YOUNGER LABORATORIES
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Certificate of Analysis

THE TOXICITY OF THE THERMAL DECOMPOSITION PRODUCTS OF
'OS-95'

Study Conducted For
MONSANTO CHEMICAL COMPANY, ST. LOUIS, MISSOURI

COPY

INTRODUCTION

The experiment was designed to determine the effect upon laboratory rats when exposed to a fog of thermal decomposition products produced by dropping OS-95, Lot 7501-3679, a product of Monsanto Chemical Company, on a surface heated to a temperature of 1000° Fahrenheit. Various intensities of fog were generated for different groups of animals.

EXPERIMENTAL PROCEDURE

Half of a fifteen inch McDanel high temperature combustion tube (inside diameter seven-eighth's inch, non-porous vitreous material) was wound with special sixteen gauge nickel-chromium wire. The wire was attached to a variable transformer for controlling temperature. After being wrapped in asbestos paper, the tube was insulated with four inches of mineral wool and then surrounded with a container made of asbestos board.

The tube was clamped at an angle of approximately 70 degrees with several inches of the unwound end protruding from the container. A thermocouple was inserted to the center of the tube and the temperature measured by an indicating pyrometer.

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At the upper end of the container two openings were made; one large enough for a small funnel to be inserted. The liquid to be volatilized was dropped from a burette at a measured rate, through the funnel to the inner surface of the heated combustion tube. The tube was slanted to prevent the drops from falling through and at the same time allow them to spatter against the sides, making for rapid volatilization.

Curved, three-fourths inch copper tubing was attached to the other opening. The tubing rose to a height of two and one-half feet above the combustion chamber and then returned about the same distance to a one liter flask from which an opening led into a five gallon glass bottle connected to a metal inhalation chamber of seventy liters capacity.

Animals were placed in the chamber, the chamber sealed, and connected to a vacuum pump with rubber tubing. The fluid was dropped at a measured rate onto the inner surface of the combustion tube heated to 1000° F. Sufficient suction was supplied by the pump to pull the combustion products through the copper tubing into the liter flask and five gallon bottle and then into the exposure chamber. From here the fog was drawn into an air trap and a calcium chloride trap attached directly before the vacuum pump. No cooling bath was used for the fog; temperature reduction was achieved by passing the combustion products through the copper tube and the five gallon bottle before entering the chamber. It was desired to expose the animals as nearly as possible to the fog as generated. The liter flask removed some solid particles of combustion.

Supplemental air for the animals' oxygen requirements was supplied by an air compressor and introduced into the five gallon bottle for mixing with the combustion products before entry into the exposure chamber.

The flow of filtered and dried air was controlled by means of a calibrated rotameter.

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GROUP A: EXPOSURE TO MODERATE MIST (SIX HOURS TOTAL)

Eight mature male rats were exposed for one hour three days per week for two weeks to a moderate to moderately heavy concentration of OS-95 volatilized at 1000° F. The concentration of fog was sufficient to partially obscure the animals at a depth of six inches within the chamber. Those at the rear of the chamber (a depth of eighteen to twenty-four inches) were all but obscured.

The fate of the animals is shown in Table I.

GROUP B: EXPOSURE TO HEAVY CONCENTRATION OF MIST (FIFTEEN MINUTES TOTAL)

Eight mature male rats were exposed for fifteen minutes to a heavy concentration of OS-95 mist produced by volatilization at 1000° F. The concentration was as heavy as obtainable. The animals in the front of the chamber were nearly obscured. Those at a depth of six inches were completely obscured.

The data on the animals is shown in Table II.

GROUP C: EXPOSURE TO HEAVY CONCENTRATION OF MIST (ONE HOUR TOTAL)

Eight mature male rats were exposed for one hour to a heavy concentration of OS-95 mist produced by volatilization at 1000° F. The concentration was as heavy as obtainable. The animals in the front of the chamber were nearly obscured. Those at a depth of six inches were completely obscured.

The results are shown in Table III.

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T A B L E I

EXPOSURE TO 'OS-95' MIST (MODERATELY HEAVY CONCENTRATION)
ONE HOUR DAILY, THREE DAYS PER WEEK FOR TWO WEEKS (SIX HOURS TOTAL)

Average Temperature Inside Chamber	75.5° F.
Average Relative Humidity Inside Chamber	56.0 %
Volatilization Rate	6.0 Ml. / Hour (Equivalent To 8.4 Gm. / Hour)
Supplemental Air Supply	6.0 Liters / Minute

Animal Number	Starting Weight Gm.	Weight Change 1 Week After Last Exposure Gm.	Weight Change 2 Weeks After Last Exposure Gm.	Fate
1	215	- 5	0	Survived
2	230	- 15	- 10	Survived
3	220	- 10	- 5	Survived
4	235	+ 5	+ 10	Survived
5	225	0	0	Survived
6	210	- 10	0	Survived
7	240	0	+ 5	Survived
8	225	0	+ 10	Survived

DISCUSSION -

Two weeks after the last one hour exposure in the series of six, all animals were alive and practically normal in outward appearance and behavior. Breathing was quiet and regular with no nasal discharge. Six of the eight animals were either maintaining their starting weight or had gained slightly. Appetite of the remaining two animals had improved over that shown the first week following the last exposure.

Fog from OS-95 decomposed at 1000° F. caused considerable discomfort within a few minutes. Nasal discharge, salivation, moderate lacrimation, and rapid breathing followed by shallow breathing was observed. The animals were usually quite active for ten to fifteen minutes after which they became lethargic and changed position in the chamber less often.

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Some weakness was noted in the animals at the end of each one hour exposure but they were not in danger of collapse. However, they were less resistant to the fog during the second week and five of the eight developed sniffles. The inflammatory condition did not reach the stage of bronchial rales.

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T A B L E II

EXPOSURE TO 'OS-95' MIST (HEAVY CONCENTRATION)
FOR FIFTEEN MINUTES

Average Temperature Inside Chamber	76.5° F.
Average Relative Humidity Inside Chamber	53.5 %
Volatilization Rate	10.4 Ml. / Hour (Equivalent To 14.5 Gm. / Hour)
Supplemental Air Supply	3.5 Liters / Minute

Animal Number	Starting Weight Gm.	Weight Change After 2 Weeks Gm.	Observations During Exposure
1	225	+ 15	Spasmodic breathing pattern --
2	210	+ 5	Copious salivation and nasal discharge --
3	240	+ 10	
4	235	+ 15	Moderate lacrimation --
5	250	+ 10	
6	220	+ 25	Animals fairly steady, can be seen in front part of cage only.
7	225	+ 20	
8	235	+ 15	

DISCUSSION -

All animals survived the fifteen minutes exposure to a heavy concentration of OS-95 decomposition products. They were lethargic and weak when removed from the chamber but were not in immediate danger of collapse. Oral and nasal discharge had about ceased within an hour. Moderate inflammation of the nasal mucosa was evident for twenty-four to thirty-six hours.

The fog was as dense as could be generated and was sufficient to obscure the animals excepting when they were in the immediate front section of the chamber.

Weight gains ran from five to twenty-five grams two weeks after exposure.

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T A B L E III

EXPOSURE TO 'OS-95' MIST (HEAVY CONCENTRATION)
FOR ONE HOUR

Average Temperature Inside Chamber	78.0° F.
Average Relative Humidity Inside Chamber	52.0 %
Volatilization Rate	10.4 ML. / Hour (Equivalent To 14.5 Gm. / Hour)
Supplemental Air Supply	4.5 Liters / Minute

Animal Number	Starting Weight Gm.	Weight Change After 2 Weeks Gm.	Observations During Exposure
1	235	+ 10	Increasing lethargy —
2	210	+ 20	Almost no activity after twenty minutes —
3	240	+ 20	
4	215	+ 5	Breathing reduced, shallow and irregular —
5	225	+ 15	
6	205	+ 10	Several instances of gasping near end of exposure --
7	230	+ 5	
8	220	+ 15	Nasal and oral discharge — Lacrimation.

DISCUSSION -

The one hour exposure to a heavy concentration of fog resulted in collapse for three of the animals and near collapse for the remainder. There were no deaths however. Fairly rapid recovery was noted after removal from the chamber. The animals were moving about in fifteen to forty-five minutes although weak. Several days were required before activity and appetite returned to normal. Pulmonary congestion, insofar as could be determined by outward observation of breathing rate, had subsided materially in seven to ten days.

All animals showed weight gains two weeks after treatment and it appeared that they would continue to thrive.

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SUMMARY

GROUP A: EXPOSURE TO MODERATE MIST (SIX HOURS TOTAL)

All animals survived the schedule of six, one hour exposures spread over a period of two weeks. Copious nasal discharge, salivation, lethargy, and moderate weakness developed. The fog caused considerable inflammation and discomfort but the cumulative effect was not lethal.

GROUP B: EXPOSURE TO HEAVY CONCENTRATION OF MIST (FIFTEEN MINUTES TOTAL)

No deaths resulted from fifteen minutes exposure to a heavy concentration of fog. There was irritation but the animals were not in danger of collapse.

GROUP C: EXPOSURE TO HEAVY CONCENTRATION OF MIST (ONE HOUR TOTAL)

Collapse and near collapse developed in the latter stages of the one hour exposure. No deaths resulted. The animals were moving about in fifteen to forty-five minutes after exposure. Weakness was evident for several days.

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BY: FRED M. YOUNGER

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