The Reagents Screening of Thermal Chemical Washing Method on Liaohe Oily Sludge

Shuangchun Yang, Shuangyu Tong and Si Li

ABSTRACT

In this paper, tank bottom oily sludge from Liaohe oil field of China was treated by a new reagent and processing based on thermal chemical washing method. Several surfactants were investigated using oil removal efficiency of oil sludge including Sodium dodecyl benzene sulfonate, Sodium dodecylsulphate, and Dodecyl trimethyl ammonium bromides, Betaine, Tween 80 and Span 20. Processing conditions, including temperature, mass ratio of liquid to solid and stirring time, were also optimized.\(^1\)

KEYWORDS

Oily Sludge, Thermal Chemical Washing, Tween 80, Tank Bottom Oily Sludge.

INTRODUCTION

Thermal chemical washing method could achieve the phase separation, and it was widely used in the treatment of oily sludge. The reagents and processing conditions of thermal chemical washing method are different for the oily sludge from different sources[1]. Appropriate reagents are the keys to thermal chemical washing treatment on oily sludge. Zhang et al [2] removed engine oil from oily sludge by surfactants washing method. Tween 80 was proved to be the optimal reagent by screening experiment, Oil removal efficiency was 86.25\%.

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EXPERIMENT

Batch Reagents Screening Experiments

Certain amount of chemical reagents and 20mL water were added into 5g oily sludge in 100mL beaker. The mixture was placed in the water bath of 50℃ for stirring by the motor agitator at 250r/min. The stirring time was 15mins. After string and standing, the oil slick on the mixture was removed, and the remainder was filtrated. The residue filtrated was dried at 105℃, and its oil content was measured.

Bath Experiments for Optimization of Washing Conditions

Certain amount of water and 0.2g/L Tween 80 were added into 5g oily sludge in 100mL beaker. The mixture was placed in the water bath at certain temperature for stirring by the motor agitator at 250r/min.

RESULTS AND DISCUSSION

The Optimized of Surface Active Agents and Soda

<table>
<thead>
<tr>
<th>TABLE I. THE OIL REMOVAL EFFICIENCY OF SURFACTANTS AND SODA.</th>
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<tr>
<td><strong>Types</strong></td>
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<tr>
<td>Anionic surfactant</td>
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<tr>
<td>Cationic surfactant</td>
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<td>Amphi-surfactant</td>
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<td>Non-ionic surfactant</td>
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<td>Soda</td>
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Table 1 shows the optimum concentration was 0.3g/L. Oil removal efficiency was increased when the amount of Sodium dodecylsulphate was increasing. The optimal concentration of Sodium dodecylsulphate was not in range of 0.1g/L-
0.5g/L, so the decreasing trend of oil removal efficiency didn’t appear. Because it is not economic when reagents concentration was more than 0.5/L, so oil removal efficiency was only studied in concentration range of 0.1g/L-0.5g/L. The best oil removal efficiency of Betaine was 79.3%. Tween 80 and Span 20 could reduce the viscosity of sludge system because of their good viscosity reduction capacity. The best oil removal efficiency of them all obtained at 0.2g/L. The optimal concentration of Na2CO3 was 0.3g/L. OH- produced from the hydrolysis of NaCO3 could decomposed the oil and transform them to soluble substances.

By comparison, the optimal surfactant was Tween 80, and its best oil removal efficiency was 89.6%.

Effects of Bath Temperature on Oil Removal Efficiency

Fig.1 shows the changes of oil removal efficiency when the bath temperature increased. The best efficiency could obtain at 60°C. When temperature exceeded 60°C, the oil removal efficiency increased slowly.

![Figure 1. Effects of bath temperature on oil removal efficiency.](image1)

![Figure 2. Effects of mass ratio of liquid to solid on oil removal efficiency.](image2)
Effects of Mass Ratio of Liquid to Solid on Oil Removal Efficiency

Fig. 2 shows the changes of oil removal efficiency when mass ratio of liquid to solid increased. With the increasing of mass of liquid to solid, oil removal efficiency increased. After 6:1, however, oil removal efficiency increased slowly along with the increasing of mass ratio of liquid to solid.

Effects of Stirring Time on Oil Removal Efficiency

Fig. 3 shows the mixing of reagents and oily sludge would more fully when the string time increased. After 20min, however, reagents had been completed mixing with oil sludge and its function had played to the best, oil removal efficiency keep unchanged with the increasing of stirring time.

CONCLUSIONS

Thermal chemical washing treatment of a certain kind of oily sludge was studied in this paper. Several surfactants and soda were optimized by using oil removal efficiency as the index. Effects of treatment conditions containing water-bath temperature, mass ratio of liquid to solid and stirring time were also studied. (1) Among the 7 reagents, Tween 80 had the excellent oil removal efficiency. The optimal concentration of Tween 80 was 0.2g/L and its best removal efficiency was 89.6%. (2) The conditions were optimized by using Tween 80 as washing reagent and oil removal efficiency as index. The results showed that the optimal water-bath temperature was 60°C, the optimal mass ratio of liquid to solid was 6:1 and the optimal stirring time was 20min. The best oil removal efficiency was 95.2%. 
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