Chemical reagents based on surfactants for oil-contaminated soils treatment: efficiency, advantages and concerns

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Abstract (300 word limit)

The enhanced soil washing, as a method of oil-contaminated soils treatment, is considered one of the Best Available Techniques due to GOST R 57447-2017 and Industrial Emission Directive 2010/75/EU (Final Draft 2017). The choice of the chemical reagent is supposed to be based on various criteria, containing efficiency, environmental safety and economic feasibility, which should be obligating for potential consumers (REACH regulation system in European Union since 2007). Nowadays Russian legislation has a lack the applicable regulation document for chemical reagents. The study is aimed to set up the major characteristics to estimate the efficiency of oil-contaminated soil washing, using chemical reagent based on surfactants, and their environmental safety due to secondary pollution probability. Methodology: the efficiency of the enhanced washing process using different chemical reagents was determined for several soil matrix types and various oils. Ecotoxicity of the chemical reagents was studied through infusoria and higher plants bioassay. Solubilization of humic substances was determined by water solution extraction of unpolluted peat. Findings: a study of a solubilization efficiency towards oil and natural organic compounds showed a significant effect of the washing solution pH and the soil matrix type, which is apparently due to two factors – the sorption capacity of the soil and the nature of the surfactants affecting the ability of surfactant molecules to be absorbed by the soils. The study results presented mainly high ecotoxicity level of the chemical reagents for infusoria and higher plants. Chemical reagent treatment has led to the overall biotoxicity increasing due to biotoxicity of chemical reagent and rising of oil substances and heavy metals bioavailability. Conclusion & Significance: the study results point the necessity of chemical reagent regulation system development and its implementation to maximize the efficiency and environmental safety of the enhanced soil washing as a treatment method.

Image

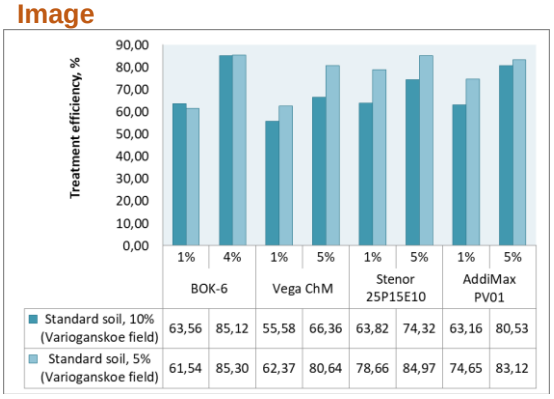


Figure 1: The enhanced washing efficiency for standard sandy soil contaminated with 5 and 10 wt% of light crude oil (0.84 g/cm^3)

Recent Publications

1. Khalilova DI, Yunusova DM (2017) Bulletin of research results. 1–2:23–31.
2. Beznezdreva EA, Vorobiev DS, Emelyanova LG (2015), et al. Collection of innovative solutions for the conservation of biodiversity for the oil-producing sector. 275 p.
3. NFESC Technical Report TR–2206–ENV Surfactant–Enhanced Aquifer Remediation (SEAR) Design Manual [Electronic resource] / EOS Remediation [Official site]. – URL: http://www.eosremediation.com/download/Source%20Zones/SEAR/SEAR%20Design%20Manual.pdf (accessed: 09.10.2018).
4. Zubair A (2015) Design and optimization of surfactant based enhanced remediation of bunker c fuel oil contaminated soil. 182 p.
5. Ying G-G (2006) Fate, behavior and effects of surfactants and their degradation products in the environment. Environment International 32:417–431.
6. Cserhati T (2002) Biological activity and environmental impact of anionic surfactants. Environment International 28:337–348.



Biography (150 word limit)

Olga Kulikova is PhD Student, supervised by Dr.Eng.Sc., Prof. Elena Mazlova, has her expertise in oil-contaminated territories remediation. The results of her research were obtained by intensive laboratory studies carried out on the basis of research laboratories of Gubkin University, MSU and TU BA Freiberg. As well as a great contribution to the work was made by the results of the Arctic expedition 2018, during which Olga acted as the leader of the expedition group.

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Notes/Comments: