CHAPTER 4

CONCLUSION

Test kit for determination of sulfur dioxide (SO_2), which is one of important pollutants of air quality index, by using air passive sampling technique and easy chemical analysis is produced. Due to analysis of sample collected by passive sampler need to be done by instrument base in laboratory, therefore concept of test kit invention is brought in order to skip those complexitys of analysis. US EPA method for SO_2 determination is a colorimetric procedure based on a modified version of the pararosaniline method originally developed by West and Gaeke in 1956 (US EPA, 1982) by measuring the absorbance of solution at wavelength of 550 nm. The method was modified and adapted in this work for SO_2 determination after sampling by diffusion passive tube.

The optimal composition of the reagent for constructing a sulfur dioxide test kit is 1 ml of standard sulfite in tetrachloromercurate solution or sample, added with 100 µl of 0.6%sulfamic acid, 300 µl of 0.2% formaldehyde solution and 500 µl of pararosaniline solution, respectively. After mixing, the solution was let stand for 10 min prior to measurement with spectrophotometer at 550 nm. In addition, interferences such as HCl, NH_3, NO_2 and O_3, which normally exists in ambient air had completely not affected to the analysis of SO_2. Under the optimum conditions, a linear calibration graph was obtained in the range of 0.002–1.2 mg/l. The detection limit (LOD) and the limit of quantification (LOQ) were 0.002 and 0.006 mg/l, respectively. The percent relative standard deviation (%RSD) of repeatability and reproducibility of the method obtained form 10 replicates of 0.1 mg/l sulfite were 1.24% and 3.95% respectively.

The passive sampling of air was found to be good alternative conventional, manual method for determination of SO_2 in ambient air. In this work SO_2 were collected by passive sampling technique and then determined by spectrophotometry under the optimized condition. This work focused on the development of passive sampler to achieve the appropriate device by testing the efficiency of materials including type and size of diffusion tube, filtration process and sampling time. The accuracy of the method was compared with Pollution Control Department (PCD) air quality monitoring station expressed as the percentage difference. It was found that the PP diffusion tube (93 mm length and 14.8 mm i.d.) provided high precision of SO_2 concentration detected among another tube types being tested. Sampling duration was also tested and found that 3 days exposure was appropriate for measurement of SO_2 in ambient air by the designed diffusion passive tube.

In this research, a test kit for determination of SO_2 in air was constructed. This kit approach is useful for rapid screening, especially for the analysis of pollutants outdoors. Additionally, it is easy for general use due to concept of color comparison base. Shades of color varied wi th sulfite concentration in a solution with finally reversed into SO_2 concentration in air. The test kit consisted of diffusion passive tubes, 4 types of chemical reagents and a standard color chart. The color chart represents SO_2 concentrations in air in a range of 0.006-1.2 mg/l equivalent to 0.2-32.2 ppbv (based on calculation using 3 days exposure). The color can be divided into 6 categories belong to the solutions with different sulfite concentrations (SO_3^{2-}), which are 0.006

mg/l (magenta), 0.1 mg/l (deep magenta), 0.2 mg/l (pale purple), 0.4 mg/l (purple), 0.8 mg/l (deep purple) and 1.2 mg/l (violet). The color has a deep shade of violet when the sulfite concentration level is higher than 1.2 mg/l.

The SO_2-kit are agreeable to the fluorescence technique of the Pollution Control Department (PCD) air quality monitoring station at Yupparaj Wittayalai School, Chiang Mai, which proves that the test kit is reliable to be used for determining the sulfur dioxide at low level in air sample. The stability of test kit reagents were studied by measurement the absorbance of the color developed. The kit reagent could be kept and used within 3 months. The aim for survey questionnaires was reliability in estimation of SO_2 content. Analysis of questionnaires has overall yielded encouraging facts 62%.

Recommendations for further works

The Objectives of this research is to construct the SO_2 test kit in ambient air using passive sampling technique. However, a further refinement of this test kit is still needed to be fully practical and it will for sure contribute to the development of reasonable technology by the Thais. Despite its relatively long history, passive sampling is still developing. However, there is also some limitation that may sometime be difficult to overcome, probably the most important of which is the possible effect of environmental conditions (such as temperature, air movement, and humidity) on the analyte uptake. The passive sampling device, which has been developed in this work, has some limitations that should be improved such as capacity of the sampler, which affects to sampling period. In this work the sampler can not be used for long term sampling according to the absorbent capacity was limited. To increase the sampler capacity, larger size and absorbent must be used. However, it also depends on concentration of sulfur dioxide in the sampling air. Lower concentration of outdoor sulfur dioxide will result in long time of steady state. Even though the self-constructed SO_2 test kit has been tested with the fluorescent technique. However, it should also be compared with a commercial test kit in different ambient SO_2 levels such as community and industrial areas to confirm its capacity and limitation.

Recommendation on methodology is to reduce steps and complexity of chemicals. Use of CDTA for preparation of Na_2CDTA in the section 2.3.8 should be replaced by EDTA because it is cheaper and formula structure substances are alike (see Appendix D).