Study on electrochemical synthesis of potassium ferrate
Hong-li Shang, Zhi-feng Tian, Wei Zhu, Shi-gang Wang, Zhong-qing Huang
Institution of Chemistry and Chemical Engineering, Chongqing University, Chongqing 400043, China

Introduction
Ferrate is a very powerful oxidizing agent that has been considered for several applications [1,2]. There are three methods for the preparation of ferrate (VI), namely dry oxidation, wet oxidation and electro-chemical method. A number of difficulties are associated with the previously known methods for preparing ferrate(VI) salts, including the relatively low yield rate and the instability of the ferrate(VI) chemical, and the toxicity of the by-products generated during preparation. In this paper we reported a cost-effective electrochemical method, it very promising to produce ferrate products commercially.

Synthesis
A novel cast iron electrodes was in the form of a foil of dimensions 18cm×3cm. The active electrode surface area was 80cm². The electrolysis condition including, applied current density, temperature, synthesis duration, electrolyte composition and concentration was showed in charts. The electrolyte was the solution of 16NaOH. The content of ferrate(Ⅵ) was determined by the chromite method.

Conclusion
Fig.1 clearly show a 0.055M potassium ferrate solution, containing KCl, KI, Na₂PO₄ and Na₂SiO₃ was used to investigate the effect of the coexisting ions on the ferrate stability at a constant temperature of 10℃. It was found that the ferrate ions decomposed rapidly in the initial stage and appeared to be relatively stable at low ferrate concentrations when KI and Na₂SiO₃ were present. Fig.2 show a influence of the temperature on the electrode corresponding to the ferrate(Ⅵ) formation. Fig.3 and Fig.4 clearly show the maximum current yield, obtained after 0.5h of electrolysis, has a value of 60.7% at a current density of 10mAcm⁻² and a temperature of 35℃. A current density of 100mAcm⁻² is observed as an optimal compromise between these phenomena supporting a high synthesis rate and a high current yield. A ferrate solution about 56.8gL⁻¹ was obtained under the optimum conditions: 16MNaOH, J=100mAcm⁻² 35℃,electrolysis duration(2.5h),The optimal current efficiency was 48.53%.

The result of this study suggested that this material is very promising to improve the yield for ferrate generation and particularly, the ferrate concentration. The coexisting ions KI, Na₂SiO₃, have been shown to offer a longer stability period of a ferrate solution.

Reference