Combining innovant electrochemical technology and ozonation process for the treatment and recycling of grey wastewater from industrial laundries

Dr. Rimeh Daghrir (Researcher, rdaghrir@cteau.com),

Center of Water Technology, Montreal, Canada.

Abstract

In Quebec, water pollution has become a serious environmental problem that has harmful consequences on public health due to the increase in population consumption. Grey wastewater (GWW) which constitutes 50-80% of the total household wastewater generates a large volume of wastewater containing a very high concentration of organic matter, total suspended solids, oil & grease [1]. Therefore, extensive efforts focus on developing powerful methods for achieving the complete removal of organic pollutants and for sustainable GWW reuse. The most common application for GWW reuse is toilet flushing which can reduce water demand within dwellings by up to 30 % [2]. However, other applications such as irrigation of parks, schoolyards, cemeteries and golf courses, vehicle washing, fire protection and air conditioning are practiced [3]. The water quality standards for wastewater recycling generally include parameters based on organic, solids and microbiological contents of the water. The most stringent criteria require a biochemical oxygen demand (BOD) of less than 10 mg/L, a turbidity below 2 NTU and a non detectable level of either total or faecal coliforms [4]. Ozonation is an efficient and powerful oxidizing process, well known for its efficiency in the degradation of refractory organic compounds [4]. However, an application of ozone alone in wastewater treatment is often limited by the cost of *in-situ* ozone production and by the high ozone consumption [5]. Nowadays, a great interest in advanced electrochemical technologies has been emerging. Electrochemical treatments are characterized by simple equipment, brief retention times and easy operation, which can contribute to reduce the operating cost in large-scale applications [6]. Electrocoagulation (EC) process is an effective technology for the destabilisation of finely dispersed particles by removing hydrocarbons, greases, suspended solids, inorganic pollutants and even heavy metals from different types of industrial wastewater. Besides, electro-reduction (ER) is also an effective electrochemical technique able to produce *in situ* H_2O_2 (1.77V) by cathodic reduction of oxygen [7]. From this point of view, the aim of the present study is to investigate a hybrid technique combining EC, ER and ozonation processes (called ECRO process) and to evaluate its performance in treating and recycling GWW. By carrying out systematic studies of the effect of different operating parameters (such as type of anode and cathode, current density, electrolysis time, O_3 dosage and pH), we were able to identify the optimal processing conditions that lead to remove organic and inorganic contaminants from GWW. The ECRO process reduced more than 95% of COD_T, 100% of BOD, 99% of turbidity, 92% of TSS, more than 95% of O&G and 100% of phenolic compounds. Thus, due to the successful results the ECRO process merits further research, in particular concerning the design of pilot unit for the treatment of GWW in continuous mode and for sustainable reuse of treated waters. The development of this technology could present an alternative to avoid the drawbacks of conventional water treatment methods.

References: **1)** Ghaitidak, D.M., Yadav K.D. (2013) *Environ. Sci.Pollut. Res.* 20, 2795-2809. **2)** Lu, W., Leung, A.Y.T., 2003. Chemosphere 52, 1451–1459; **3)** USEPA (US Environmental Protection Agency), 2004. Guidelines for Water Reuse. Report EPA/625/R-04/108, USEPA, Washington, DC, USA; **4)** Dai et al., (2015) Degradation and kinetics of phenoxyacetic acid in aqueous solution by ozonation. *Sep. Purif. Technol.* 142: 287-292; **5)** Riva et al., (2009) *Chemosphere*. 74: 854-859; **6)** Daghrir et al. (2014) *Sep. Purf. Technol.* 131:79–83; **7)** Yavuz et al., (2011) *Chem. Ind.* 86, 964-969.