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Lead Contamination in Street Dust in Hong Kong

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In recent years increasing attention has been paid to lead contamination on the roadside ecosystem (SMITH 1976). Such contamination is generally attributed to the combustion of leaded gasoline and the consequent release of lead particles through automobile exhausts. As a result, elevations in the levels of lead in soil and roadside vegetation (CANNON and BOWLES 1962, PAGE and GANJE 1970, HAVRE and UNDERDAL 1976) and street dust (DAY et al. 1975, ARCHER and BARRATT 1976, DUGGAN and WILLIAMS 1977, FARMER and LYON 1977) have been detected. It has also been suggested that the amount of lead accumulation bears positive correlation to the motor vehicle density (PAGE and GANJE 1970). The very high motor vehicle density of 190 vehicles per kilometer of road in Hong Kong indicates its very likelihood of high level of lead contamination. The purpose of this study was to investigate and monitor the levels of lead in street dust in Hong Kong.

PROCEDURES

Sampling took place from November 1977 to January 1978. A total of 82 sampling sites were selected to cover a range of traffic volumes as well as an even district distribution in the Island of Hong Kong. The mean daily traffic volume ranged from a minimum of 110 to a maximum of 92840 vehicles (HONG KONG TRAFFIC AND TRANSPORT SURVEY DIVISION, 1977) amongst the sites. For convenience, sampling sites were geographically allocated out of each of the following seven districts: Western (A), Mid-level (B), Central (C), Wanchai (D), Happy-Valley (E), Eastern (F) and Southern (G). All the districts are mainly residential with the exception of district C which is predominantly commerical.

Dust samples were collected from road gutters with the help of plastic brushes and trays and transferred to acid-cleaned glass specimen bottles. Duplicate samples were taken from each site. All samples were dried at 105^{0}C for 12 hours and then passed through B.S. 20 mesh (750 μm aperture, stainless steel) sieve. A weighed subsample of approximately one gram from each sample was taken. Lead was extracted from the subsample by boiling in 10 cm^3 of 25% (v/v) nitric acid for 15 minutes, filtered and then made to 50 cm^3 with distilled water. The amount of lead in the filtrate

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was determined by the dithizone method (ALLEN 1974). The concentration of lead is expressed as $\mu g\ g^{-1}$ dry weight.

RESULTS AND DISCUSSION

Taking all the samples together, the arithmatic mean concentration of lead was 2974 ± 408 (± standard error of the mean) $\mu g\ g^{-1}$ dry weight. This value was the highest when compared with concentrations obtained in other cities in the last few years (refer to Table 1).

TABLE 1

Road-side dust lead concentration ($\mu g\ g^{-1}$ dry weight) in Hong Kong and four other cities.

Location	Lead Concentration		Authority
	Mean	Range	
Hong Kong	2974	271-19073	This study
Birmingham	1630	160-50000	ARCHER and BARRATT, 1976
Glasgow	960	150-8900	FARMER and LYON, 1977
London	1200	430-3500	DUGGAN and WILLIAMS, 1977
Manchester	970	90-10200	DAY, HART and ROBINSON, 1975

The range spanned was also considerable for Hong Kong samples, although Birmingham topped the list amongst the five cities. The traffic volumes of all the sites studied averaged 15308 vehicles per day in Hong Kong.

No significant correlation was detected between the traffic volume and the lead concentration when all the sites were taken together. Correlation coefficient between the two was found to be low ($r = 0.084$, $P>0.01$). Similar findings were reported by DAY et al. (1975). Table 2 demonstrates this non-correlation between traffic volume and lead concentration. Large differences, however, were detected in the mean levels of lead in the street dust amongst the 7 districts as shown in Table 3. But such differences bore no direct relationship to the traffic volumes of these districts. Differences in the mean lead levels were also detected, though to a lesser degree compared with this work, amongst the five urban areas in London by DUGGAN and WILLIAMS (1977).

TABLE 2

Road-side lead (μg g^{-1} dry weight) and traffic volume (vehicles day^{-1}) values on ten sampling sites with the highest and ten with the lowest amount of lead.

Sampling site	Lead concentration		Traffic volume	
	Mean	Range	Mean	Range
Highest 10	11046	5185-19073	15415	4860-30790
Lowest 10	603	271-802	12679	110-41100

TABLE 3

Lead (μg g^{-1} dry weight) and traffic volume (vehicles day^{-1}) data of the 7 districts in Hong Kong.

District	Lead concentration		Traffic volume	
	Mean	Range	Mean	Range
A	960	516-1542	7910	590-22160
B	7427	1570-19073	13466	1060-30790
C	1234	710-2258	11732	660-32280
D	2031	562-5142	33828	1180-92840
E	3596	788-13691	17213	360-54950
F	1102	271-1987	14939	110-47500
G	2278	458-8487	6027	810-18330

SUMMARY

Lead levels were generally found to be high in road-side dust samples collected from different sites throughout the Island of Hong Kong during winter 1977-78. Considerable differences in the concentration of lead amongst these sites were detected but such differences bore no direct relationship to the traffic volumes of the sites from which the samples were collected. Different districts within the city varied widely in the mean concentration of lead in their road-side dust samples.

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REFERENCES

ALLEN, S. E.: Chemical analysis of ecological materials. 1 ed. Oxford: Blackwell Scientific Publications 1974.

ARCHER, A., and R. S. BARRATT: Sci. Total Environ. 6, 275 (1976).

CANNON, H. L. and J. M. BOWLES: Science 137, 765 (1962).

DAY, J. P., M. HART, and M. S. ROBINSON: Nature 253, 343 (1975).

DUGGAN, M. J., and S. WILLIAMS: Sci. Total Environ. 7, 91 (1977).

FARMER, J. G., and T. D. B. LYON: Sci. Total Environ. 8, 89 (1977).

HAVRE, G. N., and B. UNDERDAL: Acta. Agric. Scand. 26, 18 (1976).

PAGE, A. L., and T. J. GANJE: Environ. Sci. Technol. 4, 140 (1970).

SMITH, W. H.: J. Air Poll. Control Assoc. 26, 753 (1976).

TRAFFIC AND TRANSPORT SURVEY DIVISION: The annual traffic census 1976. Hong Kong: Hong Kong Government Public Works Department 1977.