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1 **Investigation on the simultaneous removal of fluoride, ammonia nitrogen and**
2 **phosphate from semiconductor wastewater using chemical precipitation**

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6 Abstract: This study investigates the simultaneous removal of the total ammonia nitrogen (TAN),
7 phosphate (PO₄-P) and fluoride (F⁻) from semiconductor wastewater by chemical precipitation.
8 The lab-scale experiment results revealed that the fluoride removal by using magnesium salts
9 produced a good performance. The fluoride present could significantly inhibit the struvite
10 crystallization, in this process. The inhibition ratio of the fluoride on struvite crystallization
11 remarkably increased with an increase in the fluoride concentration and a drop in the pH value.
12 The optimal pH for struvite precipitation in the semiconductor wastewater was taken as 9.5, the
13 value at which the fluoride effect significantly decreased. Therefore, to further lower the fluoride
14 effect, an overdose of the magnesium source was required in the process of struvite precipitation.
15 The experimental results thus indicated that overdosing the bittern was the more effective method
16 to treat the semiconductor wastewater compared with a brucite overdose; this was because large
17 amounts of un-reacted brucite remained in the solution, causing increased costs and operation
18 difficulty when it was employed as magnesium source. The pilot-scale study demonstrated that
19 97% of the PO₄-P, 58% of the TAN and 91% of the F⁻ could be removed from semiconductor
20 wastewater by a two-stage precipitation process. An economic analysis showed that the treatment
21 cost of the process proposed was approximately 1.58 \$/m³.

22 Keywords: Ammonia nitrogen, phosphate, fluoride, struvite, semiconductor wastewater.

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