Magnetic field coupled with electrochemical process for enhancing Al$_{13}$ formation

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**ABSTRACT**

Rare earth Nd-Fe-B magnetic field was used to enhance the conventional electrochemical process for preparing the polyaluminum chloride (PACl) of high Al$_{13}$ polymer. It was found the formation process of Al$_{13}$ polymer was obviously influenced by electrobath's voltage ($V_i$), magnetic field intensity ($B_i$), current density ($d_i$), the distance of two adjacent electrodes ($d_{adj}$), and the circulating rate. The concentration polarization was inhibited by external magnetic field and out-circulating pump, therefore, the comfortable surroundings for the formation of adequate Al(OH)$_4$– precursor was formed. The Al$_{13}$ polymer content of PACl with Al$_i$ (total aluminum concentration) = 0.8 M and B (basicity) = 2.2 reached 79.8 % of Al$_i$ when the $V_i$, $B_i$, $d_i$, $d_{adj}$ and circulating rate was 2.0 V, 0.4 T, 3.34 A/dm$^2$, 20 mm and 23.7 L/h, respectively. For aging 15 d, it increased to 84.6%. In comparison with the conventional electrolysis process, the content of Al$_{13}$ polymer was improved by 8.7% and 8.9%, respectively.

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**Keywords:** Magnetic field; Electrochemical process; Polyaluminum chloride (PACl); Al$_{13}$ polymer; Flocculants; Polarization