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AN AUTOMATED METHOD OF DETERMINING NITRIC OXIDE IN SMOKE

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Our goal was to develop an automated method of determining nitric oxide in smoke. The technique which we use provides a rapid puff by puff analysis of nitric oxide in smoke from 20 cigarettes. These are smoked under standard puffing conditions. The analysis is accomplished by coupling a cheriluminescent nitric oxide analyzer to a modified syringe smoking machine. The smoking machine was altered to purge itself with fresh air after each puff. This purging cycle dilutes the smoke which retards the NO decay. It also effectively eliminates problems resulting from the relatively large internal volume of the standard design.

Several methods of nitric oxide analysis have been reported in the literature: IR, UV, gas chromatography and chemiluminescence. Most of the more recent work is being done by chemiluminescene. We used a chemiluminescent analyzer made by the British-American Tobacco Company. This analyzer is currently marketed by Filtrona.

(SLIDE 1)

First, we examined our analyzer to establish its stability and to determine its accuracy. Analyzer stability was evaluated using four levels of nitric oxide in nitrogen (199.4, 388, 808, and 1196 ppm's). These samples were analyzed twice a day over a ten-day period. An analysis of detector response, (peak height x attenuation) versus nitric oxide concentration showed that no significant day to day variations or drifting occurred at any concentration. This is based on the column of "F" values shown in Slide 1.

The estimated variance was also calculated and is shown under the column listed, S^2. From these estimated variances, we can see that the higher the standard level (X), the less reliable the measurement of response (Y). As a result of this a weighted least squares approach was used to fit our data to the calibration line $Y = A + BX$. The fitted equation is shown in the next slide.

(SLIDE 2)

The standard errors of the estimates of A and B are respectively equal to .3065 and .001.

Nitric oxide is a reactive compound. The decay with time of nitric oxide in smoke as a result of reactions with oxygen or other smoke components has been well documented. It has also been demonstrated that dilution of smoke with air retards this decay. This result of dilution is consistent with the third order oxidation reaction of nitric oxide in air.

(SLIDE 3)

We used our detector to examine the decay of nitric oxide in whole smoke and in smoke diluted with an equal volume of air. The system we used is shown in this slide.