

# 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

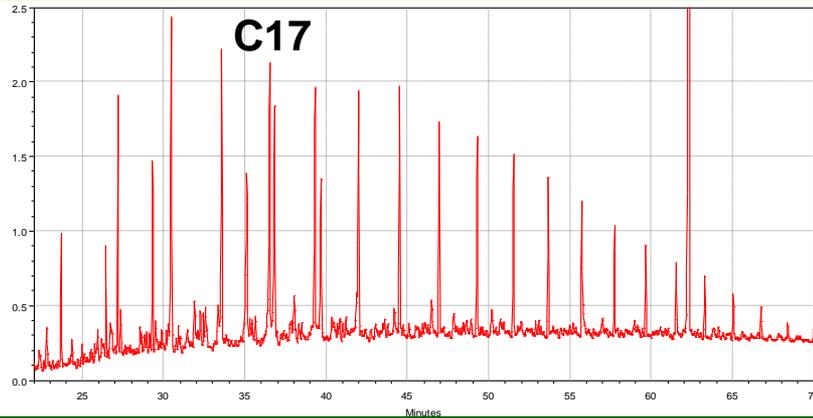
# Current agricultural uses of U-Mate humate

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



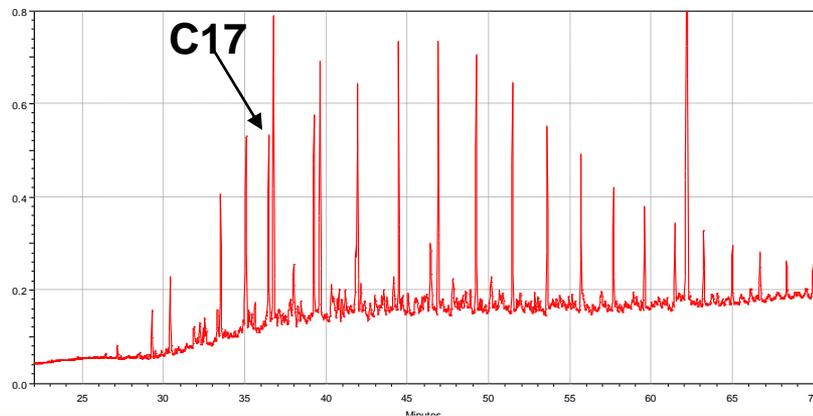
# Humate Remediation of Petroleum Contaminated Soils

## Crude Oil Contaminated Soil: Control, Day 3

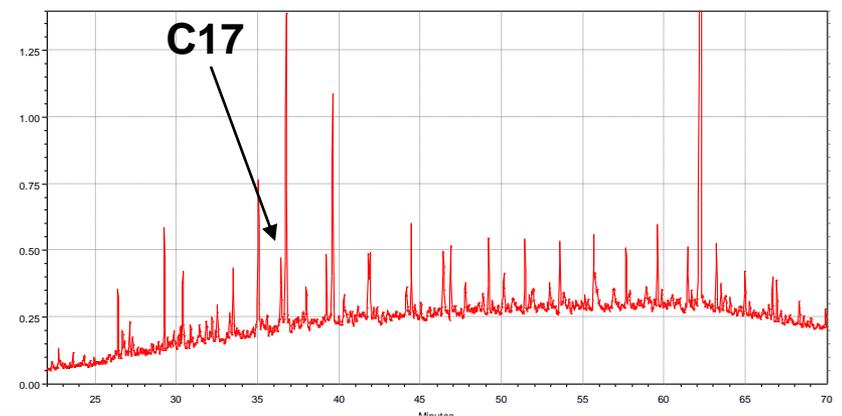


## Microcosm Studies:

- Humates facilitate the degradation high-end linear alkanes
- Combination of sorption and biodegradation processes



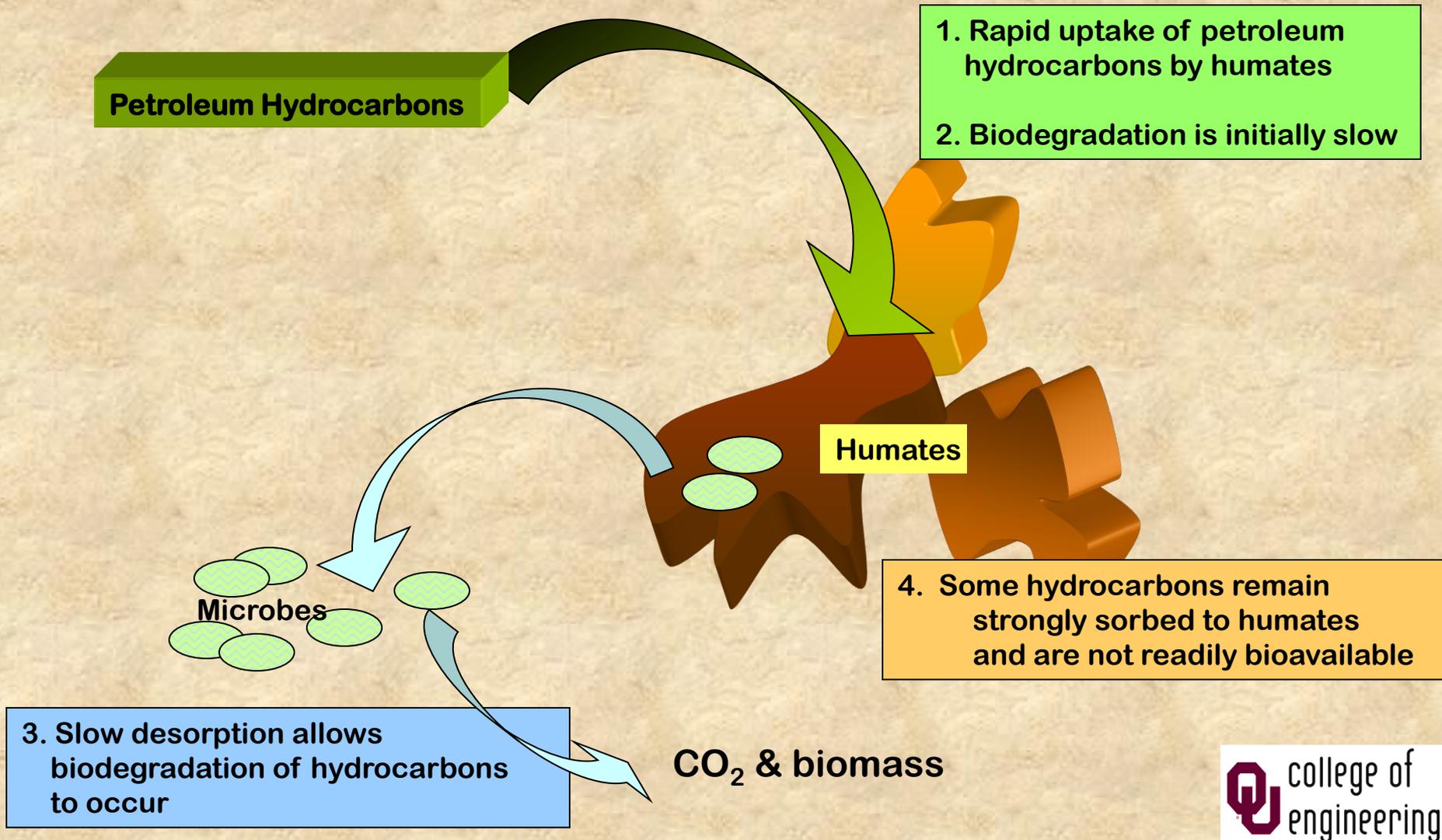
## Crude Oil Contaminated Soil: Control 3 Months



## Crude Oil Contaminated Soil + Humate 3 Months

# Proposed Humate Remediation Model

Sorption and Enhanced Biodegradation of Petroleum Hydrocarbons



# Treatment Methodology

## Petroleum contaminated shorelines

- **Application procedure**

- Mechanical incorporation into sediment (depth  $\sim$  5 cm)
- Application amount: 50 g humate/m<sup>2</sup> (10 lb humate/1000 ft<sup>2</sup>)
- 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	\$ <u>20,000</u>
 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