

## The study of the heavy metal adsorption to absorption ratio in the Spanish moss (*Tillandsia usneoides* L.) around gas separation factory

Kiattipan Wansoh<sup>1</sup>, Natthaya C. van Beem<sup>2</sup>, Kua-anan Techato<sup>1,\*</sup>

<sup>1</sup>Faculty of Environmental Management, Prince of Songkla University, Hatyai Songkhla, Thailand

<sup>2</sup>Faculty of Science, Thaksin University, Paphayom Phatthalung, Thailand

### Abstract:

Currently, the airborne heavy metal pollution is the worldwide problem. Some kinds of plants are capable to trap heavy metal in the environment. Spanish moss (*Tillandsia usneoides* L.) is chosen to this research not only to be the passive sampler for heavy metal in the air but also measurement of the quantitative ratio of the Mercury's adsorption to absorption. *T. usneoides* L. is capable to be used as the environmental biomonitor. It will be divided into 4 sets placed at the four corners of the Gas Separation Plant, Songkhla for 6 months (May to October, 2014). Every month, sample sites will be analyzed by the Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES), cold vapor Atomic Absorption Spectrometry (AAS) and Scanning Electron Microscopy (SEM) techniques. The results showed that there was  $4.30 \pm 0.05$  mg of Pb per kg of plant whereas the other heavy metals i.e. Cd, and Hg were not found.

**Keywords:** *Tillandsia usneoides* L., Adsorption, Absorption, Heavy metal, Pb lead

\*Corresponding author. Tel.: +66-74-286843, Fax: +66-74-429758

E-mail address: kuaanan.t@psu.ac.th

### 1. Introduction

Air pollution is the problems that can impacts the life and health of humans. The major sources of air pollution mainly come from the combustion of transportation by vehicles and industrial emissions. In Thailand, the industrial sectors are regulated regarding toxic gases and dust including heavy metals by the Pollution Control Department (PCD) of Thailand. They need to monitor air pollution by using complicate and expensive tools or equipment to know the status of air pollution. Biological methods as a way to help address air pollution. It has been developed by using plants to trap and absorb heavy metals.

The plants used in this study were Spanish moss (*Tillandsia usneoides* L. - air plant and the member of the Bromeliaceae family Fig.1). It has characteristics of chains. It does not need the soil for growth. The leaves are light and have trichome covering the entire tree (Papini et al., 2010, Haslam et al., 2003). The Spanish moss has been characteristics similar to White fur which helps absorb vapor, gas and nutrients in the air. The morphology of Spanish Mosses is drought resistant, less water required and photosynthesis as Crassulacean Acid Metabolism (CAM). It is therefore adapt well to the green hot weather as the characteristic of xerophyte. The stoma opens during the night time and closes during the day time to reduce loss of water (Andrzej et al., 2009). This plant is suitable for absorbing heavy metals such as cadmium, copper, vanadium, manganese, iron, cobalt, and nickel (Brighigna et al., 1997).

This research studies the using of plants to trap the heavy metal air pollution. From reviewing, the air plant named Spanish moss is capable to be used for the monitoring of mercury in the air (Lodenus, 2013, Wannaz et al., 2012). The Trichome or small scale leaves on the surface of the plant can adsorb or absorb the moisture and nutrients from the air including the particle of heavy metal in the dust (Martínez-Carrillo et al., 2010).

The natural gas separation factory in Songkhla is one of the good sites for this studying. As in natural gas normally contain some heavy metal like mercury. This is why the process must be equipped with the mercury treating unit to filter it out. The factory is however prefer to do the double check around the area of the factory again. Because of this, researchers study of the passive

sampler for the determination of heavy metals in the air and the ratios of total mercury by adsorption on the Spanish moss and the absorption part in its tissue.



**Fig. 1** Spanish Mosses (*Tillandsia usneoides L.*).

## 2. Methodology

This research was to study the bearded hermit species existing in Thailand. For example, in testing for heavy metals in the air. The sampling and laboratory analysis to account for the absorption and bioavailability of mercury. Conducted for a period of six months and given a trial in the Trans Thai - Malaysia (Thailand) Limited, Chana District, Songkhla Province.

2.1 The Spanish moss 80 cm length is hung on of the steel frames 100 cm width at four corners of the gas separation by placing the north, south, east and west of the Trans Thai - Malaysia (Thailand) Limited, Songkhla. Fig. 2 Sample set of Spanish moss around at 4 sites of the Trans Thai - Malaysia (Thailand): (S1) north, (S2) east, (S3) south and (S4) west.



**Fig. 2** Sample set of Spanish moss around at 4 sites of the Trans Thai - Malaysia (Thailand): (S1) north, (S2) east, (S3) south and (S4) west.

2.2 The sampling and analysis of mercury adsorption to absorption ratio had done every month for the period of 6 months (June 2014 - October 2014). The area is around the Trans Thai - Malaysia (Thailand) Limited, Songkhla.

2.3 The analysis will check the amount of lead, cadmium, mercury in Spanish moss by cleaning the sampled with water and find the heavy metal in both from water and in the washed plant in order to calculate the ratio.

### 3. Results and discussion

The results of the analysis of Hg, Cd and Pb (in mg/kg) for the first month in June 2014 showed that there is only Pb  $4.30 \pm 0.05$  mg/kg.

### 4. Conclusion

For the first month of testing, the result shows that there is some Lead in Spanish moss. The trace back to the raw material or the process of the gas separation as the source of Lead may not from the factory. For the further study, the second month testing might be done to ensure the result.

### 5. Acknowledgement

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