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EFFECTS OF Fe(III) ON DISSIMILATORY FERRIC REDUCTION, NITROGEN AND PHOSPHORUS REMOVAL IN ACTIVATED SLUDGE PROCESS

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Abstract

An activated sludge from SBBR (sequencing biofilm batch reactor) reactor filled with Fe⁰ as filler had been acclimated to Fe(III)-rich environment aiming at secure an enrichment culture of iron-reducing bacteria. The dissimilatory Fe(III) reduction ability and its efficiency on the effect of nitrogen and phosphorous removal by dosing different Fe(III) under anaerobic condition were investigated. The mechanism was also proposed based on the results derived from the experiment and that in the literature. The experimental results show that there is great consistency between the ability of Fe(III) reduction and the effects of nitrogen and phosphorous removal, with the order of Fe(OH)₃>iron oxide scale>green ore>red ore. However, NH₄⁺-N and TN show a removal hysteresis. The results support that the mechanism of phosphorous removal using dissimilatory Fe(III) reduction seems to be the chemical sedimentation driven by IRB, rather than the surface adsorption of Fe(III) source. Judging from ΔG⁰, it is reasonable to believe that Feammox, ANAMMOX and nitrate-dependent oxidation coupled with Fe(III) reduction under anaerobic condition are thermodynamically feasible. They are potentially critical components of N cycle in activated sludge.

Key words: activated sludge, dissimilatory Fe(III) reduction, nitrogen and phosphorus removal, reduction mechanism

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