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A Method for Sampling and Analyzing Trona Dust



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A Method for Sampling and Analyzing Trona Dust

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At present, a gravimetric technique is used for evaluating the environmental atmosphere in trona mines. This technique, although highly efficient, requires long sampling periods. In order to obtain an estimate of the airborne dust concentration during individual mining operations, a short-term sampling procedure is desirable. Considering the different sampling and analytical methods available, it was decided to use the Bureau of Mines midget impinger with modification in analytical procedures.

TEST PROCEDURE

In the development of a suitable method for evaluating trona dust concentrations using the midget impinger, the solubility of the dust was the primary consideration. Trona dust is collected in distilled water, and the relative concentration is determined by titrating to an end point with 0.1 N hydrochloric acid using a suitable indicator. It would have been simpler to collect the dust in a standard acid medium directly; however, acid vapors or mists could be detrimental to the operation of the sampling pump.

The volume of acid required for neutralizing the carbonates in the trona is proportional to the mass of the carbonates. Bromcresol green mixed indicator was selected because its color change from green to pink is readily discernible at pH 5. When the color begins to change, the carbonates have been converted to carbon dioxide and water. Although the carbon dioxide should be removed from the solution by boiling before titrating to a final end point, this step can be omitted because it only affects the equivalent value by 1 to 2 percent of the true concentration.

Sampling was conducted in the laboratory wind tunnel shown in figure 1. The air velocity in the 9-inch-square, 12-foot-long tunnel was maintained at 100 feet per minute. Trona dust, through 200 mesh, was introduced into the tunnel by means of a Wright dust feeder.³ During the tests dust concentrations ranged from 6 to 16.5 mg/m³.

Midget impingers used in the study were calibrated to sample at 0.1 cubic foot per minute \pm 5 percent. Simultaneous dust concentration measurements were made by sampling with membrane filter assemblies to compare results obtained by gravimetric sampling with those obtained using the midget impinger. Air velocities entering both types of measuring devices were adjusted to insure isokinetic sampling.

Calibration curves were used to determine equivalent mass concentration of trona samples. The curves are prepared by determining the milliliters of 0.1 N hydrochloric acid required to neutralize known weights of trona. As the carbonate-bicarbonate content of trona can vary from mine to mine, curves are prepared for typical ores from each mine.

³Wright, B. M. A New Dust Feeding Mechanism. J. Sci. Instr., v. 27, 1950, p. 12.

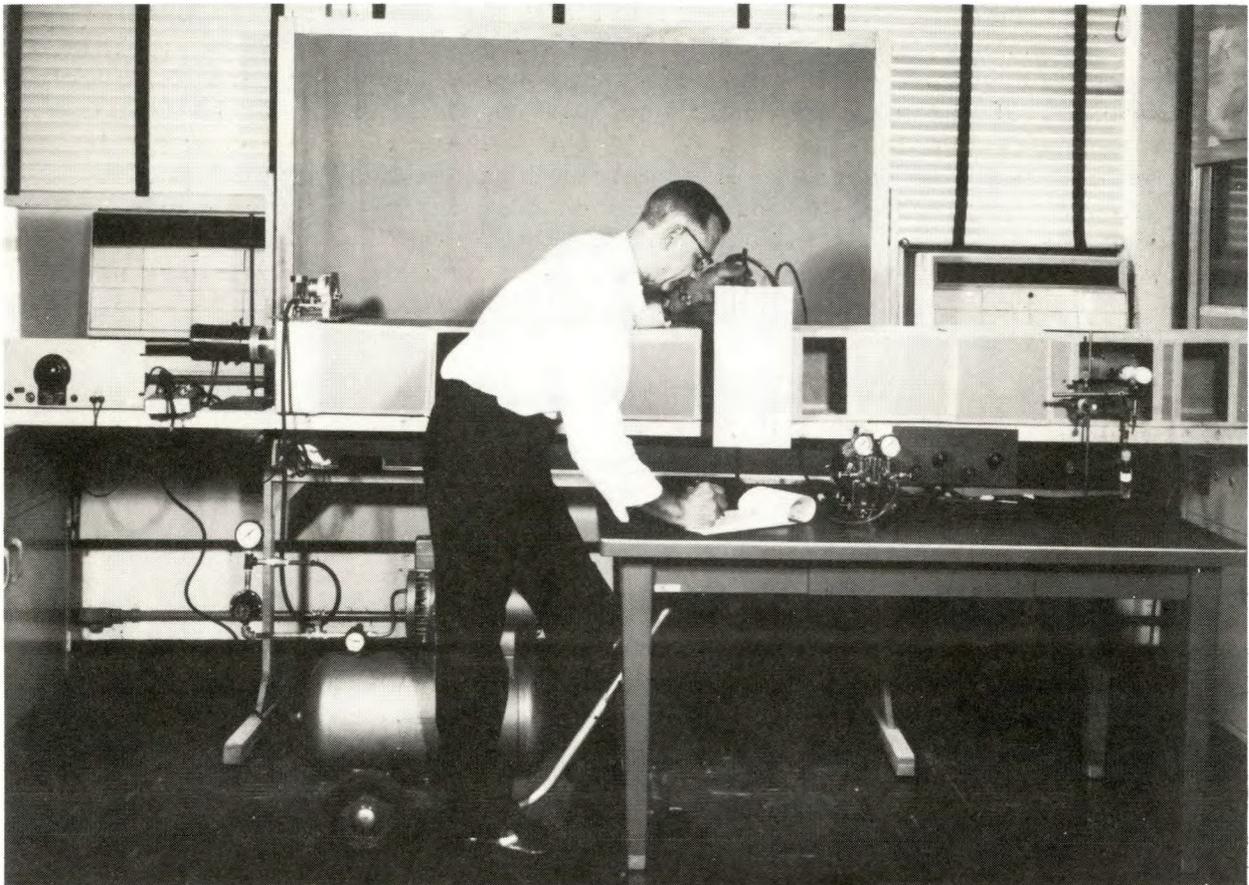


FIGURE 1. - Laboratory Wind Tunnel.

TEST RESULTS AND DISCUSSION

Test data, shown in table 1, indicate that the midget impinger sampling procedure produces equivalent mass concentrations that are the same as those obtained by gravimetric sampling. Results of a statistical analysis using the Student's test show that there is no significant difference between sets of data at a 95-percent confidence level.

TABLE 1. - Trona dust concentrations determined using two sampling methods

Test	x_1 , total dust concentration on membrane filter, mg/m^3	x_2 , equivalent dust concentration in midget impinger, mg/m^3
1.....	15.6	14.3
2.....	15.8	16.3
3.....	9.4	9.0
4.....	16.5	16.3
5.....	15.5	16.6
6.....	6.4	6.5
7.....	13.8	13.9
8.....	8.0	8.4

As the preceding shows, a quantitative method for evaluating underground trona dust concentrations by short-term sampling has been developed. This method does not permit differentiation between the carbonates and the insoluble component of the ore. To obtain a truer representation of the factors affecting the occupational health of all the workers in this industry, it would be necessary to develop a more detailed method of analysis, permitting environmental samples to be separated into their individual components, which could then be analyzed and evaluated according to their significance. It is hoped that through a sound monitoring program, trona dust levels will be controlled to prevent discomfort or unhealthful conditions for people employed in this industry.

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