



Nanofiltration polishing membrane process for fluoride removal

N. Meftah^{a,b}, A. Mejdi^b, A. Ezzeddine^a, A. Bedoui^b, A. Hannachi^{a,*}

^aChemical Process Engineering Department, National Engineering School of Gabes, University of Gabes, Omar Ibn El khattab Street, 6029 Zrig, Gabes, Tunisia, emails: ahmed.hannachi@enig.rnu.tn (A. Hannachi), nouha-meftah@hotmail.com (N. Meftah), abdessalem.ezzeddine@enig.rnu.tn (A. Ezzeddine)

^bFaculty of Sciences of Gabes, Department of Chemistry, University of Gabes, Erriadh City, 6072 Zrig, Gabes Tunisia, emails: assil.benharakat@gmail.com (A. Mejdi), ahmed.bedouifsg@yahoo.fr (A. Bedoui)

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ABSTRACT

The objective of this experimental study is to investigate, at a laboratory scale, the removal efficiency of a process combining dilution, neutralization, and nanofiltration (NF) membrane separation of real industrial wastewater. The considered effluent is produced by an aluminum fluoride manufacturing plant with a fluoride concentration in the range of $4,606 \pm 547$ mg/L. First, the effect of drying of technical grade hydrated lime, used as a neutralizing agent has been explored. Drying allowed the considerable saving of lime with slightly better fluoride removal efficiency giving a removal rate of $98.7\% \pm 0.3\%$ at the optimal lime excess of around 36% for the neutralization step. The polishing NF membrane separation, conducted on a laboratory pilot unit, yielded a fluoride rejection rate of $77.3\% \pm 0.3\%$ at the optimal operating transmembrane pressure of nearly 85 psi. The overall fluoride removal rate at optimized operating conditions has reached $99.85\% \pm 0.02\%$ with a permeate effluent having fluoride contents of 6.6 ± 0.1 mg/L.

Keywords: Industrial wastewater; Fluoride; Removal process, Hydrated lime neutralization; Nanofiltration; Laboratory scale experiments, Optimization

* Corresponding author.