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D. M. DOTY
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ODOR CONTROL TECHNIQUES PROJECT COMPLETED

The comprehensive study on odor control techniques at IIT Research Institute has just been completed. You will recall that this project was supported in part by the Environmental Protection Agency and by special grants from meat industry trade associations. Progress on the study was reported in "The Director's Digest," No. 95, May 17, 1972.

To compare minimum probable costs for different systems for controlling odors, appropriate design calculations were used in a computer program. The data (Table 1) indicate that the cost to attain 99% reduction in odor level is lowest for a two stage horizontal spray tower scrubber with a two stage packed tower scrubber slightly higher. The treatment cost using incineration is competitive only at extremely high odor levels (more than 1000 ppm) or for achieving more than 99.9% reduction in odor level. Carbon bed adsorption, with incineration to destroy desorbed odorous compounds, may be the most economical technique for removing odors at low levels (10 ppm or less) from ventilation air.

Since a scrubber of some type would be the most economical technique for removing rendering odors, various scrubber solutions were used in a packed tower experimental scrubber to remove odorous compounds known to be present in rendering process emissions. The scrubber was designed to remove 90% of the odorous compounds assuming that mass transfer was the limiting parameter. More than twenty different scrubber solutions were tested in preliminary "bubbler" experiments to test their reactivity to the various odorous compounds. The more promising solutions were tested in the experimental scrubber.

The data from the scrubber tests (Table 2) show clearly that no one scrubber solution is effective against all odorants. The oxidizing solutions were the most effective against many of the odorants. Because of cost and convenience, sodium hypochlorite (or chlorine gas) would be the oxidant of choice. As expected sodium bisulfite was effective for aldehydes and hydrochloric acid removed amines. Sodium hydroxide was not generally effective but did remove butyric acid and butanedione.

Copies of the detailed highly technical final report (141 pages) covering the IITRI studies will be available soon. If you wish to obtain a copy please request it from the FPRF office.

It would appear from the data that at least a two stage scrubber would be required to remove all odorants from the rendering process emission stream. Plans are underway to test a two stage experimental scrubber in a rendering plant to confirm the results obtained in this study.

The work upon which this report is based was performed pursuant to Contract No. 68-02-0260 with the Environmental Protection Agency.

Table 1. Cost of Odor Control Treatment by Different Techniques

Technique	Flow CFM	Odor Reduction,%	Cost		
			Investment	Total Yearly*	$/1000 CFM/hr.
Two-Stage Spray Tower	25,000	99.9	$ 28,600	-	0.17
	150,000	99	126,300	-	0.13
Two-Stage Packed Tower	5,000	99	22,600	7,200	0.29
	25,000	99	67,400	24,800	0.19
	25,000	99.9	99,800	35,200	0.28
Incineration	5,000	99	24,500	22,500	0.90
	25,000	99	49,500	103,000	0.83
	25,000	99.9	57,600	106,500	0.85
Catalytic Incineration	5,000	99	27,100	23,600	0.94
	25,000	99	78,800	103,900	0.83
	25,000	99.9	95,500	114,200	0.91
Carbon Bed Adsorption**	100,000	99	123,000	55,000	0.11

*Based on 5000 hrs. operation per year

**Costs are estimates based on data for compounds other than actual odorants.

Table 2. The Removal (%) of Odorants by Various Scrubber Solutions

	Valer-aldehyde	Dipropyl Sulfide	Amyl Alcohol	Trimethyl-amine	Tertiary Butylamine	Hepta-diene	Dimethyl Disulfide
Water	30	0	80-90	80-90	≥ 90	0	10
Sodium Hypochlorite, 1%	10	≥ 90	80	≥ 90		20	50
Hydrogen Peroxide, 3%	≥ 90	0	75		≥ 90	0	slight
Potassium Permanganate, 3%	30	10-25	40-80	≥ 90		25	20-75
Sodium Bisulfite, 5%	≥ 90	10	75				
Hydrochloric Acid, 5%	0	0	80	≥ 90			
Sodium Hydroxide, 5%*	10-30	0	0-60	0	≥ 90		

*Sodium hydroxide also removed more than 90% butyric acid and more than 90% butanedione.