

Thesis Title	Fluoride Removal from Industrial Wastewater and from Natural Water
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Candidate	Mr. Surasak Manarattanasuwan
Supervisors	Assoc. Prof. Naraporn Hamvajanawong Assist. Prof. Dr. Suntud Siriananpaiboon
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### Abstract

This research was to reduce the fluoride content in industrial wastewater to comply with the standard of Industrial Estate Authority of Thailand ( IEAT ) which allows the fluoride concentration in the treated wastewater to be not more than 5 mg/dm<sup>3</sup>, by using a coagulation process and to reduce the fluoride content in natural water (ground water) to comply with the standard of Ministry of Public Health which allows the fluoride concentration in drinking water to be not more than 1 mg/dm<sup>3</sup>, by using adsorption process. The experiment was divided into 2 parts, the first part was the treatment of fluoride from the synthetic wastewater, and the second part was the treatment of fluoride from the industrial wastewater and the natural water. The results of the treatment of fluoride from the synthetic wastewater containing 200 mg/dm<sup>3</sup> of fluoride by using coagulation showed the optimum pH before adding lime as the coagulant was 7.0 and the optimum dose was 937.5 mg/dm<sup>3</sup>, the optimum pH before adding alum as the coagulant was 7.0 and the optimum dose was 1,312.5 mg/dm<sup>3</sup>. For the fluoride treatment of the industrial wastewater containing 105 mg/dm<sup>3</sup> of fluoride, lime was used as the coagulant and the experiment was done in two ways. The first one used sodium hydroxide solution to adjust pH before coagulation in which the optimum pH before adding lime was 5.0 and the optimum dose was 1,125.0 mg/dm<sup>3</sup>, while the second one, no pH adjustment before coagulation, the optimum dose was 1,375.0 mg/dm<sup>3</sup> and the final pH was 11.612. Although the quality of the treated wastewater by those two

methods could not comply with the standard of IEAT ( $\leq 5 \text{ mg/dm}^3$ ), when it is combined with the treated wastewater from other parts of the industrial plant before discharging into the central wastewater treatment system of the industrial estate, the fluoride concentration was below  $5 \text{ mg/dm}^3$ .

Considering the total chemicals cost, the second method has the advantage over the first method as it costs 5.50 Baht per cubic meter, which is 1.57 Baht per cubic meter cheaper than the first one.

For the fluoride treatment of the natural water, the adsorption isotherm experiment indicated that the activated alumina was much more effective than the fly ash. The value of service time,  $N_0$  and K coefficients as a function of flow rate were calculated using the Bohart - Adams equation. It was found that the service time of activated alumina in the adsorption of the natural water was shorter than the synthetic fluoride water because many ions, especially bicarbonate and sulfate, present in the natural water were also adsorbed by activated alumina, resulting in the reduction of the activated alumina effectiveness. The experiment also showed that activated alumina could adsorb more quantities of fluoride than bicarbonate and sulfate, respectively.

**Keywords :** Fluoride Removal / Activated Alumina / Coagulation / Adsorption