CHAPTER 6
DISCUSSION, CONCLUSION AND RECOMMENDATION

6.1 Discussion

In normal practice, mass concentration of particulate matter in air is measured in weight (gram) per volume (m3) of air collected. It should be noted that the average mass concentrations of TSP and PM-10 given in tables 5.1 and 5.2 do not reflect their real concentrations in air, but only their relative concentrations at different sampling places if the same type of filter is used. In this work, both TSP and PM-10 matters are collected on the Whatman No.41cellulose filter for which the particle size of about 25 μm can be retained most efficiently. For this reason, the relative concentration of PM-10 collected on Whatman No.41cellulose filter may be higher than that of TSP (table 5.2). Morever, clogging of the cellulose filters may be another reason for concentration of PM-10 being higher than TSP.

The errors (σ_C) of concentration are computed by program **"error"** (given in appendix B), results of which were accompanied with determined values of concentration in tables 5.5 to 5.10. It could be seen that the values of relative error (determined as $\delta = \sigma_C\ 100\% / C$) are about 0.5 to 1.5 % for major elements and about 1 to 10 % for the minor trace elements. This means that the counting statistics in the measured line-intensities are quite good. As we know the counting statistics is one of principal bases to assess accuracy in determining concentration of element.

In appendix A are the calibration curves prepared for elemental constituents determined in TSP and PM-10. The curves showed good linearity between incremental concentrations added and corresponding count rates, hence, the addition method can be satisfactorily used to analyze air particulate matter.

As mentioned above, in order to correct for the sample matrix effects induced by adding the grade solution, the peak-to-background ratio was used. The experimental results showed that for the medium and heavy elements such as Zn and Pb (table 5.6), and for the light elements with high concentrations such as Al, Si and S (tables 5.5 and 5.7), the effect of the matrix variations can cause the errors about 2 to 4 % in concentration. For other elements, the errors caused by the effect of the matrix variations are much less than the statistical error and may be ignored.

The experimental results showed that the major elements such as Al, Si, Ca, S, Mg and Fe and most of trace elements such as Mn, Zn, Cu and Ti were detected. These elements are originated from soil and the results are consistent with other researches (4,8,10).

It could be seen that the Pb concentration in ambient air of Plant A is rather high (table 5.6). Pb is a toxic pollutant. However, this is only the average concentration of Pb in air particulate collected during the 3 days (29^{th}-November to 1^{st} December/1998) of sampling. If further understanding is needed, TSP and PM-10 samples should be taken more at this place and carefully analyzed.

6.2 Conclusion and Recommendation

From the analytical results of concentrations of elements in particulate it could be concluded that:

1. Most of elements determined are the major constituents in soil.
2. Air particulate can be characterized into a group of major elements such as Al, Si, Na, K, Ca, S, Mg and Fe, and a group of minor and trace elements such as Pb, Br, Mn, Zn, Ni, Ti and Cu.
3. The comparison between elemental constituents for TSP and PM-10 showed that, for the group of major elements such as Al, Si, Ca, Mg, K, Na, Fe and S, the average concentrations in TSP are about 6.6, 5.4, 5.43, 3.03, 5.31, 2.84, 5.07 and 2.54 times, respectively, greater than in PM-10.
4. For the minor and trace elements such as Mn and Ti, the concentrations in TSP are larger by factors of 2.29 and 9.4, respectively, than in PM-10. In practice, this is in good agreement.
5. The characterization of particulate may be useful for the study of source –receptor relationships as well as for the effects on human health, as we know PM-10 may easily infiltrate into the lung by breathing.
6. It may be expected that the above ratios between average concentrations of element for both types of dust, i.e. TSP and PM-10, will be nearly constant. It allows to determine elemental constituents in PM-10 in case of only TSP is collected and analyzed.

It should be noted that at the same sampling place, concentration of elements may be changed day by day. This variation in concentration can be due to environmental impacts caused by generation and transport of air particulate as well as

weather factors such as wind speed, temperature, humidity, rain, etc. The repeated analyses showed that in the same filter, change in concentration of element is negligible, this means that sample collection procedure is quite satisfied.

As a methodology, it could be concluded that the X-ray Fluorescence Technique could be used for analyzing particulate as a reliable convenient and economical way. In this work, all elements in particulate were determined using WDX-ray Spectrometer. In practice, the EDX-ray Spectrometer which is faster and cheaper analytical instrument could be used to determine concentration of major elements in particulate and to see preliminarily traces of other elements which may be required for further analyses. Besides, the XRF method has advantage of being non-destructive and needs no sample preparation. The analyses could be repeated if needed.

In air particulate are contained also natural radioactive isotopes such as Uranium, Thorium, Cesium (^{137}Cs), ^{40}K , etc with very low concentrations. Most of them are heavy elements, in this case direct γ-spectral method is proved to be more effective in analyzing the trace concentrations of these elements.

In conclusion it should be emphasized that the environmental pollution is a global problem including urban smog, acid rain, global warming, depletion of the ozone layer, chemical poisons, radioactive pollution , etc. The environmental pollution is caused by emissions from industrial activities, transportation and services, etc. The determination of pollutants in air particulate is an important part in the global environmental problem, especially in developing countries. They found many evidences linking air pollutants to the causation of various diseases. By controlling the emissions and by dispensing pollutants, concentrations of pollutants could be reduced. However, increasing population and energy demands have ensured that air pollution remains one of the most important environmental challenges. Therefore, there are two big problems that can be set as: (1) studies on the nature, generation and transport of air particulate pollution, (2) studies on the relationship between sources and control of air pollution, accompanied with which are four broad areas of interest in air pollution: (1) the effects of pollutants on health and welfare, (2) the laws and regulations that must be passed in efforts to improve air quality, (3) the modeling of atmosphere dis-

persing of pollutants, (4) the approaches to the control of emissions from both stationary and mobile sources.