CASE STUDY CS062

Recovery of Oil from Production Waste Sludges

Objective

Trial was to demonstrate cost effective separation and recovery of crude oil from oil and natural gas production waste sludges containing typically 10% crude oil, which are stable oil/water emulsions, potentially eliminating a waste stream from gas production, and saving energy and carbon tax credits. These sludges contain emulsions, which are caused by metal soaps and the cocktail of chemicals used in production fields to aid extraction of natural gas and have proven impossible to separate using conventional techniques, preventing the recovery of valuable crude oil. Currently the only effective disposal route for these sludges is incineration, usually mixed with absorbent, combustible solid waste, which is energy intensive and wastes a valuable resource.

Overview

A sequence of tests were carried out to determine the most effective method using chemicals and, where appropriate, physical processes, to break the waste sludge emulsion and achieve separation of the crude oil content so that it could be recovered.

The method developed to separate crude oil from the production sludge emulsions uses the following:

1) Two chemical/surfactant formulations developed by Global Advantech: **Heavy Duty Aqueous-Phase Demulsifier DC201** and **Heavy Duty Oil-Phase Demulsifier DC202**
2) Salt water (at least 4% concentration, brine or sea water)
3) A low shear mixer
4) An oil separator

To break the sludge emulsion and separate the crude oil, the emulsion is first diluted with several times its own volume with salt water (at least 4% concentration, brine or sea water) at ambient temperature (12°C/54°F or higher). Then small quantities of the two formulations are added in sequence, whilst maintaining agitation. The formulations interact with the emulsion causing it to break immediately, releasing the crude oil. Once the agitation is stopped, the crude oil floats to the surface, where it coalesces and any heavy particulates released from the sludge emulsion sink.

The above method was successfully used to break the sludge emulsion samples (ex USA) and separate crude oil using small quantities of the two chemical formulations, Heavy Duty Aqueous-Phase Demulsifier DC201 and Heavy Duty Oil-Phase Demulsifier DC202, and 4% salt water at a temperature of 14°C/57°F.

Demonstration

The following section describes the method used to separate the crude oil out from production waste sludge and the results obtained.

Approximately 2Kg of production waste sludges were available (ex USA) containing approximately 10% of crude oil by weight for the development and tests.

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Method

1. 100ml sample of natural gas production waste sludge containing emulsified crude oil.

2. 100ml sample of sludge mixed with five times its volume of 4% salt water solution (at 14°C/57°F).

3. 5ml of Heavy Duty Oil-Phase Demulsifier DC202 added to sludge + salt water with agitation for 10 seconds. Followed by the addition of 20ml of Heavy Duty Aqueous-Phase Demulsifier DC201 with agitation for 20 seconds and allowed to stand for 1 minute.

4. The liquid after standing for 5 minutes showing coalescence of the crude oil where it is beginning to cling to the glass container, with particulates settling. out

5. The crude oil floating after 20 minutes.

6. The inside of the glass container showing the separated crude oil clinging after the salt water containing the aqueous component of the sludge had been emptied out.

Conclusion

The crude oil from the oil/natural gas production waste sludge samples (ex USA) was successfully separated by diluting the sludge with salt water at ambient temperature, then by adding small amounts of the two formulations to break the oil/water emulsion.

The trial above demonstrates an alternative cost effective and environmentally sound process to recover valuable crude oil from oil and natural gas production waste sludges rather than disposal by incineration, and saving energy and (tradable) carbon tax credits.

To minimise cost, the majority of the salt water containing the aqueous component of the emulsified sludge may be re-used in each subsequent process cycle. Options for the remainder of the salt water are:

- Delivery to a suitable waste water treatment plant or pumped into an evaporation lagoon (where permitted)
- Used to make up brine for reservoir injection, reducing water abstraction requirements