

CHAPTER 5



CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be drawn from the results of the study on the application of CGAs and conventional surfactant solutions for flushing pyrene from the columns containing contaminated pumice:

Pumice grain size influenced pyrene removal by toluene extraction: the smaller size pumice had better pyrene removal efficiency due to more surface area per unit weight.

From the preliminary studies, BioNonex was found to be more effective for pyrene removal from pumice than BioSolve.

As the surfactant concentration increased from 1% to 7%, the percent of pyrene removed from pumice also increased using both conventional surfactant solutions and CGAs flushing due to increasing pyrene solubility. However, increasing surfactant concentration beyond 7% does not improve pyrene removal significantly.

Concentration of surfactant solution influenced the stability of CGA bubbles: the more concentrated the solution, the more stable CGA bubbles, and the longer half-life obtained.

Performance of surfactant in the CGA form at any concentration is more effective at pyrene removal than that in the conventional aqueous form of the same concentration, or conventional water floods.

The pyrene removal rate in all the cases was high in the initial stage of the flushing followed by a slower rate as the experiment continued. The high removal in the initial stage was attributed to any free-phase pyrene that attached loosely to the external surface of pumice.

For pyrene loaded at 1300 mg/kg pumice, BioNonex-3% solution and CGA removed about 47% and 55% of pyrene from pumice, respectively. Changing the flushing media to BioNonex-7% solution and BioNonex-7% CGA removed 68% and 78% of pyrene, respectively. Using water alone as the washing media removed only 11% of pyrene.

For pyrene loaded at 12000 mg/kg pumice, BioNonex-3% solution and CGA removed about 29% and 36% of pyrene from pumice, respectively. Changing the flushing media to BioNonex-7% solution and BioNonex-7% CGA removed 43% and 53% of pyrene, respectively. Using water alone as the washing media removed only 7.5% of pyrene.

Pyrene removal by BioNonex-5% solutions was about 58% in the test on real soil and about 55% in the test on pumice so BioNonex appears to have good potential as fluid for remediation of pyrene contaminated soil.

For the future work of this study, one should vary the conditions that relate to the underground subsurface and study other variables such as other types of contaminant, pH, temperature, or flow rate of surfactant solutions and CGAs that can affect the results. Further study should be done with microorganisms that can biodegrade the effluent of soil washing with biodegradable surfactant containing pyrene and other PAHs.