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Pilot test operation of biological nitrogen removal of gold mill effluents

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ABSTRACT

Effluents from gold mills are a potential environmental hazard, unless toxic substances such as nitrogen compounds (sodium cyanide, thiocyanate and ammonia) and heavy metals are removed. In northern Sweden, there are gold mines that are either already in operation, or to be opened, among them is the proposed Lappland Goldminers AB gold mill facility. The environmental permit for this new activity requires stringent removal levels of nitrogen. It was decided to operate a pilot plant to study the biological nitrogen removal performance. It has been based on a continuous activated sludge plant suited for biological nutrient removal. The plant has been operated at a neighbouring gold mill plant with an identical gold extraction process. The pilot study focused primarily on nitrification; however, also the denitrification performance and cyanide removal were monitored. The test results have been encouraging, showing up to a 100% nitrification capacity. The specific nitrification rate has been in the range (0.5) of 1.1–2.6 g N_{ox}/kg VSS/h, at temperatures ranging from 7.6 to 20°C. Different unintended process disturbances have been allowed for conclusions on the process stability and recovery potential. Low levels of total cyanide were recorded in the inlet, but virtually no traces were found in the treated water.

Keywords: Gold processing effluent; Biological nitrogen removal; Pilot plant operation; Load variations; Process stability

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