

**MICROBIAL DEGRADATION OF
BENZYLDIMETHYL
HEXADECYLAMMONIUM CHLORIDE
(BDHAC)
USED IN OILFIELD CHEMICAL
FORMULATION**

BY

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Discharges From Offshore Oil and Gas Installations

Sources:

- Accidental discharge
- Discharge of drill cuttings
- Discharge from produced water

Produced Water

Some facts:

- It becomes rampant with ageing of reservoir
- A side effect of pressure drop treatments

Produced Water: Composition

- Dissolved and dispersed oil components derived from reservoir other formation-derived organic compounds
- Trace Metals
- Inorganic Salts
- Produced Solids
- Dissolved gases including O_2 , CO_2 , and H_2S
- Residual process chemicals

Process Chemicals

Some facts:

- Virtually all production chemicals are complex formulations of compounds manufactured from impure raw materials.
- The formulations sold by the chemical supply companies contain materials other than a single compound – as a minimum, beside the ‘active’ ingredients. Normally there will be a solvent. Chemical type is defined by the functional group(s) of the main active ingredients.

Types of Oilfield Chemicals

Biocides

Oxygen Scavengers

Demulsifiers

Antifoam

Dispersants

Fluid-loss Control

Emulsifiers

Surfactant/detergents

Corrosion inhibitors

Scale inhibitors,

Coagulant/deoiler

Flocculant (injection)

Thinners

Viscosifiers

Corrosion Inhibitors

What are they ?

A corrosion inhibitor is a chemical compound that, when added in small concentration, stops or slows down corrosion*.

* Corrosion is the deterioration of intrinsic properties in a material due to reactions with its environment

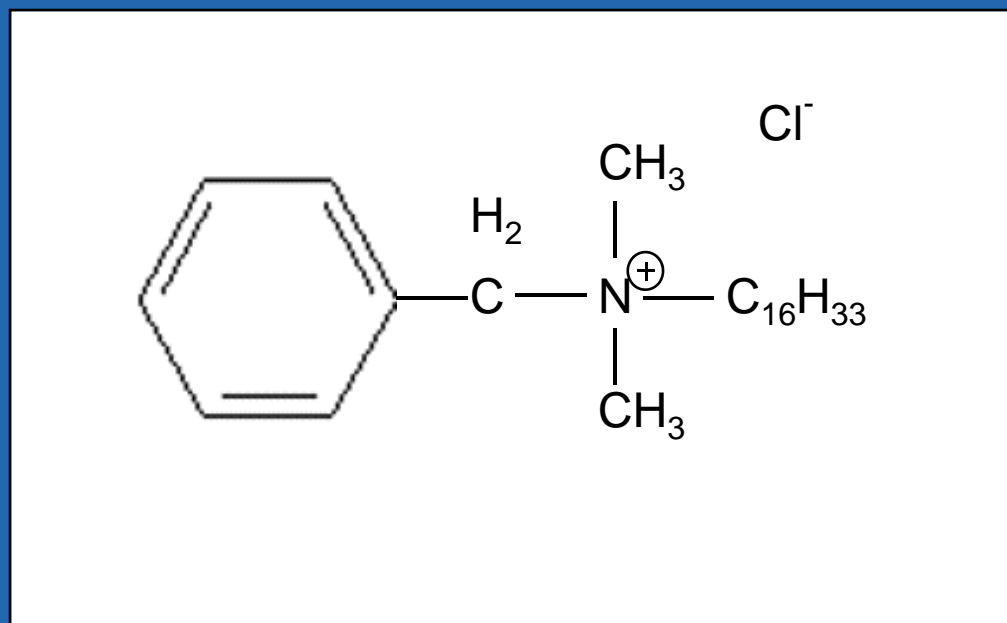
Quaternary Ammonium Salts

These are principal constituents of corrosion inhibitors. The active component may be a molecule like trimethylalkyl ammonium chloride, with a side chain, R, most likely comprising a complex mixture of long chain hydrocarbons.

BDHAC is an example of a Quaternary Ammonium Salt.

Benzyldimethylhexadecyl ammonium- chloride (BDHAC)

- Structure:

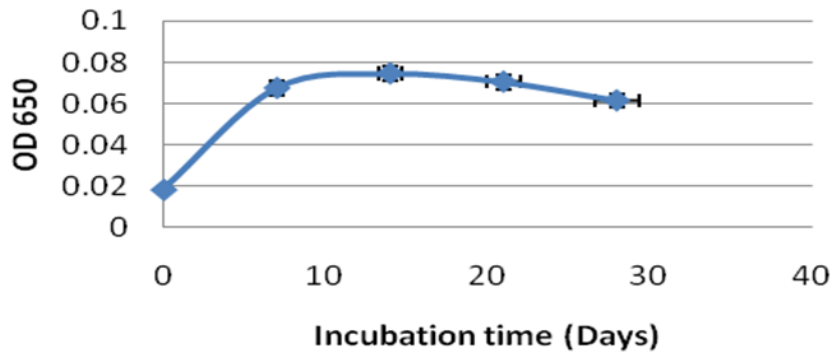


Isolation of Bacteria From Marine Sediments

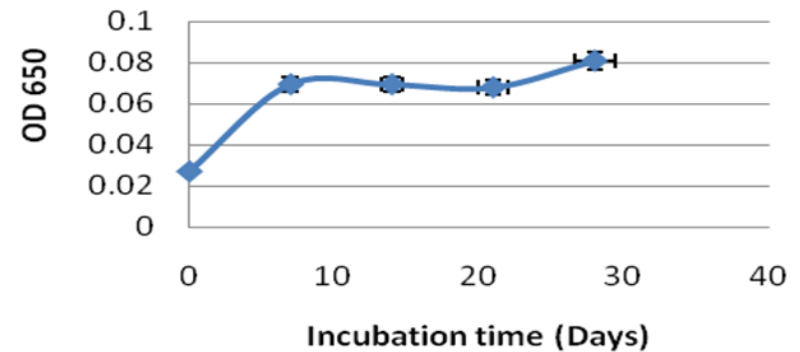
- Incubation of culture for 28days
- Screening Tests for bacterial Isolates
- Identification of Isolates by Sequencing of 16S-rDNA genes.
- Some of the Isolates Identified:
G (Bacillus niabensis), F (Bacillus subtilis), J(Thalassospira sp), & H (Sporosarcina sp).

Degradation of BDHAC by Four Strains of Bacteria

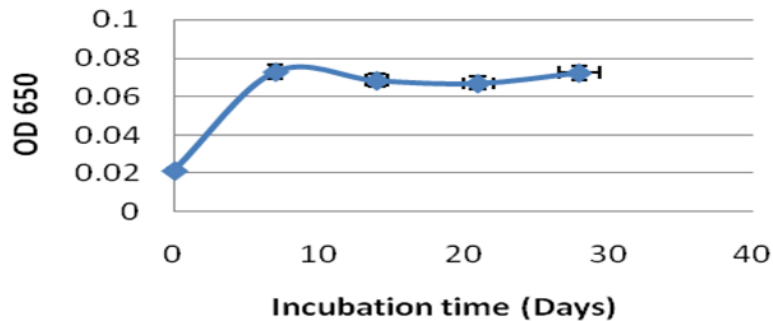
Growth of *Sporosarcina sp.* in 28 days of incubation



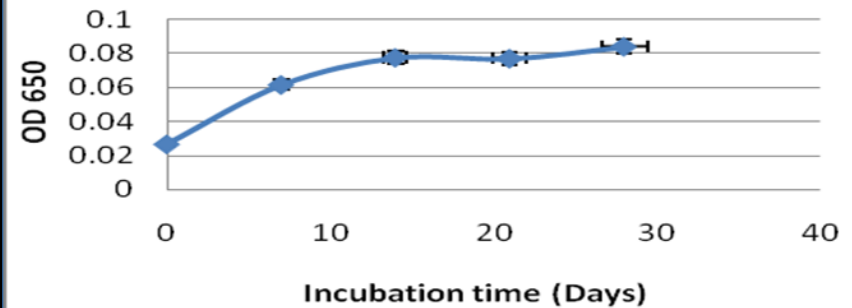
Growth of *Bacillus subtilis* in 28 days of incubation



Growth of *Bacillus niabensis* in 28 days of incubation



Growth of *Thalassospira sp.* in 28 days of incubation

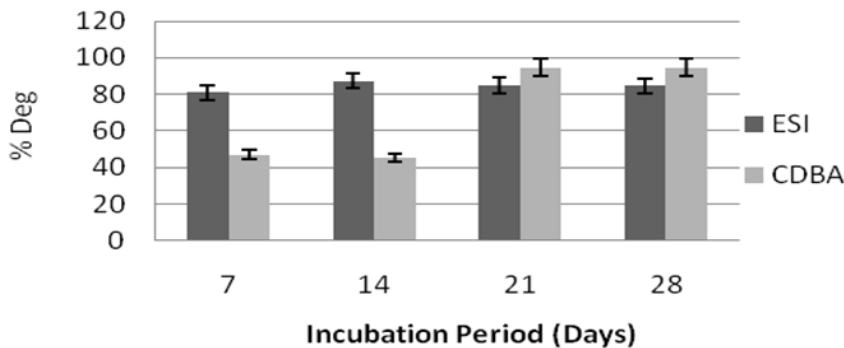


Analysis of Degraded Quat

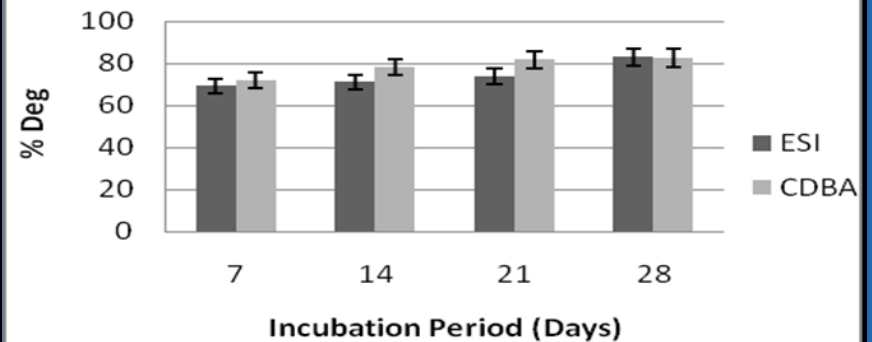
- Analytical Techniques:
 - Colorimetric Dye Binding Assay (CDBA)
 - Electrospray Ionization Mass Spectrometry (ESI/MS)

Comparison of Analytical Techniques Used.

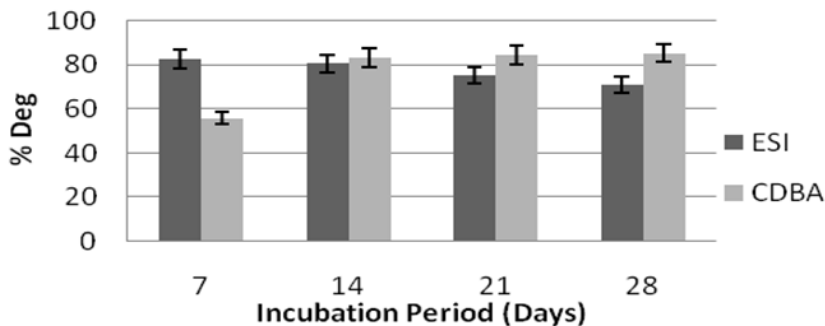
Mean % Degradation from ESI & CDBA by *Sporosarcina sp.* in 28days of incubation



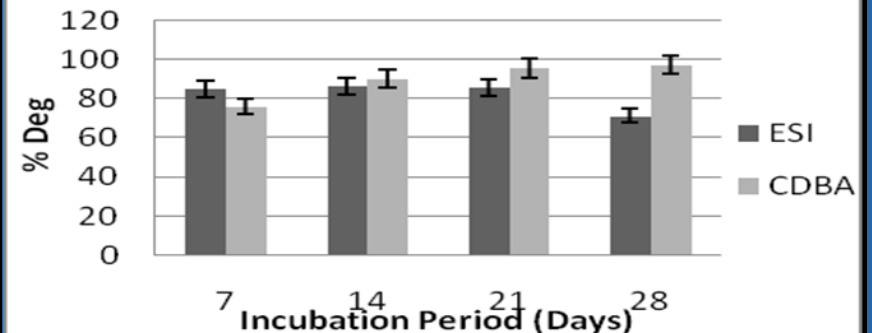
Mean % Degradation from ESI & CDBA by *Bacillus subtilis* in 28days of incubation



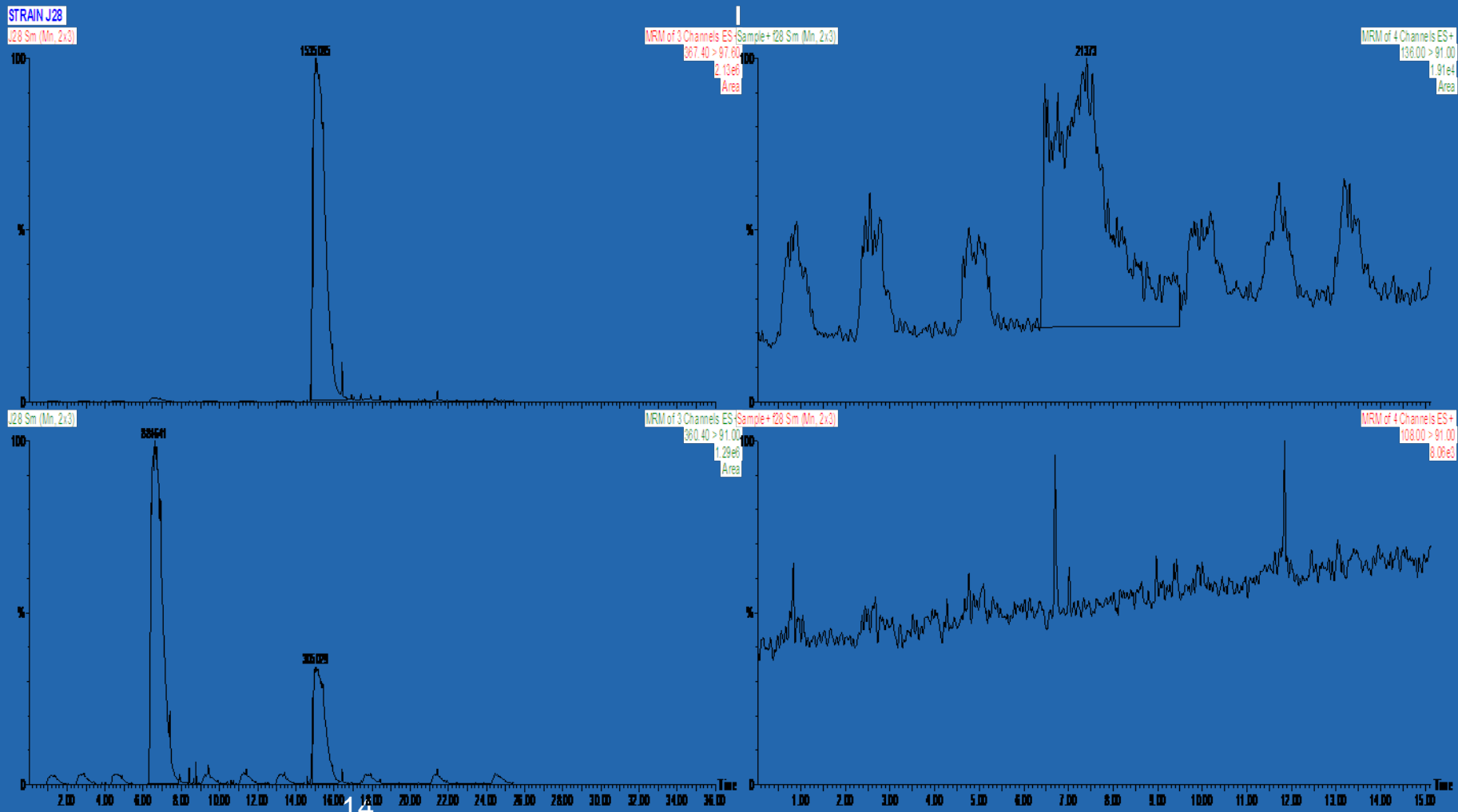
Mean % Degradation from ESI & CDBA by *Bacillus niabensis* in 28days of incubation



Mean % Degradation from ESI & CDBA by *Thalassospira sp.* in 28days of incubation



Chromatograms From Analysis



Conclusion

In the study, it can be concluded that four strains were able to utilize BDHAC at low concentrations.

Future Work

The research is ongoing and further investigations are on to check for other possible degradation products (metabolites) and propose a possible degradation pathway for the breakdown of the BDHAC by these strains.

Questions

