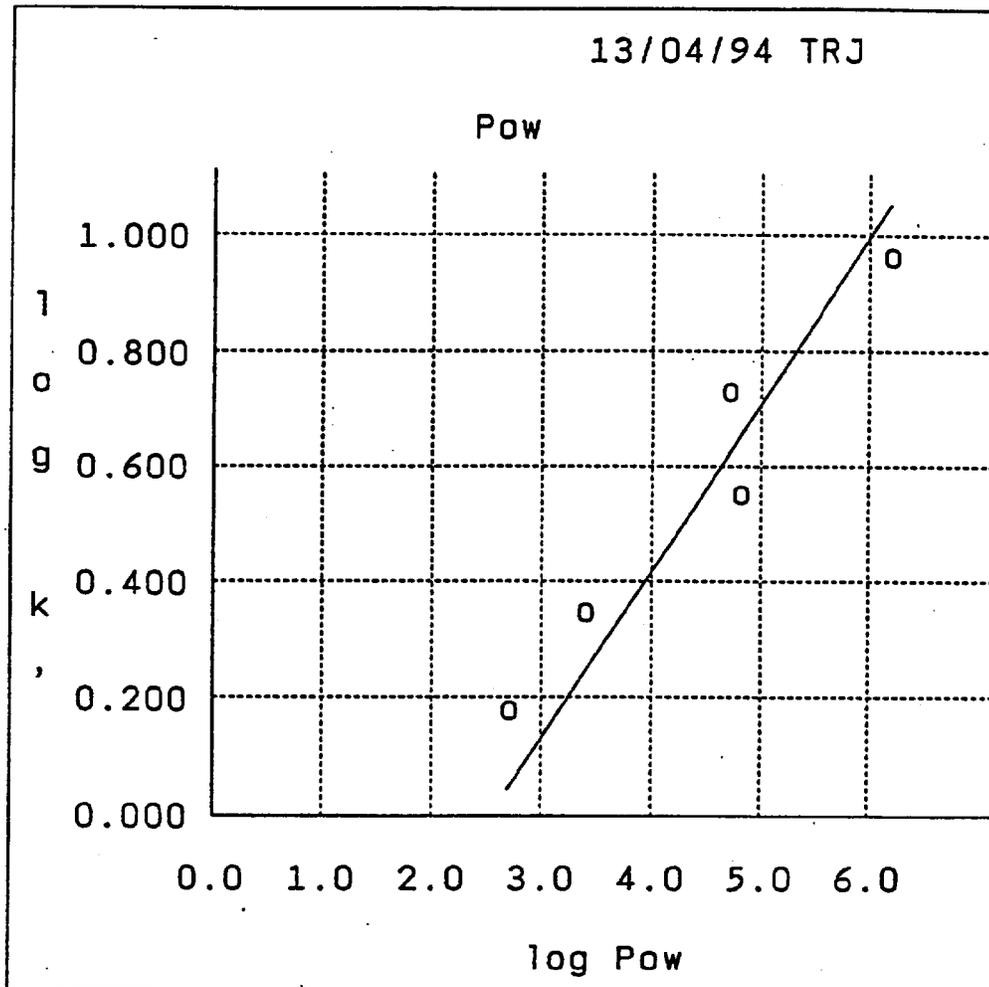


Figure 5 Plot of log P_{ow} (x-value) versus log k' (y-value) from the reference substances.