Using of *Tillandsia usneoides* L. as biomonitor for dust from gas separation factory

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Abstract:
Tillandsia usneoides L. plant was used as biomonitor. The morphology of the particulates diameter less than 10 μm namely PM 10 retained on the surface of plant was studied by using Scaning Electron Microscope (SEM). This study was taken place around the area of gas separation factory in Songkhla, Thailand. The analysis had also investigated the size of dust during February to April 2014 which is summer and during May to July 2015 which is raining season by collecting data once a month and twice a month. The quantity result of PM 10 would be compared to the quantity of PM 10 on filter paper and also to the result from monitoring by the process of *Environmental Impact Assessment* (*EIA)* of gas separation factory. The result of the first month or May 2014 showed that the mean amount of dust smaller than 10 μm on plant is 4.942% related to all paticulates on the *T. usneoides* L.

Keywords: *Tillandsia usneoides* L.*; Biomonitor; PM 10*

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1. Introduction

With the increase of anthropogenic activities the emission of air pollutants has substantially increased, affecting humans, animals and plants directly and indirectly because they are incorporated into water bodies, soil and food crops. Traffic and industrial activities in emerging economies deteriorate the air quality in wide areas where no pollution measurements are available at all. This is one important factor that contributes to the lack of strategies to preserve public health. These pollutants are often contaminated with dust. These particles can be separated into coarse fraction (PM 10, diameters between 2.5 and 10μm), fine fraction (PM 2.5, diameters between 0.1 and 2.5 μm), and ultrafine fraction (PM 0.1, diameter less than 0.1μm) (Fernandez et al. 2000). Most of the mortality/morbidity caused by atmospheric pollution in urban areas is caused by PM with aerodynamic diameters less than 10 μm, known as the inhalable fraction (MacNee and Donaldson, 2000) Fig. 1.

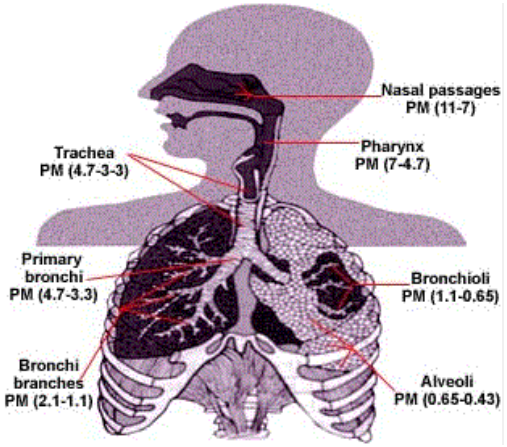

Fig. 1 health effects from dust processing.
(our health our help. 12/th/2012. smoke.magnexium.com)

The main air pollution problems occur in urban and industrial centers, but can also be observed at remote sites due to agricultural activities, mining and long-distance transport of contaminants.

These activities cause dusts.

The gas separation plant in the south of Thailand plays the important role in supplying natural gas to the demand of natural gas power plant in Jana district. To meet the demand, the operation of the gas separation produces also certain emission. The dust namely PM10 or lower size should be monitored carefully (Vianna, 2010).

[a]

[b]

[c]

Fig. 2 Physical picture of *T. usneoides* L..
([a] khunchet . http://topicstock.pantip.com/home/topicstock/2009/05/R7857407/R7857407.html**.,** [b] Jeff Johnson. Nov 2009. http://www.rv-orchidworks.com/orchidtalk/jungle/19434-spanish-moss-tillandsia-usneoides-blooming.html., [c] http://ssairplants.com/T_usneoides/index.html.)

The air quality, especially the dust monitoring, can be done preliminarily by using plant *T. usneoides* L. as biomonitor under the concept of passive sampler. Easily grown without soil of this air plant is the benefit for air quality monitoring because there would be no bias from fertilizer used in the soil (Husk, 1999).

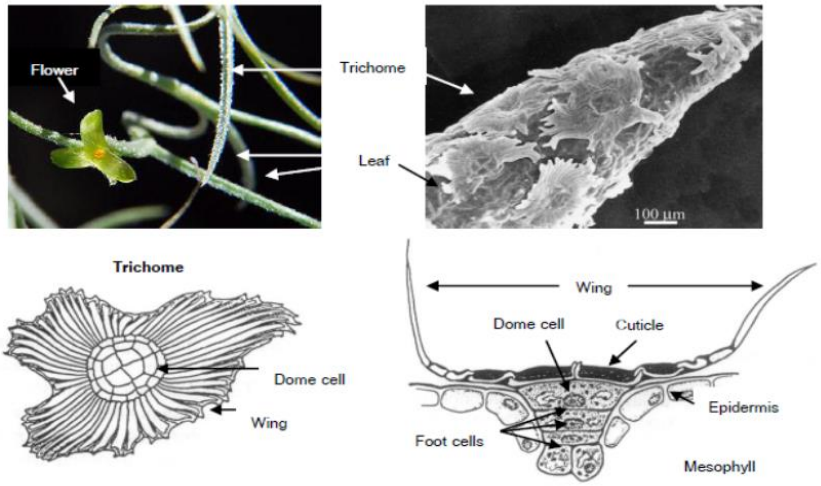

Fig. 3 structure picture of *T. usneoides* L..
(Brett and Craig, 2010 and Brighigna *et al*., 1997)

T. usneoides L. (see morphology in Fig. 1) is monocotyledon, Bromeliaceae, and epiphyte plants. The roots stretching to the perch with their habitats. The leaves are reduced to scales leaf with white trichome covered or dome cell coated on the top with a layer of cutin to reduce the dehydration. The wing of dome cell can absorb water and nutrients in the air for passive transportation and endocytosis (Brighigna, L.). The green surface of this kind of plant is actually covered by the small scale of trichome which can trap the dust (Papini et al., 2010; Haslam et al., 2003).

The measurements of air pollution is expensive because it requires advanced tools. Thus the measurement of air pollution by using plants as biomonitor to assess air pollution is an interesting alternative solution. Using plant can reduce the cost of sensing whereas the green space is increased. The objective of this research is the study of *T. usneoides*L. using as biomonitor for PM 10. The results of this research will be particularly useful to guide the measurement of other air pollutants. The low cost of using bio-monitoring compared to the using of high technology is its advantages.

2. Material and method

Study using *T. usneoides* L. as biomonitor of dust quantity particular point of time in keeping dust.

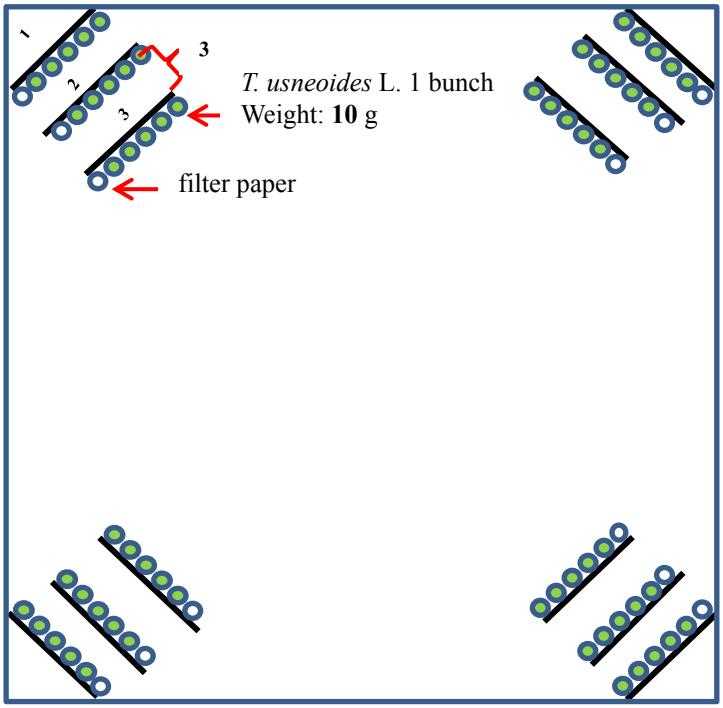

Fig. 4 layout of the samples (*T. usneoides* L.) in gas separation plants.

3. Physical and morphological analysis.

Physical and morphological analysis by using Scaning Electron Microscope (SEM).

3.1 Analyzing the quantity and size of dust

3.1.1 Preparation process

T. usneoides L. wash with clean water (Deionized water)

3.1.2 Transplant procedure

Put the *T. usneoides* L. on the rack at four corners around the gas separation plant. Each corner has three sets (1 min between of each set) to be used for the three composite sample in order to avoid

the variance of dust on the plant. The study period is 4-months for each season (February to April 2014 and May to July 2015). The sample will be used for 3 plans.

Plan 1: To compare between two seasons

Plan 2: To compare between the result of one month, two months, and four months accumulation

Plan 3: To compare the result with the result on the filter paper.

3.1.3Experimental procedure

The sample plant was washed with water (DI) 250 ml. The washed water is therefore tested by LS particle size analyzer. For filter paper, the dust was also washed from filter paper and dry for weighing of the dust.

4. Results and discussion

4.1 Physical and morphological Analysis

The result had not been yet shown as it is in process.

4.2 Result volume Analysis of TSP

For the first month of testing in raining season, June 2014, the result showed that the amount of PM10 compared to TSP in *T. usneoides* L. at the north, east, south, and west side of the gas separation plant equaled to the 5.286, 2, 3.487, 4.402, and 6.590 respectively. The comparison as plan cannot be done as it is only the first month of the monitoring.

5. Conclusion

The regulation by the pollution control department in Thailand for PM10 in the air is the active standard (High Volume, Quartz Fiber Filter, 8 × 10 inches), not more 0.12 mg/m^3 within 24 hours or not to exceed 0.05 mg/m^3, for one year whereas this research is passive air sampler. The benefit of result of the research then could be the relative quantity compared between seasons, between from plant and filter paper, and between different accumulative months.

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