FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

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DISPATCH FROM DES MOINES: - PROGRESS IN ODOR CONTROL

Recent scrubbing tests with experimental packed towers have demonstrated that the intensity of rendering plant odors can be reduced by as much as 99% or more. These studies are being conducted by IIT Research Institute under contract with the Fats and Proteins Research Foundation, the support of the Environmental Protection Agency and the cooperation of National By-Products, Inc. of Des Moines, Iowa.

A three stage laboratory tower packed with ceramic saddles was installed in parallel with the horizontal spray scrubber of the rendering plant. Air ducts leading from four locations in the plant permitted scrubbing of the various odor streams and sampling before and after treatment. Air samples were collected in specially designed adsorbent sampling tubes for later analysis by gas chromatograph and mass spectrometer at the IITRI laboratories and in polyethylene containers for evaluation by an odor sensory panel using the IITRI-designed dynamic olfactometer.

Our earlier investigations on the nature of the constituents of the odors associated with the rendering process by gas chromatography revealed an extremely complex mixture of organic compounds including aldehydes, fatty acids, hydrocarbons, amines and sulfur compounds of which only a handful has so far been identified. Preliminary scrubbing experiments with prototype components of the rendering odors quickly showed that certain reagents such as alkalis were effective in scrubbing out fatty acid constituents, acidic solutions absorbed amines and that sulfur-containing compounds and olefins could be removed with oxidants such as sodium hypochlorite, hydrogen peroxide or potassium permanganate solutions. These experiments also demonstrated the effectiveness of the three stage sequence of dilute caustic-1% sodium hypochlorite, 1% caustic - 1% hydrogen peroxide, 1% sulfuric acid in the packed tower scrubbers. Numerous test runs were performed and

multiple samples were taken at each sampling point to compare the results of gas chromatographic analysis with those reported by the odor sensory panel. The data collected so far indicate that the instrumental method is not yet strictly comparable with the odor sensory method. This discrepancy can be attributed to incomplete adsorption and desorption in the samplers, unequal response of the constituents in peak integration on the gas chromatogram, differences in the human sensory response, and so forth.

At low odor intensities, such as that of plant air in Experiments 1-3 in Table I, some residual background odor was contributed by the polyethylene sampling containers and the true effectiveness of the scrubbing procedure can only be estimated. At high odor intensities, however, the background odor of the sampling containers becomes negligible and a high order of effectiveness is evident. In Experiment 4, for example, a concentrated air stream measuring 17,000 odor units which is normally fed directly to the incinerator was reduced to an intensity of 45 units in the laboratory packed tower scrubber, a reduction of over 99%. Experiment 6, in which an even more concentrated odor stream was treated, confirmed the effectiveness of the three reagent scrubbing system with a reduction in odor intensity of the same magnitude.

When the high intensity incinerator air stream was diluted with plant air to an intensity of 320 units and led through the plant scrubber using the same three reagent sequence (Experiment 5) the effluent odor intensity was lowered to 20 units, a reduction of 94%. Although this sequence of reagents was shown to be a highly active combination in both high and moderate intensity odor streams it suffers from some practical disadvantages. The acidic medium is corrosive to metals, three separate reagent reservoirs and circulating pumps are necessary and commercial concentrated hydrogen peroxide is both irritating and a fire hazard.

Experiment 7 was designed to test the effectiveness of a single oxidant solution composed of caustic and sodium hypochlorite in the three stages of the laboratory scrubber. In this trial the intensity of the incinerator air stream measuring 63,000 odor units fell by over 99% to 550 units. This encouraging result prompts us to next investigate the use of sodium hypochlorite-caustic in the plant scrubber on the incinerator air stream. Not only do we envision a very significant simplification in the reduction of rendering plant odors with this modification but it should also result in an appreciable saving of labor, chemical and fuel costs.

Table I

ODOR PANEL RESULTS

Test	Scrubber	Scrubbing Solutions			Air Source	Inlet ED_{50}	Outlet ED_{50}
		First stage	Second stage	Third stage			
1	Lab	Dilute caustic pH ~ 11	0.9% hypochlorite + 1% caustic	1% peroxide, 1% sulfuric	P	15	10
2	Plant	"	"	"	P	25	20
3	Plant	"	"	"	P	30	20
4	Lab	"	"	"	I	17,000	45
5	Plant	1% caustic	0.7% hypochlorite 1% caustic	"	P & I	320	20
6	Lab	"	"	"	I	34,000	460
7	Lab	0.7% hypochlorite 1% caustic	0.7% hypochlorite 1% caustic	0.9% hypochlorite 1% caustic	I	63,000	550

P = plant ventilation air
I = concentrated airstream normally going to odor incinerator
ED_{50} = dilution factor of odor stream perceptible by 50% of sensory panel