



Advanced BioCatalytics Corporation



Multifunctional Protein-Surfactant Surface Washing Agent

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Alameda, California. February 24, 2015

Definition by the US EPA

“Surface washing agent is any product that removes oil from solid surfaces ... such as beaches and rocks, through a detergency mechanism, and does not involve dispersing or solubilizing the oil into the water column.”

Accell Clean[®] SWA

Certifications

- Listed in the U.S. EPA NCP product schedule as Surface Washing Agent
- Licensed by the California Dept. of Fish & Wildlife as Oil Spill Cleanup Agent /Surface Washing Agent
- Was approved by the Unified Command for Deepwater Horizon oil spill decontamination

Core Technology - PSC

- Based on Protein-Surfactant Complexes
 - combination of commonly used surfactants
 - with non-enzymatic proteins from baker's yeast
- Enhancing surfactant efficiencies
- Accelerating natural biodegradation of residual petroleum contamination
- 9 US Patents issued

Mechanical Effect

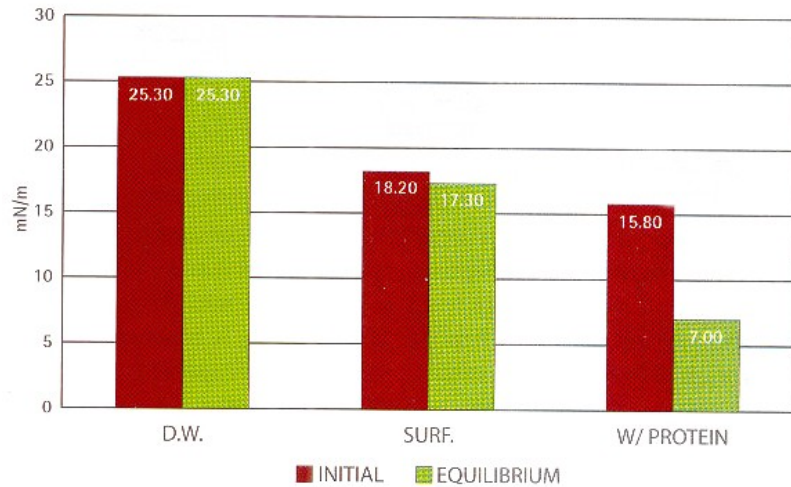
Cleaning Enhancement

Protein-Surfactant Complexes (PSC)
provide significant reduction of

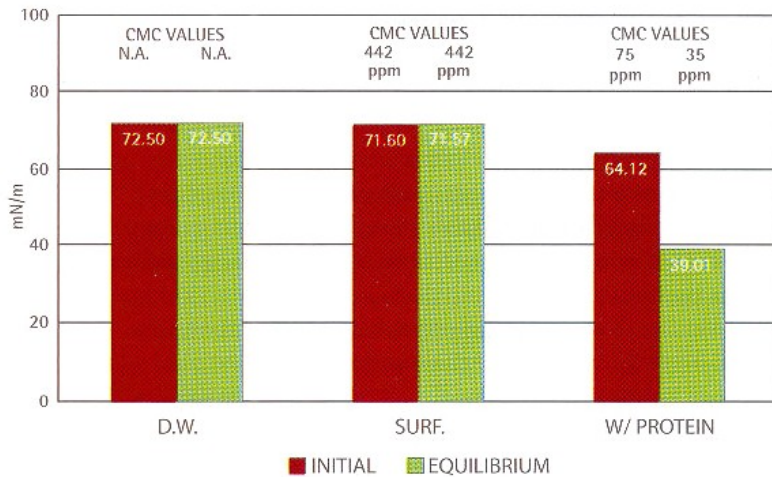
- Surface tension (ST),
- Interfacial tension (IFT),
- Critical micelle concentration (CMC).

This yields enhanced detergency and cleaning at lower concentration of the product in water, beyond achievable with surfactants alone.

Mechanical Effect - Investigation



Decrease of IFT with PSC compared to surfactant alone



Decrease of ST and CMC with PSC compared to surfactant alone



"Changing the nature of surfactants"
Ind. Biotech., Vol. 1, No. 4 (2005)

Biological Effect

Bioremediation Acceleration

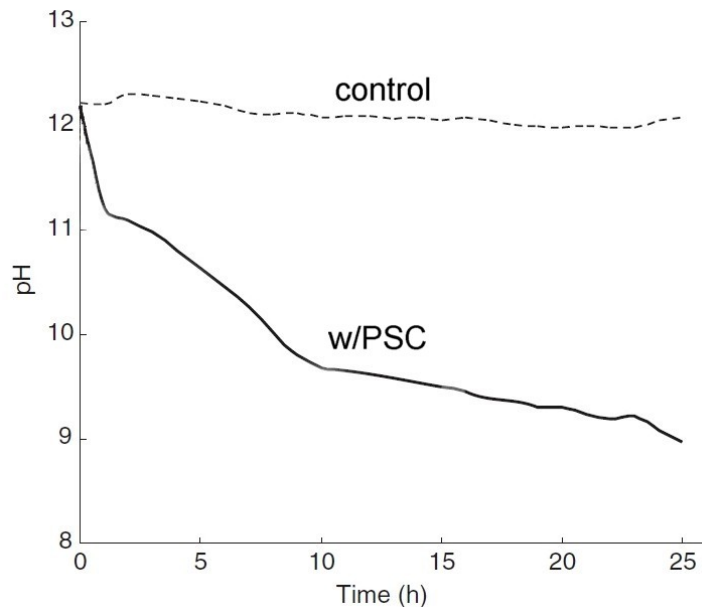
Protein-Surfactant Complexes (PSC) stimulate native oil-consuming bacteria to ingest more oil from the environment without greater growth of bacterial biomass.

This accelerates natural biodegradation of residual petroleum contamination on shoreline, plants, soil and water.

Biological Effect - Investigation

Increase of oil consumption by bacteria if PSC added

Total Organic Carbon	Control	w/PSC
Nutrient TOC (mg l^{-1})	175	353
Biomass TOC (mg l^{-1})	143	147
C in exhausted CO_2 (mg l^{-1})	50	198



Loss of alkalinity in a model cell with PSC added (causing the cell membrane to leak H^+ ions in). Alkalinity in live cells results from food oxidation and stores energy for growth and reproduction.

Journal of Applied Microbiology

Yeast protein-surfactant complexes uncouple microbial electron transfer and increase transmembrane leak of protons

C.W. Podella, N. Hooshnam, S.M. Krassner, M.G. Goldfeld

Published Online: Dec 1 2008



"Yeast protein-surfactant complexes ... increase transmembrane leak of protons"
J. Appl. Microbiol., Vol. 106, No. 1 (2009)

Accell Clean[®] SWA

Applications

- Cleaning shoreline rocks, piers, etc.
- Cleaning shoreline vegetation
- Beach sand cleaning
- Equipment decontamination onshore

Accell Clean[®] SWA

Advantages

- Cleans more thoroughly
- Cleans with less labor and less product
- Stimulates bioremediation of residual oil
- Safe for people and environment
 - does not contain harmful solvents
 - is pH neutral and biodegradable

Accell Clean[®] SWA

Equipment Decontamination Onshore

Excellent performance in 2010 Oil Spill Cleanup in Gulf of Mexico



**Cleaning a pump with high-pH cleaner
- required 6 men working for 2 hours,
with scrubbing and wiping**



**Cleaning a pump with Accell Clean[®]
- required 2 men working for 0.5 hour,
just spraying and rinsing, no wiping**

Accell Clean[®] SWA

Equipment Decontamination (cont.)

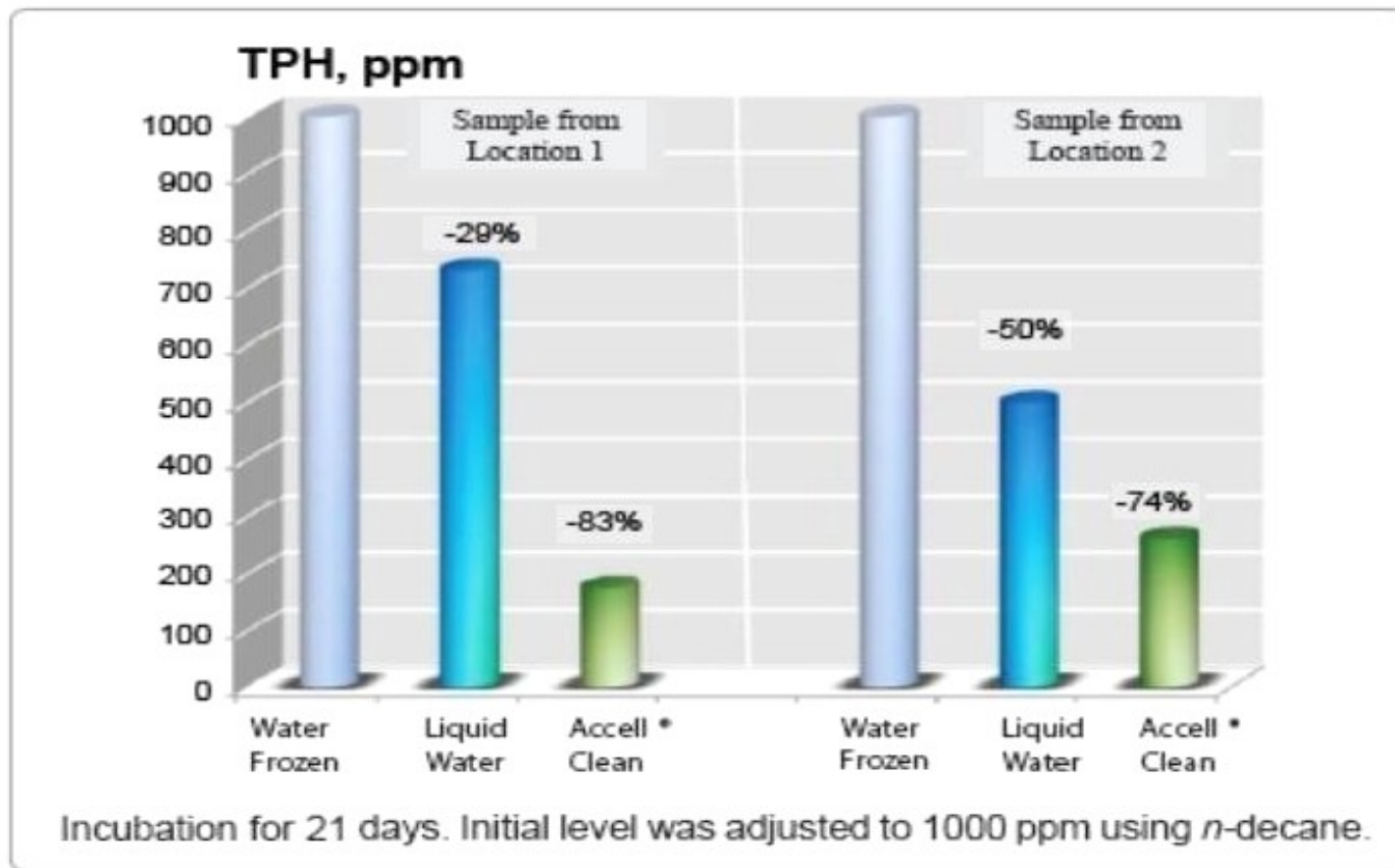


Underside of the pump after washing with Accell Clean[®]

Accell Clean[®] SWA

Helping Biodegradation of Residual Oil in Water

Reduction of Total Petroleum Hydrocarbon (TPH) in Ocean Water
- taken near Louisiana Shore after 2010 Oil Spill in Gulf of Mexico



Accell Clean[®] SWA Beach Sand Cleaning

Tested on beach in Alabama after 2010 Oil Spill in Gulf of Mexico



**Before washing
>2% oil content**

**After washing
< 0.1% oil**

**Mobile Sand-Cleaning Machine
by Proven Technologies
- using 1% solution of Accell Clean[®]**

**Cleaning capacity of the machine -
50 cubic yards of sand per hour**

Accell Clean[®] SWA

Washing Oiled Soils and Solid Waste

Washing with Accell Clean[®] SWA in Sand-Cleaning Machine

- Soil Contaminated by Oil Spills from Pipelines
- Sediments from Crude-Oil Storage Tanks
- Drill Cuttings from Oil Wells



Before washing



**After washing
with 1% solution
of Accell Clean[®] SWA**

Advantage of On-Site Cleaning of Oiled Sand or Soil

- Avoiding hauling of hazardous waste to landfill
- No need for bringing sand for replacement
- No expenses for transportation and disposal
- Avoiding contingent liabilities



Mobile sand-cleaning machine

