CHAPTER 6
CONCLUSIONS

Estimation of air quality using lichens in the city center of Lampang involved 21 lichen species, with 15 species being crustose lichens and 6 species being foliose lichens. The lichen species, which were mostly found in the urban area, were *Rinodina* sp., *Lecanora* spp., *Hyperphyscia adgultinata*, *Pyxine cocoes* and *Chrysothrix xanthina*. The presence of *Hyperphyscia adgultinata*, which prefer high pH and nutrient rich substrate, was related to the higher bark pH in the urban area. The high dusts concentrations from transportation or construction and the eutrophication could be the cause of reduced the bark acidity, which results in high pH of bark.

The lichen diversity mapping using the guideline by Asta *et al.* (2002) provided the general picture of air pollution pattern within the study area. However, this method lacks a local evaluation scale. Therefore further work on crating an evaluation scale for this mapping method for tropical zones is necessary. The lichen diversity values (LDVs) were calculated based on the frequency of lichens present on mango trees. Based on the LDVs from the investigation, eight air quality classes were classified. The obtained lichen diversity classes were related to the type of land use, population density and NO_2 level in ambient air. The high air pollution was found in the city center area where the development was dense, and the population density was high. The air quality was slightly better in the outer zone of city where there was more open area and low population density. The correlation test between concentration of NO_2 and SO_2 in each sampling unit measured by the passive sampling technique and the LDVs, which were obtained from lichen frequency occurring on the investigated trees, was carried out. The results from Pearson's correlation showed significant correlation ($r^{**} = -0.614$, $p < 0.01$) between NO_2 and LDVs, while there was no significant correlation between LDV and SO_2 ($r = -0.119$, $p < 0.01$).

Passive sampling technique provides a cost effective method to measure air pollutants over a large-scale area. A significant correlation between the results from passive sampling and the results from chemiluminescence monitor was reported. This technique was then used to measure concentrations of NO_2 and SO_2 in the study area.

A polyethylene diffusion tube with Whatman filter paper no.1 coated with 20% TEA was used as the absorbent. The results from the one-way analysis of variance (ANOVA) with LSD showed that the mean SO_2 concentration of each air quality class was not significantly different ($F^{NS} = 1.599$, $p < 0.05$). However, the test showed a significant difference in mean NO_2 concentration between air quality classes ($F^{*} = 5.455$, $p < 0.05$).

The concentration of NO_2 and SO_2 obtained by the passive sampling technique during the two weeks period of exposure was compared with the average concentration obtained by the co-located active monitoring station. The 11.56% of underestimation of average NO_2 concentrations were found from passive sampling compared to active sampling, while the results of average SO_2 concentration from passive sampling was overestimated compared to active sampling. The underestimation error could be eliminated by using a non-transparent diffusion or a foil wrapped tube to prevent the occurrence of photo degradation of the NO_2-TEA in the tube. However

In summary, the results from lichens mapping allows us to see the general picture of air pollution in Lampang city. It can be concluded that most of the study area was characteristic of moderate air pollution and one of the major factors influencing the lichen diversity value in the study is NO_2. The increased in bark pH is associated with an increase in nutrient tolerant species, *Hyperphyscia adgultinata.* However, further work in measure pH of bark surface with more accurately is required. The results provide the understanding effects of air pollution in the seasonal tropics.