CHAPTER 1

Introduction

Water is the essential natural resource for human society. Actually, most of industries from agriculture, electric power and beverage, apparel and tourism rely on it to develop and eventually sustain their business (Oki and Kanae, 2006; Morrison *et al*., 2009). With the rapid growth of socio-economic development, water is becoming scarcer globally and its' trend is increasing each year (Oki and Kanae, 2006). Thus, the issue of water conflicts occur caused which physical water scarcity problem. It is majorly caused by insufficient water management such as decreasing availability and declining quality but growing demand (Oki and Kanae, 2006; Aldaya *et al*., 2010). Therefore, the water topic should be more focused on research.

In 2004, the US Food and Drug Administration reported that the rice cadmium contamination was clarified in Mae Sot District, Tak Province (Simmons *et al*., 2005). Thai government has prohibited rice cultivation and introduced other crops which are excluded from the food chain. In 2006, the Mae Sot Clean Energy Company as the ethanol production factory was established in this contaminated area. The factory tried to support the sugarcane cultivation farmers and buy it for ethanol production. However, the sugarcane cultivation requires a lot of water (Scholten, 2009). The promotion of ethanol use will inevitably affect the water usage in agriculture and industries, particularly in such an agricultural country as Thailand. In 2008, the Ministry of energy of Thailand presented the 15-year Renewable Energy Development Plan (REDP 2008-2022), which aims to increase renewable energy consumption to 20% of the country's total energy consumption by 2022. In 2011, the REDP was subsequently replaced by the 10-Year Alternative Energy Development Plan (AEDP 2012-2021). The AEDP aims to increase the target of Renewable Energy to 25% of final energy consumption within 10 years. According to these plans that promote bioenergy, the sugarcane production is more required (to increase yields of sugarcane by 15tons/rai/year in 2021) (DEDE, 2012). Actually, the capacity of sugarcane fields to

produce sugarcane in Mae Sot is about 11-12 tons/year, but until now sustainable water usage has not been reported in this area. Because of the uncertainty of the agricultural state, the study about how to use water sustainably in this area is necessary. Therefore, the study should be performed for planning the sustainable water usage (Kongboon and Sampattagul, 2012). At the present, the water usage situation can be shown by water footprint (WF) as indicator of freshwater usage by sugarcane cultivation (Scholten, 2009; Hoekstra *et al*., 2011). WF can be considered to be the opportunity of organizing a sustainable management. WF concept has been studied in many countries. However, in most cases, secondary data has been used for calculating WF. The local character of water-used product as primary data can give clearer and more accurate WF value for better understanding and the real situation (Chapagain and Orr, 2009). Therefore, this study aims to calculate WF by using local data and to make clearer the water usage situation. Moreover, the situation of pollution by heavy metals in Cd contaminated areas will be clarified. The outcome of this study was expected to benefit for sustainable water usage and capacity of heavy metals uptake.

Objectives:

1. To investigate the water footprint of sugarcane cultivation for producing bio-ethanol

2. To investigate the heavy metals uptake by sugarcane from soil in different Cd contaminated areas