ABSTRACT

THESIS: Treatment of Hydraulic Fracturing Fluids in Petroleum Wastewater Using Physical and Biological Techniques

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Hydraulic fracturing ('fracking') is a drilling and extraction technique that uses large volumes of high-pressure, chemically-treated water to free petroleum and natural gas trapped deep in underground strata. The chemically-enriched water, along with brine and groundwater, are recovered from the well together with the oil and gas. There is an urgent need for treatment of this contaminated water prior to possible reuse. The reported research tested two methods for removal of contaminants from synthetic fracking fluids: (1) physical sorption using activated charcoal (GAC), peat, synthetic resin, and plastic chips packed in columns; and (2) biological treatment using a two-stage constructed wetland grown to cattail (*Typha latifolia*). The resulting leachates were tested for chemical composition; likewise, the soil and *Typha* grown in the constructed wetland were analyzed. GAC and peat were moderately successful as compared with plastic and resin for both increasing pH of the hydraulic fracturing fluid (from 4.1 to 7.4) and in removing Na. Results were variable for Cu and Pb removal. In the constructed wetland, pH increased from 4.1 to 7.0 and electrical conductivity decreased significantly. Transfer factors for Pb were 0.67 (Stage 1 of wetland) and 1.37 (Stage 2). *Typha* shoots had bioconcentration factors for Pb ranging from 2.9 (Stage 1) to 8.0 (Stage 2). These data indicate that *Typha* may be effective for Pb removal from hydraulic fracturing fluids. The reported study may be of significant practical value to oil and gas production industries which generate large quantities of contaminated oil and gas wastewater.