Title: Electrokinetic Nondestructive *In-situ* Technique for Rehabilitation of Liners Damaged by Fuels

Authors: Mousa Bani Baker, Maria Elektorowicz, Adel Hanna

PII: S0304-3894(18)30673-3
DOI: https://doi.org/10.1016/j.jhazmat.2018.07.113
Reference: HAZMAT 19622

To appear in: *Journal of Hazardous Materials*

Received date: 2-12-2017
Revised date: 30-7-2018
Accepted date: 31-7-2018

Please cite this article as: Baker MB, Elektorowicz M, Hanna A, Electrokinetic Nondestructive *In-situ* Technique for Rehabilitation of Liners Damaged by Fuels, *Journal of Hazardous Materials* (2018), https://doi.org/10.1016/j.jhazmat.2018.07.113

Electrokinetic Nondestructive *In-situ* Technique for Rehabilitation of Liners Damaged by Fuels

Mousa Bani Baker[1], Maria Elektorowicz[2], Adel Hanna[2]

[1]Assistant Professor, Department of Civil and Infrastructure Engineering, Al-Zaytoonah University of Jordan, P .O. Box 130 Amman 11733 Jordan. E-mail:m.banibaker@zuj.edu.jo
[2] Professor, Department of Building, Civil and Environmental Engineering, Concordia University, 1455 Boul. de Maisonneuve W, Montreal, QC, Canada, H3G 1M8, mariae@encs.concordia.ca

Highlights,

- The paper went through linguistic and grammatical editing as per reviewer 2 request in order to improve the readers understanding of the delivered concepts. Now the authors believe that the revised manuscript is in much better shape.

Abstract

Underground Storage Tanks (UGST) are often used to store hydrocarbon products and fuels. Liners under such tanks are normally formed to prevent leaching or/and overflow to groundwater. Similar protection is required in case of waste fuels, which are discharged to disposal sites (e.g. ponds, landfill). Thus, a successful protection depends on the liner formation, which might undergo destruction due to leaching. This paper presents the results of experimental investigation to examine the serviceability of liner against leachate infiltration. In order to simulate the behavior of sand-bentonite liners affected by alternative fuels (ethanol and biofuel), the leaching column tests were applied and the hydraulic conductivity was used as an indicator of the effectiveness of the rehabilitation process. Furthermore, the silicate grout solution and pretreatment with surfactant under the effect of electrokinetic phenomena to pre-wash the biofuel residuals in liner were investigated. Silica grout formulations were developed and adequate curing periods were established for electro–silicatization process. Results showed that hydraulic conductivity was reduced fourfold for the case of using three-step electro-rehabilitation for alternative fuels under pressure of 40 kPa, and reduced threefold in the case of 100 kPa pressure on liner**.**

Keywords: Clay liners; three-step soil rehabilitation; electrokinetics (EK), silicatization, surfactants, hydrocarbon's infiltration, alternative fuels

1. Introduction

Due to liquid infiltration, the liner's structure changes and the hydraulic conductivity increases as a result of displacement of fine particles, tunneling and a number of physicochemical phenomena. Accordingly, the liner composite fractures due to coagulation of sand-bentonite matrix in contact with ethanol and biofuels as well as various petroleum products, which account for sixty-nine percent of soil contamination in Quebec [1].

The washing out the clay particles from the soil matrix increases with hydraulic pressure. This phenomenon, known as suffusion or piping, increases the hydraulic conductivity of the liner due to the creation of larger pores [2]. Kayabali and Mollamahmutoglu [3] investigated the influence of hazardous fluids on the permeability of earthen liners, where highly acidic solutions, bases, leather industry leachate and municipal industry leachate were used as principal permeates. Their study implied that using a lower percentage of