A COMPARISON BETWEEN SOILING INDEX AND TOTAL CARBON CONCENTRATIONS

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Carbon is an important constituent of the atmospheric aerosol. Both particulate and elemental carbon are emitted from the combustion of fossil fuels. These emissions may soil materials with which they come in to contact and reduce visibility if they remain in suspension.

In South Africa the concentration of smoke is measured by passing a known volume of air through a filter paper. The method was specifically designed to determine the concentrations of fine particles that have a darkening effect (Kemeny and Halliday, 1974). As such, it is reasonable to assume that the measurement's optical unit (Soiling Index) would be correlated with the carbon content of the aerosol. A small project has been initiated this year to establish if this is true.

EXPERIMENTAL

Four sites were selected in Pretoria at which sampling was to be conducted. At each of the four sites there is existing National Survey monitoring equipment operated by Pretoria City Council's Health Department. The sampling equipment has two identical sampling trains, consisting of pump, gas meter, filter chamber and funnel. The equipment used was calibrated and used in accordance with the recommended methods for measurement (Kemeny and Halliday, 1974). In one sampling unit a Whatman No. 42 filter paper was used, and in the other a Whatman QM–A Quarts microfibre filter. The filters were changed between 11h00 and 12h00 on Mondays to Fridays. The sampling unit was used at each of the four sampling sites for a period of a fortnight and then moved to the next location; this cycle was repeated twice (Table 1).

TABLE 1
Sample locations and dates

Location	Date (1985)		No. of samples
Church Street	3/6–17/6	29/7–12/8	20
Visagie Street	17/6– 1/7	12/8–26/8	16
Hamilton Street	1/7–15/7	26/8– 9/9	17
Capital Park	15/7–29/7	9/9–23/9	27

The Whatman No. 42 filter papers were measured by the use of a densitometer and the results expressed as Soiling Index (S/m^3). The Quartz microfibre filters were analysed by the Analytical Chemistry Division of the National Chemical Research Laboratory, CSIR. The carbon determination was made on a Carlo Erba Strumentazione at a temperature of 1045°C.

Duplicate analysis for carbon was undertaken for all samples initially and then on a random basis. The analysis of blank filters showed a carbon content of 42 (± 3,8) μg.

RESULTS AND DISCUSSION

The results are presented graphically for each individual site and for the complete data set (Figure 1). The Soiling Index (S/m^3) is plotted against total carbon ($\mu g/m^3$).

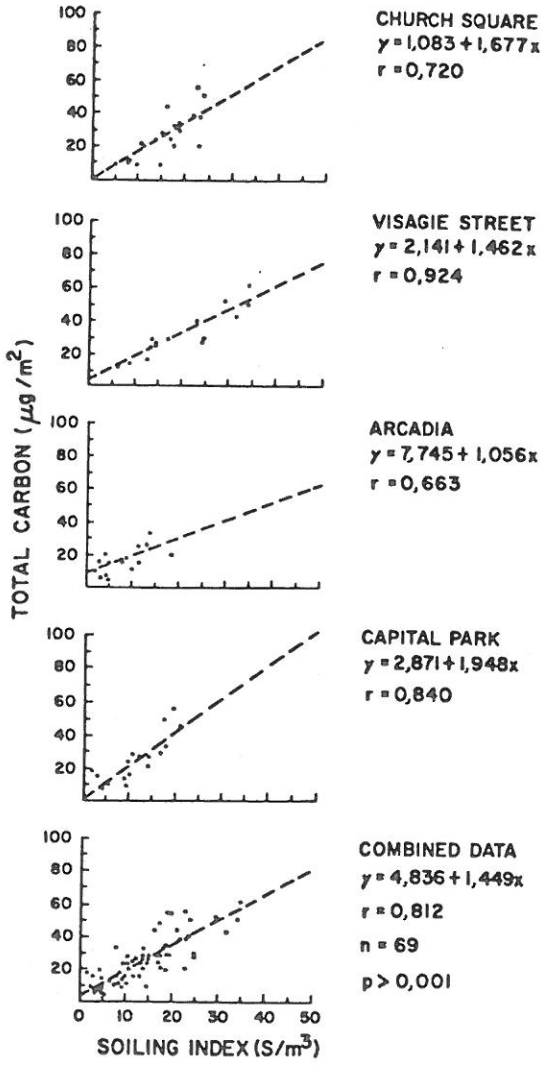

Figure 1. Correlation between Soiling Index and total carbon concentrations in Pretoria.

The results show that there is a strong relationship between the Soiling Index of smoke concentration and the total carbon concentrations in the aerosol. This supports the original concept behind the development of the standard sampling unit, in that the method measures the black particles and is normally not influenced by the light-coloured natural dust particles which are also collected on the filter.

The average concentration for total carbon obtained in Pretoria over the whole sampling period was 24,7 (± 13,9) $\mu g/m^3$. Pratsinis et al. (1984) gave two values of 15,8 and 28,0 $\mu g/m^3$ for total carbon in Los Angeles. Ohta and Okita (1984) found concentrations of between 5 and 18 $\mu g/m^3$ around the Tokyo Bay area. At present because of the many different measurement techniques in use for the determination of carbon, direct comparison between studies is not only difficult but can be misleading.

In the future, due to increased use of diesel automobiles, the increasing emission of elemental carbon should be of concern. For example, Pratsinis et al. (1984) concluded that between 27 and 44% of the incident light extinction can be attributed to the carbon containing component of the aerosol.

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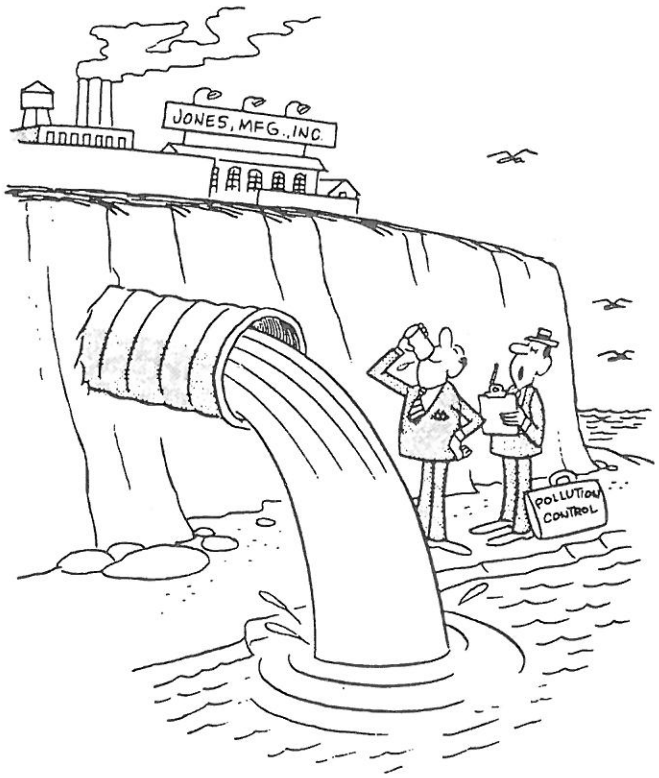

"But our department doesn't consider that a reliable test of your effluent's quality Mr Jones".