CHAPTER 4

CONCLUSIONS

In the present study, isothermal analysis was used to evaluate and characterize aflatoxin B_1 adsorption of different adsorbents including the commercial toxin binder, the commercial bentonite, activated carbon, the commercial zeolite, synthetic Na-X zeolite, and synthetic sodalite zeolite. The isothermal adsorption of aflatoxin B_1 on different adsorbents could be determined using the linearized Langmuir model and linearized Freundlich model. These models are generally used to characterize the adsorption behavior and estimate values of adsorption capacity and affinity constants of each adsorbent. The results showed that the adsorption behavior of aflatoxin B_1 could not be applicable to the linearized Langmuir model, which suggested a monolayer of molecular of aflatoxin B_1 adsorbed on these adsorbents. The experimental data were better fitted to the linearized Freundlich model with the higher correlation coefficients. This implied that adsorption behaviours of aflatoxin B_1 on these adsorbents were multilayer/multiple site adsorption on heterogeneous surfaces. According to the results of adsorption capacity and affinity constants, the commercial toxin binder had the greatest, followed by the commercial bentonite, activated carbon, the commercial zeolite, synthetic Na-X zeolite, and synthetic sodalite zeolite, respectively.

As, the adsorption data were transferred to 2D Table Curve program and fitted with the generalized Langmuir model, generalized Freundlich model and modified

Freundlich model. The isotherm equations were entered as user-defined function to evaluate the estimated maximum capacity, the distribution coefficient, and the heterogeneity factor, respectively. For most adsorbents, the generalized Freundlich model showed excellent fitting results, as demonstrated by the higher correlation coefficient. As compared with linearized models, the most data should apply to generalized Freundlich model. In this study, the commercial toxin binder provided the highest ability to adsorb aflatoxin B_1 from aqueous solution when compared with other commercial adsorbents, which had the largest the estimated maximum capacity, the distribution coefficient, and the heterogeneity factor for aflatoxin B_1 adsorption. The commercial toxin binder is clay-based mineral consisting of montmorillonite as a major constituent. It has the properties of adsorbing organic substances either on its external surfaces or within it interlaminar spaces by the interaction with or substitution for the exchange cations presented in these spaces [3, 62]. Therefore, the commercial toxin binder was highly effective for adsorption of aflatoxin B_1. For synthetic zeolites, both Na-X and sodalite, had slightly different adsorption ability on aflatoxin B_1. However, they had relatively low adsorption ability than other adsorbents studied. From the study of temperature effect, it revealed that adsorption mechanism was preferred at lower temperature which corresponding to exothermic adsorption behavior. Overall, the adsorption efficiency highly depends on structural characteristics of both adsorbate and adsorbent.

Based on the results of current study, adsorption method is useful for *in vitro* testing of adsorbent materials, screening substances for their ability to adsorb mycotoxins. However, the *in vitro* results do not always predict the success or failure of materials *in vivo*. Thus, it need to test *in vivo* to confirm their efficacy and safety in aflatoxin-sensitive animals, and their potential for interactions with nutrients in diet [8, 23, 35-36].

THE RELEVANCE OF THE RESEARCH WORK TO THAILAND

Aflatoxins contamination in animal feedstuffs is a serious problem. They contamination in livestock feeds often results in poor growth and feed conversion efficiency, increased mortality rates, and a greater susceptibility to diseases. Aflatoxins have been associated with various diseases, such as aflatoxicosis, in livestock, domestic animals, and humans throughout Thailand and the world. Consequently, to reduce the economic lost and health risks from aflatoxin contamination, one of encouraging approaches is the addition of adsorbent materials to feedstuffs that can bind and reduce mycotoxins, which several adsorbents have high affinity for removal of mycotoxins. The attempts to find the efficient adsorbents for the adsorption mycotoxins were carried out. In this research, the commercial adsorbents and synthetic zeolites were used as adsorbents. The commercial adsorbents had high effective to adsorb aflatoxin B_1; however, these adsorbents had high price. Therefore, the efforts to use synthetic zeolites, which produced from fly ash, to adsorb mycotoxins instead of the commercial adsorbents because fly ash was low price. The efficiency of each adsorbent was investigated through adsorption isotherm. This *in vitro* method is a simple, rapid and useful method for screening adsorbent and for predicting efficacy before evaluating their efficacy *in vivo*.