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論 文 要 旨
THESIS SUMMARY

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要旨（英文 800 語程度）
Thesis Summary (approx.800 English Words)

Around 1977, zinc mining activities of 3 companies were started after the Department of Mineral Resources Ministry of Industry classified this area as the richest source of zinc minerals in Thailand. There are many mining activities that may influence the cadmium contamination throughout the environment, for instance, drilling, material transfer and removal of mine tailings and drainage. There are many sources of cadmium pollution in environment, mainly found in fuel combustion, industrial sludge, phosphate fertilizer and mine tailings. Cadmium is a heavy toxic metal which causes environmental problems and can be accumulated in human body by the food chain and also causes damage to the ecosystem. Previous studies have found high concentrations of cadmium in the rice field, rice grain which may contain up to 284 mg/kg on a dry material base and contamination in water, sediment, fish and shellfish in an average of 50.84 mg/L. People that live in this area have high levels of cadmium in their urine and have experienced kidney and bone damages problems. The World Health Organization (WHO) recommends the permissible cadmium concentration of 0.01 mg/L in potable water. There are varieties of water treatment for cadmium contaminated water such as filtration, reverse osmosis, flocculation, activated carbon, chemical precipitation or coagulation, ultrafiltration and electrochemical method. However the aforementioned techniques are not economically feasible for small or medium industries and rural area or developing countries. Recently, the ion-exchange and adsorption process are the most common and effective process for removal of hazardous substances at very low concentrations usage of agricultural waste products or bio-sorption are becoming the new alternative for waste water treatment and suitable for small or medium industries and rural area or developing countries as well.

Rice husk is the most important agriculture residues in quantity in Thailand. Rice husk can be used as fuel for steam boiler to generate hot steam in power plants, and then the ashes were remained in a huge amount each year. For the utilization of this ash is used in the concrete related application and/or insulator in steel industries, while the remainder is disposed of in landfills or lagoon which is results in a hazardous impact on the environment, pollution soils and groundwater. In other cases if the remaining ashes from burned husks are not collected and treated properly, they can cause air pollution that affect the environment as well due to their small particle size and light weight. As above reasons, much research work has been undertaken to develop new techniques of ash utilization. The rice husk ash (RHA) is mainly composed of high silica content and some alumina content typically used in zeolite synthesis, such as coal fly ash, oil shale ash and bagasse fly ash.

Zeolites are crystalline microporous aluminosilicates with very well-defined structures that consist of framework formed by tetrahedra of SiO_4 and AlO_4. The isomorphous substitution of Al^{3+} for Si^{4+} in the tetrahedra results in a negative charge on the zeolite framework that can be balanced by exchangeable cations. Hence, zeolites can exchange cations but not anions. Zeolites show special importance in water and gas purification, catalysts for hydrogenation, alkylation and isomerization, and sorbents for the removal of contaminants such as heavy metals, toxic gases, dyes and organic

pollutants. There is much research work on production of zeolites using coal fly ash as a resource constitutes one important issue of waste management. However, there are few researchers on production of zeolite using silicon content from rice husk ash as a resource. Moreover, Na-A and Na-X zeolites are within the group of lindes (LTA) and faujasites (FAU), respectively, and are considered to be low-silica zeolites (Si/Al < 5). They are obtained from starting mixtures differing essentially in the Si/Al ratio which is higher for Na-X than for Na-A in the temperature ranges from 20 to 120℃, preferred temperatures around 90℃, as is the case with this study.

The use of zeolites as adsorbent for cadmium removal from aqueous solutions was investigated by many researchers over the last decades due to the ion exchange properties and their hydrophilic affinities as well as high surface area. Until now there is still research on the removal of cadmium by zeolitic materials are ongoing. In a recent paper, Shawabkeh and his team used oil shale ash formed of zeolite synthesized to uptake cadmium in wastewater. In other papers dealing with the removal of cadmium in water, Purna et al., found that the commercial zeolite 4A and 13X can adsorb cadmium from aqueous solution. The results show that the removal of cadmium at pH 6 was 9.891 mg/g with zeolite 4A and 9.441 mg/g with zeolite 13X. However, rice husk ash used to synthesize several kinds of zeolite such as ZSM-11, beta, NaY, ZSM- 5, NaA, NaX still have low adsorption capacity. In this study, the adsorption capacities of synthesized zeolite from rice husk ash would be investigated with simple method to find a suitable way to remove cadmium contamination in rural region such as Northwestern of Thailand.