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Magnetic field coupled with electrochemical process for enhancing Al_{13} formation

Wen-qi Gong, Ke-wu Pi*

School of Resources and Environmental Engineering, Wuhan University of Technology, 430070 Wuhan, P.R.China
Tel. +86 (27) 87215931; Fax +86 (27) 87215931; email: pkw519@163.com

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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 inhabited 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_T (total aluminum concentration) = 0.8 M and B (basicity) = 2.2 reached 79.8 % of Al_T 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.

Keywords: Magnetic field; Electrochemical process; Polyaluminum chloride (PACl); Al_{13} polymer; Flocculants; Polarization

* Corresponding author.