# CHAPTER 4

# CONCLUSION

Excessive fluoride intake is a serious problem in Thailand, especially in the northern and western parts. People become ill from drinking underground water containing excessive fluoride. This is known as fluorosis. This study aimed to remove fluoride from drinking water. The advantage of this study is that the people will be able to know how to remove fluoride by using a common and readily available material such as firebrick.

By studying of the optimum equilibration time for fluoride adsorption using 15 g of firebrick (6-20 mesh in size) added to 15.00 ml of 10 mg/l fluoride solution. It was found that the time required to obtain equilibrium for fluoride adsorption occurred within 1 hour. When the effect of pH was considered, the influence of pH on fluoride adsorption was conducted, it was found that the fluoride adsorption on firebrick was independent on the pH change. Likewise the study on the effect of temperature on adsorption of firebrick, the adsorption isotherms of fluoride on firebrick at 30, 40 and 50 $^{o}$C reveals that the temperature posed only slight effect on adsorption. Fluoride adsorption behavior of firebrick was found to be non-Langmuir type with multilayer adsorption, but approximated monolayer adsorption yielded the capacity of 3.6 μmol/g(at30 $^{o}$C). The heat of adsorption was found to be 8.26 kJ/mol so the type of adsorption is physical adsorption.

On the other hand, the effect of foreign ions such as chloride, nitrate, sulfate, phosphate, sodium, calcium and magnesium, on the adsorption of fluoride by firebrick demonstrated that most of ions revealed none or slight effect occurred to the

adsorption except calcium and magnesium ions which can precipitate out the fluoride as $CaF_2$ and $MgF_2$.

The packed column experiment showed that an operating condition such as the amount of firebrick and the flow rate of the water passed through the packed column significantly influenced the extent of defluoridation. The packed column of 1200 g firebrick was capable of reducing fluoride in the test water exceedingly better than the ones packed with 800 and 400 g firebrick, respectively. The removal efficiency was increased with the increasing amount of adsorbent media due to the increase of adsorbent surface area.

The influence of the flow rate of the test water passing through the packed column was studied at 3, 5, 7 and 9 ml/min. With the flow rate of 3 ml/min, fluoride content in water could be removed from 10 mg/l to below 1.5 mg/l yielding 6 liters of defluoridated water. Other flow rates obviously demonstrated lower efficiency due to the less contact time of the higher flow rates.

The column experiment also revealed the feasibility of using firebrick for defluoridation of potable water. The adsorption can occur at room temperature and the column system can be operated at no cost of energy. The good properties of firebrick are high porosity and consists of $SiO_2$, $Al_2O_3$ and $Fe_2O_3$. Firebricks are readily available material and very inexpensive. Although the fluoride removal capacity of the firebrick is not so high compare to other adsorbent such as bone char or anion exchange resin, but the firebrick is local material that can be found valuable in improving the quality of consuming water especially in some area. A packed column of firebrick is a potential economically efficient method for fluoride removal from potable water at village and household levels.