

**CODING FORMS FOR SRC INDEXING**

<b>Microfiche No.</b>	OTS0001070		
<b>New Doc ID</b>	FYI-OTS-0794-1070	<b>Old Doc ID</b>	
<b>Date Produced</b>	02/15/85	<b>Date Received</b>	07/14/94
		<b>TSCA Section</b>	FYI
<b>Submitting Organization</b>	MONSANTO CO		
<b>Contractor</b>			
<b>Document Title</b>	INITIAL SUBMISSION: ENVIRONMENTAL PERSISTENCE SCREENING OF SELECTED RUBBER CHEMICALS WITH COVER LETTER DATED 02/15/85		
<b>Chemical Category</b>	N-TERT-BUTYL-2-BENZOTHIAZOLESULFENAMIDE		

745-0774-0010-70 IR-414



INIT 87/14/94

# Monsanto



84948888161

MONSANTO POLYMER PRODUCTS CO.  
800 N. Lindbergh Boulevard  
St. Louis, Missouri 63167  
Phone: (314) 884-1000

February 15, 1985

Contains No

RECEIVED  
OPPT CBIC  
94 JUL 14 9:23

Dr. Lewis Borghi  
Senior Scientist  
DYNA-MAC, Corporation  
11140 Rockville Pike  
Rockville, Maryland 20852

Dear Dr. Borghi:

Enclosed with this letter are copies of the aquatic toxicity data summarized in the previously submitted Material Safety Data Sheets for N-tert-butyl-2-benzothiazolesulfenamide (TBBS; CAS No. 95-31-8) and N-cyclohexyl-2-benzothiazolesulfenamide (CBS; CAS No. 95-33-0), as you requested. Also enclosed are two reports on the environmental fate of TBBS and CBS and their amine hydrolysis products.

Thank you for your offer to supply a copy of the Information Review of thiocarbanilide (DFTU, CAS No. 102-08-9), which is numbered IR-421. We will be sending production volume figures to Dr. Arthur Stern at the Interagency Testing Committee as Confidential Business Information.

Please free to call if you have any questions on the enclosed toxicity and environmental fate studies.

Sincerely,

Bernard J. Hill  
Product Safety Manager

/jmc

ENVIRONMENTAL PERSISTENCE SCREENING OF SELECTED  
RUBBER CHEMICALS

TBBS  
CAS NO. 95-11-8

INTRODUCTION

A chemical released into the environment may be affected by physical transport processes and chemical, biological, and photochemical degradation processes. To predict the environmental fate of a chemical requires basic data on how the chemical may be affected by these processes. In this study chemical degradation and biodegradation screening data were obtained for eight rubber chemicals:

[REDACTED] Santocure<sup>®</sup> NS, [REDACTED]

SUMMARY AND CONCLUSIONS

Chemical degradation and biodegradation screening on [REDACTED]

[REDACTED] suggest that the parent molecules may have a relatively short residence time in the environment. Of the chemicals tested only [REDACTED] showed significant resistance to primary degradation by either chemical or biological processes. Primary degradation data were not obtained for Santocure NS.

Ultimate biodegradation testing using both the Thompson-Duthie-Sturm and Monsanto shake flask procedures showed significant evolution (>25%) only for Santocure NS [REDACTED]. These data suggest that more persistent metabolites or degradation products may be formed from [REDACTED].

Identification of such products is needed for an understanding of the hazards associated with the release of the chemical into the environment. Our scheduled 1979 test program includes identification of [REDACTED] degradation products together with aquatic toxicity testing on [REDACTED] and Santocure NS degradation products.

EXPERIMENTAL

Materials

The source of the specific rubber chemical samples used in these tests along with either the experimentally determined or calculated carbon content are tabulated in Table I.

## Test Method

### 1. Chemical Degradation

The oxidative and/or hydrolytic stability of the chemicals were determined by the following procedure. A borosilicate glass cylinder of the type employed in the SCAS biodegradation test was filled with 1500 ml of purified water (Milli-Q water purification system, Millipore Corp.) and adjusted to a 1 mg/l concentration of test chemical using 200 l of a 7.5 mg/ml acetone stock solution. The continuously stirred and aerated aqueous solution was then sampled as a function of time. Sample analyses were either carried out directly on aqueous solutions, or on methylene chloride extracts.

### 2. Primary Biodegradation

Primary biodegradation is defined as the disappearance of the original material due to bacterial action as evidenced by a specific analytical technique. Primary biodegradation measurements alone may not suffice to establish biodegradability because some materials which undergo complete primary biodegradation may be converted to more persistent intermediates. The use of specific analytical methods allows one to work with a wide variety of bacterial systems and conditions. Two procedures which have been widely used in primary biodegradation measurements are the semi-continuous activated sludge (SCAS) test - simulating a secondary-sewage treatment process - and the river die-away (RDA) test - simulating the natural environment of a river.

#### a. Semi-Continuous Activated Sludge (SCAS) Procedure

In our SCAS procedure, mixed liquor (activated sludge and supernatant) from a local domestic sewage treatment plant is charged to a magnetically-stirred vessel of 1.5 liter capacity. Means for aeration and sampling are provided. The SCAS unit is generally operated using a retention or aeration cycle of 23 hours. At the beginning of each cycle, a given level of test material (generally in acetone solution) and synthetic (300 mg glucose, 200 mg nutrient broth and 130 mg  $K_2HPO_4$ ) and/or raw sewage are added to the mixed liquor (2,500 mg/liter suspended solids concentration). Aeration is maintained until the end of the cycle, at which time the sludge is settled and one liter of supernatant drained. The cycle is then re-initiated by the addition of tap water, sewage and test material. Primary biodegradation is determined during one cycle each week by analyzing 50 ml mixed liquor samples withdrawn after feeding ( $C_0$ ) and at the end of the aeration cycle ( $C_n$ ). The percent biodegradation is calculated from the following equation:

$$\% \text{ Primary Biodegradation} = (C_0 - C_n)/C_0 \times 100$$

#### b. River Die-Away (RDA) Procedure

The RDA test consists of exposing a low level (usually in the range 100 ppb to 1 ppm) of test chemical to the natural microorganisms in replicate river water samples. Changes in the level of test chemical

are monitored as a function of time by analyzing samples at selected intervals. The river water supply is obtained from either the Meramec or Mississippi Rivers. After settling for two days, the water is transferred to a five-gallon carboy and 250 ml portions withdrawn and added to 32-ounce Boston round bottles. For water-insoluble test chemicals, five  $\mu$ l portions of an acetone or ethanol solution of the test chemical are injected into each bottle. For water-soluble chemicals an aqueous stock solution is used. Each bottle is sealed with a foil-lined cap, mixed by swirling, and stored in the dark at ambient temperature. Sterile water controls are included to verify that a decrease in the initial level is due to biodegradation and not some physical or chemical phenomena. If the test chemical is sufficiently water-soluble and the analytical method of adequate sensitivity, aliquots of river water and sterile river water may be withdrawn from the same bottles at each sampling point. In other cases, the total contents of the bottle should be analyzed for test chemical. The duration of the test is generally 4 - 6 weeks. The result may be expressed as a half-life-days required for the initial level to decrease by 50 percent.

### 3. Ultimate Biodegradation

We define ultimate biodegradation as complete conversion of an organic material to carbon dioxide, water, inorganic salts and normal cellular products of bacteria. The rate and extent of CO<sub>2</sub> production by bacterial action is dependent on many variables. However, the extent of CO<sub>2</sub> production in a given time under constant conditions can be used as a measure of ultimate biodegradability of a material. Several test procedures have been developed for this purpose. Readily degradable materials such as dextrose and linear alkylbenzene sulfonate (LAS) typically yield 80-90% and 60-80% of theory, respectively, by these procedures. Since the bacterial systems used in these procedures are relatively weak, a material showing a high degree of conversion to CO<sub>2</sub> during the test interval is not likely to persist in the environment.

#### a. Thompson-Duthie-Sturm Procedure

In this procedure [J. Amer. Oil Chem. Soc. 50, 159 (1973); J. Water Poll. Control Fed. 40, 306 (1968)] a nine-liter bottle containing 50 ml of acclimated bacterial seed and 5,500 ml of standard BOD water is prepared for each test material and a control. Except for the control bottle, each bottle receives a weighed quantity (approximately 120 mg) of the appropriate test material. The bottles are connected to a source of CO<sub>2</sub>-free air and the effluent air passed through a set of aqueous barium hydroxide scrubbers. The evolved CO<sub>2</sub> is trapped as barium carbonate and quantitated by titration of the remaining barium hydroxide with 0.1 N HCl. CO<sub>2</sub> values obtained from the control are subtracted from those obtained for the test material. The CO<sub>2</sub> produced during an experiment (generally 28-35 days) is compared to the theoretical yield based on the carbon composition and weight of the material.

**b. Monsanto Shake Flask Procedure**

The shake flask system is similar to that described by Gledhill [Appl. Microbiol. 30, 922 (1975)]. In the shake flask procedure, 60 ml of acclimated bacterial seed is mixed with 440 ml of minimal salts media in fluted 2-liter Erlenmeyer flasks. A weighed quantity (approximately 15 mg) of the appropriate test material is added to each flask except for the control. After aerating the solution with 70% oxygen in nitrogen, an open reservoir containing 10 ml of 0.2 N barium hydroxide is suspended via a glass tube inserted in a rubber stopper. Provisions for removal and addition of the barium hydroxide solution, aeration and sampling are provided. After sealing, the flasks are agitated on a rotary shaker at 80 rpm in the dark at ambient temperature. Periodic removal e.g. (3, 7, 14, 21, 28, and 35 days) and titration of the barium hydroxide solution are used to determine the CO<sub>2</sub> evolved. Fresh barium hydroxide solution is added back at each sampling point. CO<sub>2</sub> evolution values obtained with the control are subtracted from values for test material.

**4. Analytical****Analyses for [REDACTED]**

[REDACTED] involved extraction with methylene chloride followed by concentration and gas chromatography using a Hewlett-Packard 5710A or 5730A chromatograph equipped with dual flame ionization detectors. Samples were injected directly into a 3 mm ID glass column. Column length and type together with temperature conditions are given in Table II.

Analyses for [REDACTED] involved direct injection of the aqueous solution into a liquid chromatograph. The chromatograph consisted of two Waters Models 6000A pumps and a Model 660 Solvent Programmer with a Schoeffel Model 770 variable wavelength UV detector. The column was a Waters  $\mu$ -Bondapak C<sub>18</sub>. Solvent system and detector wavelength are listed in Table II.

The t-butylamine was analyzed by gas chromatography using direct injection of the aqueous solution. The column and temperature conditions are given in Table II. In the initial SCAS work the acidified SCAS supernatant was concentrated by freeze-drying (Labconco Freeze Dry-3) prior to analysis. A measured volume (750-850 ml) of supernatant was acidified to pH 3 with hydrochloric acid and concentrated to about 10 ml. After transfer and washing of the freeze-dry flask, a final aqueous volume of 35-45 ml was obtained. The solution was made basic and analyzed on a Hewlett-Packard 5730A gas chromatograph with flame-ionization detectors. In subsequent testing, a Hewlett-Packard 5730A gas chromatograph with nitrogen-phosphorus (N-P) flame-ionization detector was used. With its greater sensitivity the need for a concentration step was eliminated. Essentially equivalent results were obtained by both methods.

## RESULTS AND DISCUSSION

Chemical stability experiments carried out on [REDACTED] are summarized in Table IV. These data show that both [REDACTED] have a half-life in aerated water of less than one day. The half-lives for [REDACTED] in the 1 - 7 day range. Only [REDACTED] appear to be reasonably stable in aerated water.

Because of the instability of [REDACTED] in aerated water no attempt to measure a SCAS primary biodegradation rate was attempted. SCAS units were operated on a 24-hour cycle for [REDACTED] and t-butylamine.

Experiments (Table III) in which activated sludge was exposed to known levels of [REDACTED] and various extractive procedures yielded very poor recoveries indicating either very strong adsorption or rapid modification of the parent molecule. Limited monitoring of the SCAS supernatant showed no detectable [REDACTED]. During the 22 week test at the 3 mg/l feed level no apparent inhibition of the normal sludge growth rate was observed. Somewhat similar results were found for [REDACTED]. Monitoring of the supernatant after feeding and at the end of the 24-hour cycle showed no detectable [REDACTED] indicating again either adsorption or rapid modification of the parent. Recovery experiments with activated sludge mixed liquor shown in Table III indicate that [REDACTED] is not strongly adsorbed. As with [REDACTED] no apparent inhibition of the normal sludge growth rate was observed during the 12 weeks of feeding at the 3 mg/l level.

SCAS testing for both [REDACTED] were carried out using a methylene chloride extraction procedure and gas chromatographic analyses. For [REDACTED] rapid primary biodegradation was observed in the 13-week test at the 3 mg/l feed level. No detectable [REDACTED] was found in the extracts taken at the end of the cycle indicating a 99+ percent primary biodegradation rate. Moderate inhibition of the normal sludge growth rate was apparent during the test. For [REDACTED] a mean biodegradation rate of 11 + 7% was obtained at the 3 mg/l feed level during a 13-week test indicating this material to be resistant to biodegradation. Slight inhibition of the normal sludge growth was observed during the test.

For t-butylamine, because of other job priorities and the need for analytical method development, sampling of the SCAS unit was not initiated until the 21st week of feeding. Sampling at the 3 mg/l feed level during the 21st to 27th week gave a mean degradation rate of 98+ %. A recovery experiment was also carried out with the acclimated sludge to verify that adsorption on the sludge was not a major disappearance route. Approximately 15 minutes after feeding of the 3 mg/l t-butylamine to the SCAS unit, aeration and stirring was stopped and the sludge settled. The SCAS supernatant was then analyzed. A 92% recovery was obtained showing that adsorption was not a significant factor.

The feed level was increased to 10 mg/l during the 28th week. During the 28th, 29th, and 30th weeks a mean degradation rate of 59% was observed. From the 31st to the 35th week when the test was terminated, 99+ % disappearance was observed. Scrubbing of the off-gases during several cycles at both the 3 mg/l

and 10 mg/l feed levels showed volatility losses of less than 2%. A river die-away test on t-butylamine at 0.1 and 1 mg/l concentrations again showed rapid primary biodegradation with half-lives of about 3 - 4 and 8 - 9 days respectively. These data are summarized in Table V.

Ultimate biodegradation CO<sub>2</sub> evolution measurements on the eight rubber chemicals are summarized in Table VI. Significant CO<sub>2</sub> evolutions (>25%) was observed only for [redacted] (76% after 49 days) and Santocure NS (64% after 32 days). For [redacted] an unusually long induction or acclimation period of 21 days was found before significant CO<sub>2</sub> evolution occurred.

Considering the rapid primary degradation of t-butylamine, [redacted] the failure to obtain significant CO<sub>2</sub> evolution suggests formation of more persistent metabolites or degradation products. For t-butylamine a likely degradation route would involve hydrolysis to t-butyl alcohol. For the others additional testing is needed to identify such products.

atio:  
wh  
ctly  
ture

us  
fel  
ii.  
in

ni:

Table I. Sample Identification

<u>Product</u>	<u>Lot Number</u>	<u>% C</u>
[REDACTED]	[REDACTED]	[REDACTED]
t-Butylamine	Eastman 6772, Lot HXH	65.64*
Santocure NS	MIC 270582	55.06
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]

\* Calculated, other values experimentally determined with Perkin-Elmer 240 Elemental Analyzer.

Table II. Analytical Methods

<u>Compound</u>	<u>Instrumental Parameters</u>
<u>GAS CHROMATOGRAPHY</u>	
[REDACTED]	2m Ultrabond, 220°C
[REDACTED]	2m Ultrabond, 210°C
[REDACTED]	2m 3% OV 101 on 100/120 Gas Chrom Q, 220°C
t-Butylamine	1m Carbowax B/4% Carbowax 20M/0.8% KOH, 2 min hold at 80°C then programmed to 1°C @ 16°C and hold at limit
[REDACTED]	2m 3% OV 101 on 100/120 Gas Chrom Q, 280°C
<u>REVERSE PHASE LIQUID CHROMATOGRAPHY</u>	
[REDACTED]	70% CH <sub>3</sub> CN/30% H <sub>2</sub> O, 395 nm
[REDACTED]	80% CH <sub>3</sub> CN/20% H <sub>2</sub> O, 250 nm

Table III. Analytical Recovery Data

Test Chemical	Matrix	Extraction Solvent and/or Treatment	% Recovered		
			Concentration mg/l		
			1	5	10
[REDACTED]	Water	CH <sub>2</sub> Cl <sub>2</sub>	96		
[REDACTED]	Water	CH <sub>2</sub> Cl <sub>2</sub>	100		
[REDACTED]	Water	CH <sub>2</sub> Cl <sub>2</sub>	100		
[REDACTED]	Activated Sludge Mixed Liquor	CH <sub>2</sub> Cl <sub>2</sub>	58	75	92
[REDACTED]	Water	CH <sub>2</sub> Cl <sub>2</sub>	80		
[REDACTED]	Activated Sludge Mixed Liquor	CH <sub>2</sub> Cl <sub>2</sub>	114	82	78
[REDACTED]	Activated Sludge Mixed Liquor	CH <sub>2</sub> Cl <sub>2</sub>	4	4	23
[REDACTED]	Activated Sludge Mixed Liquor	Hexane			<1
[REDACTED]	Activated Sludge Mixed Liquor	Basify/CH <sub>3</sub> CN Co-Solvent/ Centrifugation	8		
[REDACTED]	Activated Sludge Mixed Liquor	Centrifugation	28		
[REDACTED]	Activated Sludge	Centrifugation/ Decant water phase/Extract solid with CH <sub>3</sub> CN/ Centrifugation	10		
[REDACTED]	Activated Sludge Mixed Liquor	Centrifugation	57	76	81
			Concentration mg/l		
			0.3	1.5	3.0
t-Butylamine	Activated Sludge Supernatant	Acidify/ Freeze-Dry	104	93	86

Table V. t-Butylamine River Die-Away

Test Sample	Concentration in Mg/l					
	Days of Exposure					
	0	2	5	9	14	19
0.1 ppm Sterile	0.082	0.063	0.063	0.050	0.041	0.071
0.1 ppm Active	-	0.049	<0.005	<0.005	<0.005	<0.005
1 ppm Sterile	1.3	1.3	1.2	1.3	1.2	1.3
1 ppm Active	-	1.3	1.1	0.47	<0.005	<0.005

	<u>K, days<sup>-1</sup></u>	<u>t'<sub>1/2</sub>, days</u>
Hydrolysis (sterile)	0.0133 <u>0.0008</u> 0.0071	97.6
Biodegradation (Active)	0.612 <del>0.223</del> <u>0.363</u> 0.4875	1.42

~~0.3502 days<sup>-1</sup> = 0~~

Table 1  
Ultimate Biodegradability of Selected  
Rubber Chemicals as Determined by CO<sub>2</sub> Evolution

<u>Test Chemical</u>	<u>Test Chemical Concentration</u> mg/l	<u>CO<sub>2</sub> (% of Theory)</u>	<u>Test Duration</u> (Days)	<u>Method</u>
[REDACTED]	30.4	15.6	32	Shake Flask
[REDACTED]	30.0	8.1	32	Shake Flask
[REDACTED]	29.8	3.4	32	Shake Flask
[REDACTED]	30.0	0.0	32	Shake Flask
[REDACTED]	30.4	18.9	32	Shake Flask
[REDACTED]	29.8	6.0	32	Shake Flask
[REDACTED]	30.0	7.2	32	Shake Flask
[REDACTED]	30.4	1.0	32	Shake Flask
Santocure MS	29.4	63.5	32	Shake Flask
Santocure MS + 50 mg/l HgCl <sub>2</sub>	30.4	2.6	32	Shake Flask
[REDACTED]	24.6	18.7	35	Shake Flask
[REDACTED]	22.7	20.4		
[REDACTED]	23.6	0.0	35	Shake Flask
[REDACTED]	20.0	0.0	49	T-D-S
[REDACTED]	27.0	0.07	{ 21 35 }	Shake Flask
[REDACTED]		34.6		
[REDACTED]	26.9	20.67	{ 21 35 }	Shake Flask
[REDACTED]		42.3		

Table VI (Continued)

<u>Test Chemical</u>	<u>Test Chemical Concentration mg/l</u>	<u>CO<sub>2</sub> (% of Theory)</u>	<u>Test Duration (Days)</u>	<u>Method</u>
[REDACTED]	27.6	0.0	35	Shake Flask
[REDACTED]	20.1	0.0 } 75.6 }	{ 21 49 }	T-D-S
t-Butylamine	39.9	13.4	32	Shake Flask
t-Butylamine + 50 mg/l HgCl <sub>2</sub>	29.2	2.8	32	Shake Flask
t-Butylamine	18.4	3.3	35	T-D-S

CBS

CBS No. 95-73-0

## ENVIRONMENTAL PERSISTENCE SCREENING OF SELECTED RUBBER CHEMICALS

### INTRODUCTION

A chemical released into the environment may undergo chemical, biological, and photochemical degradation. To predict the environmental fate of a chemical requires basic data on the importance of these degradation processes. In this study, ultimate biodegradation and chemical degradation screening data were obtained for 2 rubber chemicals: cyclohexylamine (CHA) [redacted] Santocure® [redacted]

### SUMMARY AND CONCLUSIONS

Ultimate biodegradation screening using the Monsanto shake flask procedure showed carbon dioxide evolution in the 50-75 percent range for cyclohexylamine, [redacted] indicating that long-term persistence of the parent compound or metabolites is not likely to present a problem. No significant carbon dioxide evolution (<10%) was observed for [redacted] Santocure, [redacted] indicating either that the parent or intermediate degradation product may tend to persist. No significant chemical degradation of any of the rubber chemicals to carbon dioxide under sterile conditions was observed.

Contract studies are currently underway at Stanford Research Institute on these chemicals to obtain primary biodegradation, chemical degradation, and photodegradation rate data.

### EXPERIMENTAL

#### Material

The source of the specific rubber chemical samples along with the carbon content are tabulated in Table I. The carbon values were experimentally determined with the Perkin-Elmer 240 Elemental Analyzer.

#### Test Method

The ultimate degradation of the rubber chemicals to carbon dioxide was determined using the Monsanto shake flask procedure. This procedure is similar to that described in Draft Method No. 2 for the Proposed Standard for the Determination of the Ultimate Biodegradability of Organic Chemicals, August, 1979, ASTM Committee E35.24. In the procedure, 100 ml of acclimated bacterial inoculum are mixed with 900 ml of minimal salts media in a fluted 2-liter Erlenmeyer flask. After aerating the mixture with 70% oxygen in nitrogen, a weighed quantity (approximately 15-25 mg) of the appropriate test material is added to each flask except for the control. For sterile controls, 50-100 µg of HgCl<sub>2</sub> are also added. An open reservoir containing 10 ml of 0.15 N

barium hydroxide is suspended via a glass tube inserted in a Neoprene stopper. Provision for removal and addition of the barium hydroxide solution and for sampling of the aqueous media are provided. After sealing, the flasks are agitated on a rotary shaker in the dark at ambient temperature. Periodic removal, e.g., (3, 7, 14, 21, 28 and 35 days) and titration of the barium hydroxide solution are used to determine the CO<sub>2</sub> evolved. Fresh barium hydroxide solution is added back at each sampling point. CO<sub>2</sub> evolution values obtained with the control are subtracted from values for the test material.

### RESULTS AND DISCUSSION

Ultimate degradation CO<sub>2</sub> evolution measurements on the eight rubber chemicals are summarized in Table II. Three of the chemicals tested [redacted] showed significant ultimate biodegradation with carbon dioxide evolution in the 50. to 75 percent range. The remaining chemicals [redacted] Santocure, [redacted] showed no significant carbon dioxide evolution (<10 percent) indicating either that the parent or intermediate degradation product may tend to persist. None of the rubber chemicals showed any significant carbon dioxide evolution under sterile conditions indicating that strictly chemical degradation to carbon dioxide is not important.

Significant problems were encountered in the preacclimation of the bacterial inoculum. Both the standard inoculum evolved from a raw sewage, soil, and activated sludge mixture and inoculum utilizing supernatant from acclimated SCAS units resulted in excessive background organic carbon levels in some of the test media. The use of acclimated supernatant starved for a period of time (nine days) before compound addition yielded consistent results in those cases.

### REFERENCES

Notebook Pages 1650644-54, 77-83, 85-91, 93 and 1633302-07, 08-11, 45-48, 60.

TABLE I. SAMPLE IDENTIFICATION

<u>PRODUCT</u>	<u>LOT NUMBER</u>	<u>%C</u>
[REDACTED]	[REDACTED]	67.40
Cyclohexylamine	1264758, 5/10/79	67.86
[REDACTED]	[REDACTED]	73.66
[REDACTED]	[REDACTED]	50.78
Santocure	-NK11-014, 5/10/79	58.85
[REDACTED]	[REDACTED]	81.63
[REDACTED]	[REDACTED]	84.82
[REDACTED]	[REDACTED]	82.12

TABLE II. ULTIMATE DEGRADABILITY OF SELECTED RUBBER CHEMICALS AS DETERMINED FROM CO<sub>2</sub> EVOLUTION

<u>TEST CHEMICAL</u>	<u>TEST CHEMICAL CONCENTRATION, mg/l</u>	<u>CO<sub>2</sub> EVOLUTION (% OF THEORY)</u>	<u>INOCULUM SOURCE</u>
[REDACTED]	24	37	Acclimated SCAS Supernatant (starved)
[REDACTED]	25	58	
[REDACTED]	25	56	
[REDACTED]	Mean =	50	
[REDACTED]	23	0	"
[REDACTED]	26	5	Acclimated SCAS Supernatant (starved)
[REDACTED]	26	17	
[REDACTED]	25	3	
[REDACTED]	Mean =	8	
[REDACTED]	20	0	"
[REDACTED]	22	8	Acclimated SCAS Supernatant (starved)
[REDACTED]	23	14	
[REDACTED]	20	3	
[REDACTED]	Mean =	8	
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Cyclohexylamine	24	74	Acclimated SCAS Supernatant (starved)
	21	77	
	23	73	
	Mean =	75	
Cyclohexylamine + 100 mg/l HgCl <sub>2</sub>	30	3	Acclimated SCAS Supernatant
[REDACTED]	18	0	
[REDACTED]	17	5	
[REDACTED]	18	1	
[REDACTED]	Mean =	2	
[REDACTED]	30	1	Acclimated SCAS Supernatant
[REDACTED]	21	71	
[REDACTED]	20	68	
[REDACTED]	20	55	
[REDACTED]	Mean =	65	
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Santocure	30	0	Standard Inoculum from Raw Sewage, Soil, and Activated Sludge
	20	0	
	Mean =	0	
Santocure + 50 mg/l HgCl <sub>2</sub>	20	4	"
[REDACTED]	20	3	"
[REDACTED]	20	2	"