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MELLON INSTITUTE OF INDUSTRIAL RESEARCH

UNIVERSITY OF PITTSBURGH

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PROGRESS REPORT for the month ended May 31, 1944

Curtide and Carbon Chemicals Corporation

Industrial Fellowship 274-7

Subjects under )  
which report is )  
to be indexed )

Phenol Removal.

CONTAINS NO CBI

S. B. C. C., I.F. #274-7

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Report 7-63 (R)

### Phenol Removal

Various special solutions have been used to remove phenol from the skin in accidents to prevent systemic injury from absorption. Our report for the month ended 8-31-43 presented experimental data bearing upon this. Further work has been done and our final conclusions are presented here.

Six commercial phenols were used, one plain phenol, the other mixtures of this with 40 to 50% of substituted phenols. The test animals were male albino rats slightly heavy for our oral doses; that is, weighing somewhat over 120 grams. Preliminary trials defined the dosage of each undiluted phenolic which would kill all or nearly all the rats upon whose clipped abdomen it was applied. This dosage was then applied and 60 seconds later was sponged off (rubbing toward the center) with a standard sized piece of absorbent cotton wet with 5 ml. of various solutions. The rats were then observed for two weeks to note survival.

A 60 second interval was selected as representing the least which could elapse in an accidental spill in a plant. When two successive treatments were applied 60 seconds also elapsed between them. Probably more rats could have been saved if sponging with various solutions had been prolonged but the standardized technique used was judged most likely to yield a reliable comparison of the treatments.

The treatments consisted of wiping all fluid off with dry cotton, wiping with 95% alcohol, wiping with 5% ferric chloride in 50% alcohol, wiping with a warm 0.5% solution of Ivory Soap flakes, wiping with the soap solution followed by 95% alcohol, wiping with a 1% "Tergitol" 7 solution followed by alcohol, and wiping with water.

All results are tabulated below in terms of the number of rats saved out of 10 upon which phenols were placed.

Table 7-77

Rats Saved Among 10 Dosed by Sponging with Various Solutions 60 Seconds after Skin Application of Phenols

Phenol Dose	Dosage in ml/kg.	Controls		95% Alcohol	Ferric Chloride Solution	Soap Solu- tion	Soap, then 95% Alcohol	"Tergitol" 7 then 95% Alcohol	Water
		Un- treated	Excess Wiped Off						
Phenol alone	1.0 1.58	0 -	- 0	10 9	8 7	- 1	- 3	- 1	9 5
Phenol + 4% p- tert. Butyl Phenol	1.0 2.52	2 -	- 0	10 2	10 3	- 4	- 2	- 2	10 3
Phenol + 4% p- tert. Butyl Phenol	1.0 2.52	6 -	- 0	10 3	10 1	- -	- -	- -	- -
Phenol + 50% o- Cresol	1.0 1.58 2.0 2.52	2 - - -	6 3 - 0	9 4 - -	- 6 - -	- 2 - 0	- 7 - 0	- 5 1 0	10 4 1 0
Phenol + 50% o- tert. Butyl Phenol	1.0 1.58 3.16	4 - -	- - 0	10 10 1	10 10 3	- - -	- - -	- - -	- - -
Phenol + 50% o- sec. Butyl Phenol	1.0 2.52 3.16	4 - -	- 5 0	10 4 3	10 2 2	- - -	- - -	- - -	- - -

The table reports upon at least two dosage levels of each material, the smaller one usually allowing some animals to survive without any treatment, and the large one killing most or all rats when unabsorbed phenol was blotted off with dry cotton in 60 seconds.

In all but one case, sponging with one of the test solutions saved rats which would have died if the excess phenol had simply been blotted off with dry cotton; but it must be remembered that resistance to phenol is not uniform among rats or

any other species, that consequent errors of random sampling eliminate the significance of small differences between numbers of rats saved. We do not consider the results significantly different unless the number saved by two treatments differs by two or more.

We must also consider that it is impractical to specify a different solution for each phenol mixture, so that the solution giving the best overall results should be chosen.

No solution was completely reliable when enough phenol mixture was applied to kill all or almost all untreated rats. Soap, or "Tergitol" 7 followed by alcohol, was as effective as water alone in only one of three cases. Alcohol, ferric chloride solution, and plain water were practically identical in results. Therefore, considering the ready availability of water we see no reason to provide any other solution for first aid use to prevent injury by phenol absorption.

While we were making these experiments Deichmann and Witherup published a paper on phenol toxicity in the J. Pharm. & Exper. Therap., vol. 80, 233-240, March 1944. They applied large dosages of aqueous solutions of phenol to rats and removed them in 15 to 30 minutes. They concluded:

"Soap and plenty of water is an effective agent for removing phenol from the skin; a 50 percent solution of alcohol in water is equally satisfactory if it is not applied over a large area of the body surface for a prolonged period (alcohol is absorbed by the skin and may augment the collapse induced by phenol.)"

Table 7-75 illustrates the need of speed in removing phenols from the skin. A relatively brief delay much reduced the number of rats we saved.

Table 7-75

Rats Saved among 10 Dosed by Sponging with  
95% Ethyl Alcohol at Various Intervals  
after Skin Application of Phenols

Phenol Mixture	Sponged with 95% Alcohol after		
	30 sec.	60 sec.	120 sec.
Phenol alone	-	10	7
Phenol + 40% p-tert. butyl phenol	-	10	8
Phenol + 50% o-Cresol	10	9	7

In conclusion we recommend that only water be used for first aid removal of spilled phenols from the skin to prevent fatal results from absorption. The need for haste in removing phenol must be stressed.

The substituted phenols studied were less toxic quantitatively by skin absorption than phenol alone but they were harder to remove from the skin.

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Henry F. Seyth, Jr. - mg

Henry F. Seyth, Jr.  
SENIOR INDUSTRIAL FELLOW

Charles M. Carpenter

Charles M. Carpenter  
INDUSTRIAL FELLOW

C. Boyd Shaffer

C. Boyd Shaffer  
INDUSTRIAL FELLOW

Walter L. Thompson

Walter L. Thompson  
INDUSTRIAL FELLOW

Typed: May 31, 1944

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