Humate Remediation of Petroleum Contaminated Shorelines

Presentation to the U.S. Senate Subcommittee of Oceans, Atmosphere, Fisheries, and Coast Guard, July 21, 2010
"Turning Ideas in Action: Ensuring Effective Clean-up and Restoration in the Gulf"

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Proposal:
Use humate to remediate and restore petroleum contaminated shorelines in the Gulf of Mexico

- **Simple Technology for a Complex Problem**
  - Simple application and treatment methods
- **Environmentally friendly**
  - Certified organic; used globally for agricultural purposes
- **Improve soil & sediment structure**
  - Foster vegetation growth
- **Sorption of petroleum hydrocarbons**
  - Decrease contaminant transport & bioavailability
- **Enhance biodegradation of petroleum hydrocarbons**
  - Supply nutrients, decrease petroleum toxicity, microbial growth medium

What's "Humate"?

- Highly heterogeneous mixture of lignite-like organic material, along with small amounts of humin, clay, and silicates.

- Originates from the diagenesis of terrestrial, marine, or lacustrine organic matter.

- 60 – 90% humic and fulvic acids

- Est. U-Mate reserves: 10 M tons

Unprocessed humate at mine located at Gallup, New Mexico USA

Current agricultural uses of U-Mate humate

- **Dole Food Company**
  - Honduras, Hawaii, and the Philippines
- **Burpee Seed Company**
- **Nutrimate, Ltd** (United Kingdom)
- **Al Khalediah Farms** (Saudi Arabia)

Humate Remediation of Petroleum Contaminated Soils

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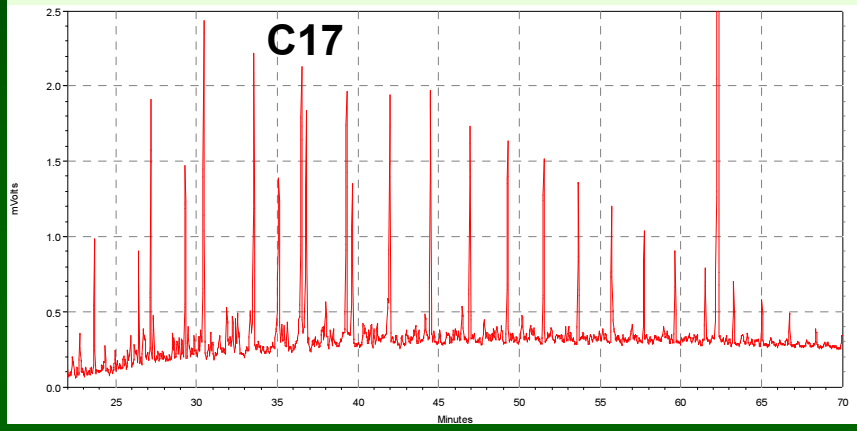
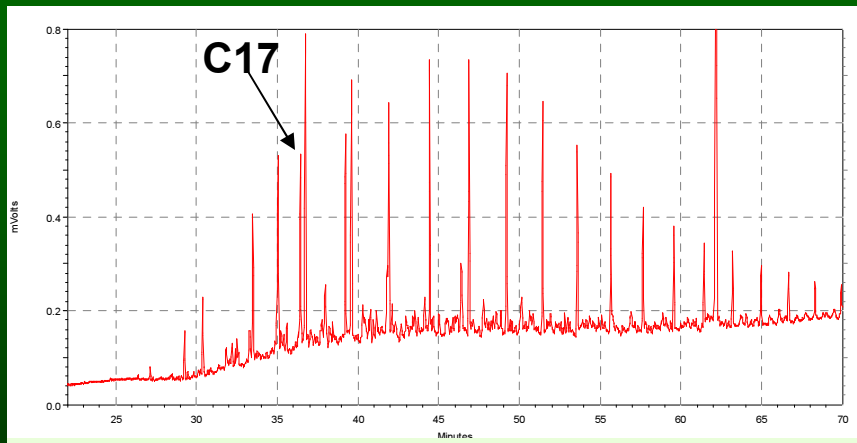
Crude Oil Contaminated Soil:
Control, Day 3



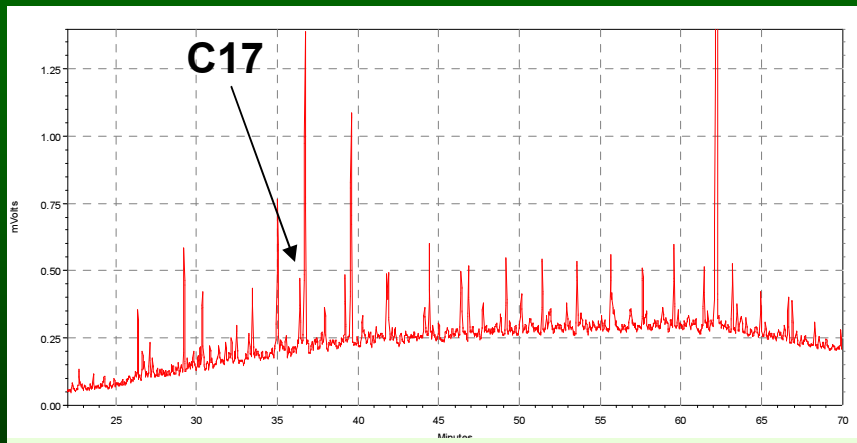
Microcosm Studies:

- Humates facilitate the degradation high-end linear alkanes

- Combination of sorption and biodegradation processes



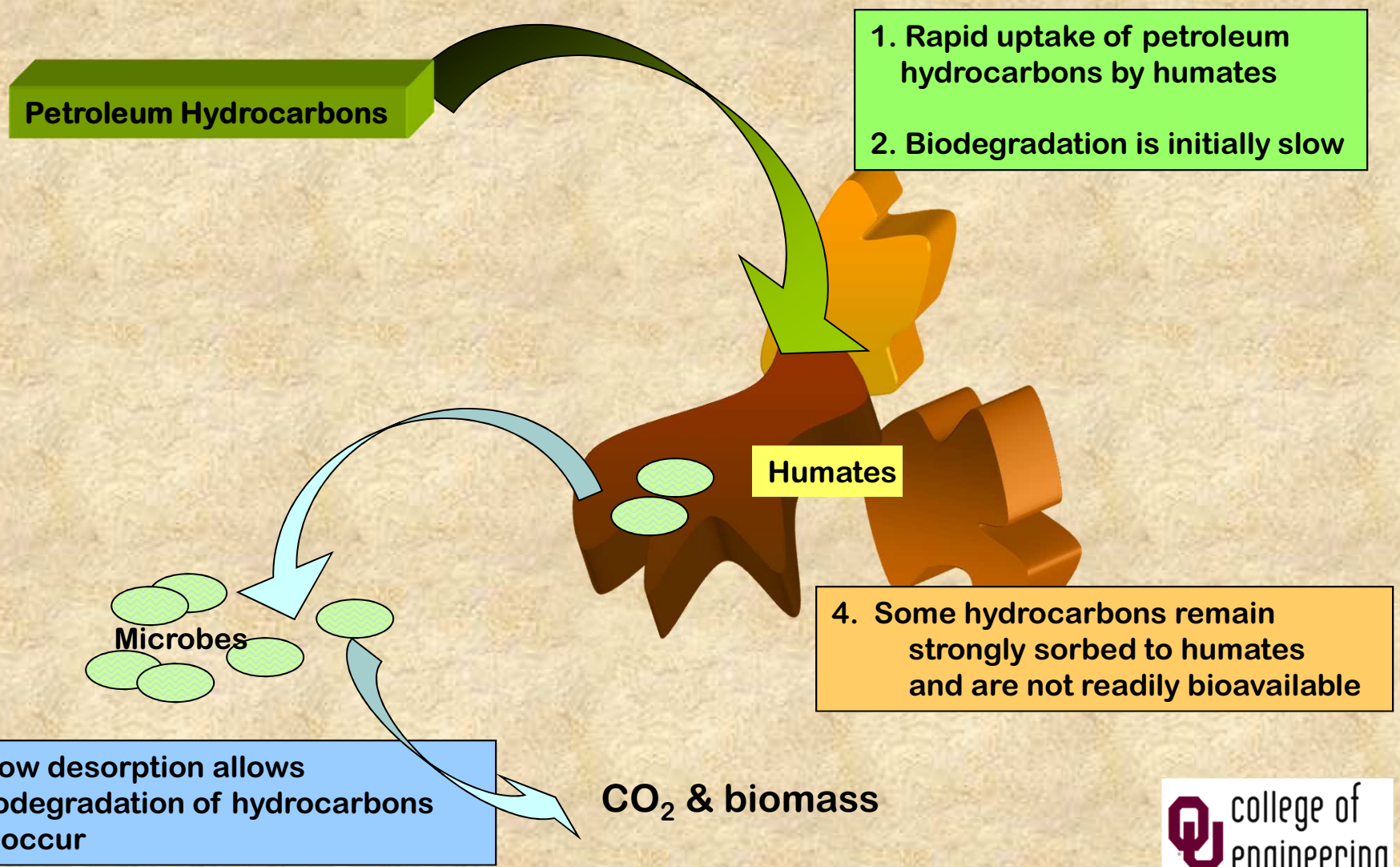
Crude Oil Contaminated Soil:
Control 3 Months



Crude Oil Contaminated Soil
+ Humate 3 Months

Proposed Humate Remediation Model

Sorption and Enhanced Biodegradation of Petroleum Hydrocarbons



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Treatment Methodology
Petroleum contaminated shorelines

- **Application procedure**
  - Mechanical incorporation into sediment (depth ~ 5 cm)
  - Application amount: 50 g humate/m^2 (10 lb humate/1000 ft^2)
  - Application rate: every 2 months for one year
  - Slow degradation sites: include lipophilic nutrients

- **Remediation monitoring strategy**
  - Twenty sampling events; over two years
  - Monitor sorption and biodegradation processes
  - Identification of aqueous-soluble compounds and adsorbed petroleum compounds
  - Gas chromatography – mass spectrometry, pyrolysis GC/MS

Economic Analysis
Petroleum contaminated shorelines

Estimated costs for the treatment and monitoring of five miles of shoreline

- Cost of New-Mex Humate®, fob Houston	$21,500,000
- Monitoring	$ 1,584,000
- Shipping from Houston	$ 1,955,000
- Application equipment and labor	$ 500,000
- On-site storage	$ 20,000
Total estimated costs	$25,559,000

Approximately $5.1 M / mile shoreline

- 20 foot width shoreline; 2 inch treatment depth
- 12 months of applications (1 application every 2 months)
- 24 months of monitoring

Activities towards Implementation
Petroleum contaminated shorelines

- **Proposal submitted to the Office of Gov. Bill Richardson, New Mexico**
  - "Humate Enhanced Remediation of Petroleum-Contaminated Shoreline Sediments along the Gulf of Mexico
  - May 28, 2010

- **RDC BAA Whitepaper submitted to USCG**
  - "Oil Remediation Proposal – An Organic Solution"
  - Deepwater Horizon Response BAA HSCG32-10-R-R00019
  - June 24, 2010