Coagulation performance and flocs characteristics of variable sludge recycling designs for the synthetic low-turbidity water treatment

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\textbf{ABSTRACT}

Drinking-water-precipitated sludge, characterized as accumulated suspended solids and organic or inorganic components is produced in large quantities during the coagulation process. The proper recycling of drinking water residual sludge is an effective method to enhance low-turbidity water treatment. The current research primarily focused on the settled water quality in terms of bulk parameters, i.e. fine particle distribution, turbidity, COD\textsubscript{305-400}, total organic carbon, dissolved organic carbon and UV\textsubscript{254} removal. Residual aluminum under variable sludge recycle designs was also studied. In addition, flocs characteristics was analyzed using optical microscopy and Image J software. The results indicated that recycled sludge combined with activated silica (AS) exhibited excellent potential for turbidity and particulates removal, which might be attributed to jointed effects of sweep floc, adsorption, and bridging. Moreover, powdered activated carbon (PAC) addition was significantly further improving organic matters elimination. Residual total aluminum or dissolved aluminum exceeded the requirement of drinking water treatment standard (0.2 mg/L) in China, indicating that pretreatments or subsequent treatments should be implemented or optimized to avert secondary pollution. Image analysis of regrowth flocs confirmed that recycled sludge combined with AS or/and PAC could be significant for the coagulation treatment of low-turbidity water.

\textbf{Keywords}: Sludge recycling; Coagulation; Low-turbidity; Flocs characteristics

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