CHAPTER 5

CONCLUSIONS

The production and the study of physical properties of planting materials from BA, FGD gypsum, PS and sawdust as raw materials showed that BA could be used as nutrient adsorbent. PS has both high plasticity and high CEC. Sawdust consists of long fibers and has highly irregular shapes. After firing, sawdust will change to be ash leading to high porosity with long pores that allow water and fertilizer solutions pass through the material. Many elements in BA, FGD gypsum and PS such as Ca, Fe, Mg, K, P, Mn, S, Ba, Cu and Zn are essential for plants. Due to these properties, BA and FGD gypsum residues from Mae Moh power plants combined with PS and sawdust as raw materials could be used as raw materials for FPM. It is found that a mixture of solid wastes (BA, FGD gypsum, PS and sawdust) at a ratio of 22:7:45:26 and fired at 850 ^{o}C for 30 minutes (at a rate of 3 ^{o}C/minute), gives the best planting material. It contains nutrient components such as P, K, Ca, Mg, Fe, Mn and Ba which are plant essential nutrients. The amounts of P, K, Mg and Mn are comparable to amounts found in HDB. This material did not slake when soaked 30 days under water. It provided good water absorption, a slightly acidic pH value, and low density. The CEC value of this planting material was 8.9 meq/100g. which is higher than that of HDB. Advantages and disadvantages of the best planting material and hydroball are summarised in Table 5.1.

Table 5.1 Advantages and disadvantages of the best planting material and hydroball.

The best planting material (FPM)		Hydroball (HDB)	
Advantage	**Disadvantage**	**Advantage**	**Disadvantage**
High surface area	Lower hardness than HDB	Low weight	Low porosity due to closed pores
High porosity		High hardness	Low CEC
Reuseability		Reuseability	Low water absorption
Able to absorb poisonous ions and nutrients		Able to absorb poisonous ions and nutrients	Low moisture content
Plants can grow quicker than on hydroball		Slightly acidic pH value	High cost
Good water absorption			
Slightly acidic pH value			

In this experimental work the adsorption of inorganic fertilizers on planting materials was also studied. The effect of contact time and solid/solution ratio on the adsorption of NO_3^-, $H_2PO_4^-$ and K^+ on two types of planting materials (FPM and HDB) were examined. The important results of this part was that (1) the required contact time for NO_3^-, $H_2PO_4^-$ and K^+ on both planting materials to reach an equilibrium condition is less than the regulated standard time of 24 hours, (2) the amount of adsorbed NO_3^-, $H_2PO_4^-$ and K^+ on both planting materials increases with increasing the solid/solution ratios. The dependence of the adsorption behavior on the

solid/solution ratio is more expressed on the FPM than on the HDB. Therefore the adsorption characteristics of nitrate, phosphate and potassium ions depend not only on the physical properties of the absorbent itself (such as the surface area) but also on the solid/solution ratios, and (3) the types of adsorption behavior of NO_3^-, $H_2PO_4^-$ and K^+ on both planting materials (FPMs and HDB) correspond with the Freundlich isotherm.

Finally, the study of the release of cadmium and nickel ions from FPM and HDB at various pH values (pH 6.5, 5.0 and 2.0) indicated that the amounts of heavy metals (Cd^{2+} and Ni^+) released from FPM and HDB are lower than the toxicity level of Cd^{2+} and Ni^+ in plants. Therefore, BA, FGD gypsum, PC and sawdust could be used as raw materials for production of planting materials. The best FPM prepared from this work has some properties that suitable for the plants grow. This planting material shows an environmentally safe material.