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January 6, 1959

Air Flow Measurements in a Laboratory Fume Hood,
Fisher Scientific Co., Type 17-105

by

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Report to

Naval Security Agency
Washington, D. C.

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NATIONAL BUREAU OF STANDARDS



Report on

Air Flow Measurements in a Laboratory Fume Hood,
Fisher Scientific Co., Type 17-105

for

The Naval Security Agency
(Attn: Mr. George A. Smith)

1. Introduction

In accordance with the request of Mr. George A. Smith, Naval Security Agency, on December 3, 1958, air measurement tests were made on one of two identical laboratory hoods, Fisher Scientific Co., Type 17-105. These measurements were made on December 10, 1958, to ascertain the velocity through these fume hoods with the front window in open and closed positions and to also ascertain the flow through the hoods while operating them at a static pressure (outlet) of 1/4-in. water gauge, as specified by the manufacturer.

It was requested by the Naval Security Agency that a vane type anemometer be used for these measurements.

2. Description of the Test Specimen

The fume hood superstructure, inside dimensions 46 in. x 23 in. x 36 to 41 in., consisted of a steel frame with side and roof panels resting on a steel base and laboratory type top. A vertical baffle was situated 2 in. out from the rear wall, beginning 10 1/2 in. up from the table top and extending 23 1/2 in. upwards, at which height it met an overhead adjustable type baffle positioned at an angle of 45 degrees with the back wall and ceiling. There were adjustable dampers at both the upper and lower edges of this inclined baffle. The plenum thus formed by the vertical and inclined baffles was connected to the exhaust system by an adapter measuring 16 in. x 4 in. x 12 1/2 in.

A motor-blower utility set located on top of the hood and connected to the adapter through a 7-in. diameter duct provided the air circulation through the hood. The motor-blower assembly, as specified in American Blower Bulletin No. 8314, consisted of a 1/3 H.P., 1725 RPM, 50-60 cycles motor driving a blower rated by the manufacturer at 855 CFM at 1/4 in. S.P.

A movable window panel at the front of the cabinet provided access to the hood. The face dimensions of the window opening in an open position were 40 1/4 in. x 30 1/2 in.; in a "closed" position, 40 1/4 in. x 1/8 in. The attached side view sketch shows the arrangement and principal dimensions of the baffles inside the hood, and the front view sketch shows the dimensions of the window opening and the opening to which the exhaust blower was attached.

THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY
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1. Introduction

The present study is concerned with the reaction of hydrogen peroxide with various organic compounds. The reaction is of interest because of its role in biological systems and its application in analytical chemistry. The reaction is studied under various conditions of temperature and concentration. The results are discussed in terms of the mechanism of the reaction.

2. Experimental

The reaction was studied by measuring the rate of disappearance of hydrogen peroxide. The reaction was carried out in a series of experiments at different temperatures and concentrations. The rate of reaction was determined by measuring the amount of oxygen gas evolved over a period of time. The results are shown in Table I. The rate of reaction increases with increasing temperature and decreasing concentration of hydrogen peroxide.

The reaction is first order with respect to hydrogen peroxide and zero order with respect to the organic compound. The rate constant, k , is determined from the slope of the plot of $\ln[\text{H}_2\text{O}_2]_0/[\text{H}_2\text{O}_2]_t$ versus time. The values of k are given in Table II.

The activation energy, E_a , is determined from the Arrhenius plot of $\ln k$ versus $1/T$. The value of E_a is found to be 15.2 kJ/mol. This value is in good agreement with the value reported in the literature. The reaction is believed to proceed via a free radical mechanism.

3. Test Procedure

With the blower running continuously, and restricted at the outlet to produce a 1/4-in. S.P. on the discharge side, a 4-in. calibrated vane type anemometer was used to make four air-velocity traverses, as follows:

(1) In a vertical plane defined by the opening existing when the window was in a fully raised position. This was an area of 40 1/4 in. x 30 1/2 in.

(2) In a vertical plane defined by the opening existing when the window was raised 4 5/8 in. from the table top. (This was the smallest vertical dimension in which the vane type anemometer could be used.) The area of the traverse was 40 1/4 in. x 4 5/8 in.

(3) In a vertical plane 9 in. from the back wall and parallel to it; from the table top to 30 in. above the table top with the front window fully open. Traverse area was 46 in. x 30 in.

(4) In a vertical plane 9 in. from the back wall and parallel to it for a height of 7 in. from the table top. This afforded an area for traverse measuring 46 in. x 7 in. The front window was closed for this measurement.

Each traverse was made twice--once with the dampers open and a second time with the dampers closed. In addition to these, there were some measurements made with the front and then the back dampers of the inclined baffle open, in turn.

A traverse in the 46 in. x 10 1/2 in. opening under the vertical baffle could not be made because of the presence of fittings and a drain in this space.

4. Test Results

The traverse made with the access window open 4 5/8 in. showed an average velocity of 535 feet/minute in the opening corresponding to a total air flow rate of 690 cu ft/min. It would be safe to assume that the air flow rate with the window fully open would be equal to or greater than 690 cu ft/min. Thus, the equipment meets the minimum air flow requirement of 500 cu ft/min reported to be incorporated in the purchase specification.

When the access window was fully open the air flow would not turn the vane anemometer steadily in any part of the opening. Calibrations of the instrument at the National Bureau of Standards indicated that a velocity

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The first section of the document discusses the general principles of the proposed system, including the objectives and the scope of the project.

The second section details the organizational structure and the roles of the various departments involved in the implementation of the system.

The third section describes the technical specifications and the hardware requirements necessary for the system to function effectively.

The fourth section outlines the software development process, including the programming languages used and the testing procedures.

The fifth section discusses the training and education programs for the personnel who will be operating the system.

The sixth section provides a detailed financial analysis, including the estimated costs and the expected benefits of the system.

The seventh section concludes the document with a summary of the key findings and recommendations for the next steps.

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The eighth section discusses the legal and regulatory aspects of the system, including the data protection and privacy policies.

The ninth section provides a final overview of the project and the expected outcomes, along with the contact information for the project team.

