Aerial Electrostatic System for Weather Modification

A novel process for enhancing rainfall has been invented using only tap water. The water is electrically charged before it is released into warm continental or maritime convective clouds with an agricultural aircraft. This technique has been shown to double the amount of additional rainfall generated compared to conventional cloud seeding methods.

Docket No: 36.18 + 79.21

Contact: Dennis.Goodes@usda.gov

Benefits

- Doubles the additional rainfall generated by cloud seeding compared to conventional methods
- Uses only tap water instead of silver iodide or calcium chloride
- Operating costs are greatly reduced

Applications

- Effective, cost efficient and environmentally friendly method of enhancing rainfall from warm continental or maritime convective clouds

Process for Producing Hydrocarbons Useful for Jet Fuel

The synthesis of renewable jet fuel is a high-profile objective. Catalysts that perform a decarboxylation reaction needed for this process have been developed. However, the amount of aromatic molecules they form in the product fuel is low, so low that those products cannot be used at many blend ratios. ARS developed a new decarboxylation technology that produces fuel aromatic contents greater than prior technologies. This new renewable fuel can be blended with conventional jet fuel in any proportion and still leave sufficient aromatic molecules in the fuel. The new technology has been studied under a variety of conditions and compares well with a previously invented method.

Docket No: 40.19

Contact: Renee.Wagner@ars.usda.gov

Benefits

- Can turn oleic acid into a suitable jet fuel hydrocarbon
- Can be used in combination with other ARS technologies
- Has been studied with High Oleic soybean oil

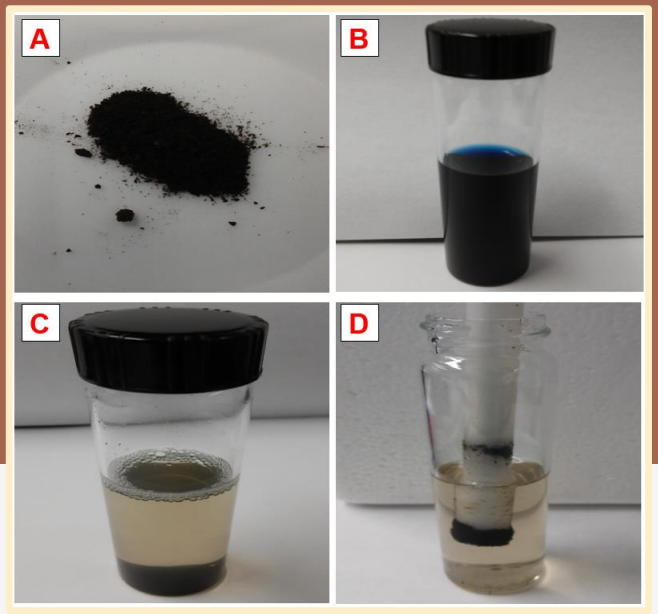
Applications

- A catalytic process for producing a biobased fuel product that can be used in applications which require significant aromatic content in the fuel, such as jet fuel

Hemoglobin/Iron Oxide Composite for the Removal of Organic Dye

A novel hemoglobin/iron oxide composite for the removal of organic dyes and other contaminants from wastewater. The composite has high removal efficiency for all the different classes of dyes studied. It possesses the extra advantage of being easily recovered after use using a magnet. The used composite can be regenerated and re-used many times.

Docket No: 177.16 + 57.20
Contact: Jim.Poulos@usda.gov



Benefits

- Easy synthesis
- Re-usable
- Minimization of agricultural waste
- Low cost

Applications

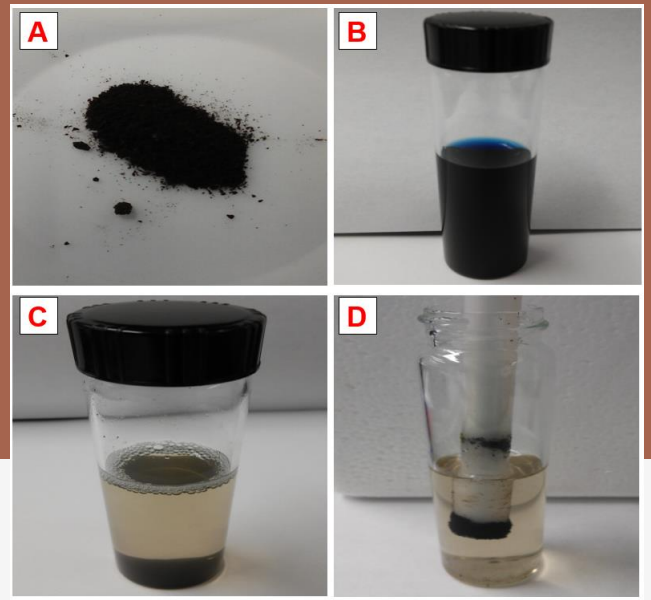
- Removal of dyes and other contaminants from industrial process water

Reusable Adsorbent for Contaminant Removal

A reusable adsorbent to remove contaminants and pollutants from wastewater and waterways. A fringe of molecular "hairs" gives the material high adsorption capacity. A magnetic component simplifies adsorbent use and reprocessing. The adsorbent can be washed and reused with minimal loss in performance.

Docket No: 156.18

Contact: Jim.Poulos@usda.gov



Benefits

- Polypeptide "hairs" on adsorbent particle enhance performance
- Magnetic component allows for simple adsorbent recovery
- Reusability reduces cost and waste

Applications

- Wastewater treatment
- Substitute for activated charcoal
- Removal of contaminants such as dyes and pesticides from water

Processes and Treatment Systems for Treating High Phosphorus Containing Fluids

A process for treating manure slurries to concentrate manure particulate matter into solid form that is easily transportable. The process involves liquid-solid separation and chemical treatment where greater than 90% of the total phosphorous is concentrated into solid form while most of the nitrogen remains in the liquid.

(Environmental, Manufacturing)

Docket No: 45.14 + 165.17

Contact: Jim.Poulos@usda.gov

Benefits

- Economical
- The system can be compact and mobile

Applications

- Efficiently remove livestock manure phosphorus from areas of excess to areas of shortfall

System for Non-invasive Measurement of Soil Chlorine

A device for making non-invasive measurements of chlorine elemental content *in situ* from the surface of the soil. The device is a portable field unit using a neutron generator positioned on the surface of the soil to generate fast neutrons that penetrate the soil. The device makes measurements in a large volume of soil and can determine the Cl content regardless of chemical component present. Results are generated immediately following scanning. The device can be utilized for the remediation of contaminated soil for contaminates such as polychlorinated biphenyl (PCB) and perchlorate.

Docket No: 125.19 + 112.15

Contact: Tanaga.Boozer@usda.gov

Benefits

- Non-invasive measurements of Cl content in soil
- Large volume soil sampling and immediate results
- Detection of any Cl containing contaminate without specific laboratory analysis

Applications

- This device can be used to detect Cl containing contaminates without the costly soil sampling, preparation, and laboratory analysis normally required. The large sample volume reduces uncertainty from site sampling and immediate results facilitates planning for soil remediation.

System for Non-invasive Measurement of Nitrogen

A device for making non-invasive measurements of nitrogen (N) elemental content *in situ* of N containing material. The device is a portable field unit using a neutron generator positioned near the material. The device makes measurements in a large volume and can determine the N content regardless of chemical components present. Results are generated immediately following scanning. The device can be utilized for measuring N in manures or compost or can be used for the detection of large N containing objects such as explosives.

Docket No: 112.15

Contact: Tanaga.Boozer@usda.gov

Benefits

- Non-invasive measurements of N content in material
- Immediate results without sample preparation or laboratory analysis
- Detection of any N containing material without specific laboratory analysis, such as for explosives

Applications

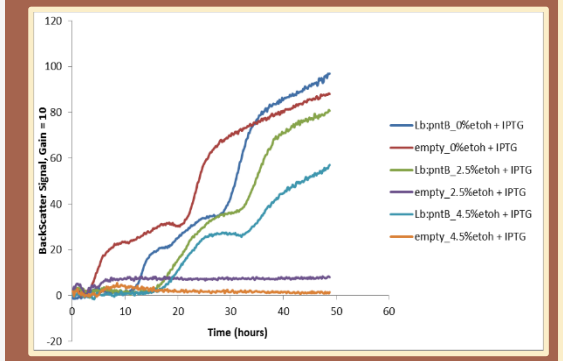
- Can be used to measure N content in materials without the costly laboratory analysis. Immediate results allows for no lag time resulting in timely determination of compost processing and N content for fertilizer application. Also, can be used to detect explosives and to determine the likely explosive material type.

Increased Alcohol Tolerance Using the *pnt*AB Gene

A strain of *Lactobacillus buchneri* was isolated from a commercial ethanol production plant. The strain was found tolerant to up to14% ethanol. Complete genome sequence of the strain and further comparison analyses with *Oenococcus oeni* genome led to the identification of the pntAB locus as the functional element in this tolerance. The pntAB genes also confer ethanol tolerance traits in other microbes as included in the invention.

Docket No: 195.16

Contact: Renee.Wagner@usda.gov



JB
Journal of Bacteriology

Benefits

- Robust alcohol tolerance genes can be introduced in other microbes to confer alcohol tolerance trait and increase survival in alcohol related stress environmental conditions
- Could result in higher product concentrations and improve product recovery

Applications

- Developing microbes with increased ethanol tolerance particularly in wine making and in industrial ethanol fermentation. Strains that tolerate higher alcohol concentrations can reduce production cost and increase production efficiency for industrial fermentation

Novel Ferulate Esterase Isolated from Lactobaccillus Fermentum

The cDNA and amino acid sequences of a ferulate esterase obtained from *Lactobacillus fermentum* NRRL B-1932 is determined. An expression vector for expression of the ferulate esterase gene is generated. Recombinant bacteria producing ferulate esterases are generate. The recombinant ferulate esterase gene and transcribed protein contains a linker sequence and 6x HIS tag for purification. Enzymatic activity of the recombinant protein is determined.

(Energy, Environmental, Life Sciences)

Docket No: 165.12

Contact: Renee.Wagner@usda.gov

Benefits

- Potential for mass production of purified and highly active ferulate esterase

Applications

- Ferulate esterase is a critical enzyme in hydrolyzing lignocellulosic biomass materials
- Can be used in the production of ferulic acid which is used in foods and skin care products because of antioxidant properties
- The enzyme can be used for biomass degradation in various applications including fuels, animal feed, textile/ laundry, pulp, and paper industries

Compositions and Methods of Treating Animal Manure

Manure amendment and method for controlling ammonia emissions from poultry litter and reducing phosphorus runoff. The manure amendment is produced by adding various combinations/ratios of sulfuric acid, bauxite and water to alum mud, a waste product from manufacturing alum (aluminum phosphate).

(Environmental)

Docket No: 50.14

Contact: Tanaga.Boozer@usda.gov

Benefits

- The manure amendment is economical to produce
- Has many of the properties of aluminum sulfate
- The exact formulation of the final product can be tailored to fit specific manure type

Applications

- Controlling ammonia emissions from poultry houses and reducing phosphorus runoff
- Treated manure lowers the concentration of ammonia in animal rearing facilities and improves environmental, health and/or animal performance

Heavy Metal Remediation Via Modified Bio-Oils

A process for the removal or extraction of metals, including heavy metals, precious metals and other metals, from a variety of solid, liquid or gas phase materials. Metal species are removed by contacting the material suspected of containing one or more metals with a fatty acid (or ester) for a period of time and under conditions effective for the sequestration of the metal species. The fatty acid or ester comprising of sequestered metal species is insoluble in water and may then be separated and recovered from the treated material.
(Environmental)

Docket No: 12.12 &133.15

Contact: Renee.Wagner@usda.gov

Benefits

- Ability to conduct remediation in an environmentally friendly, bio-based manner
- Simplicity of process to localized contaminations such as spills, offers a broader range of markets
- Over 90% by weight of the metal species content, preferably 99% or more, can be removed from the material being treated

Applications

- Removal of toxic metals from contaminated drinking water and other freshwater systems (such as lakes, ponds, estuaries, rivers and streams
- Removal of toxic metals from waste discharge streams of agricultural, municipal sewage and from contaminated soil from agricultural
- Removal of toxic metals from industrial or mining sites and from flue gases discharged from commercial or industrial sites

Automated Sampling System

A brief case sized field-portable chromatography instrument designed to test water samples. The automated sampling system floats in a body of water and continuously extracts and tests samples. The data gathered by the system is wirelessly transmitted to a shore-based date processing unit.

(Electronics & Hardware, Environmental)

Docket No: 49.15

Contact: Jim.Poulos@usda.gov

Benefits

- Collects real-time and accurate water quality data for long periods without maintenance or servicing
- The instrument is portable, automated and not labor-intensive
- Operates on solar or self-contained battery
- The device can be submerged in water

Applications

- Ion chromatograph to analyze dissolved anions or cations autonomously on site

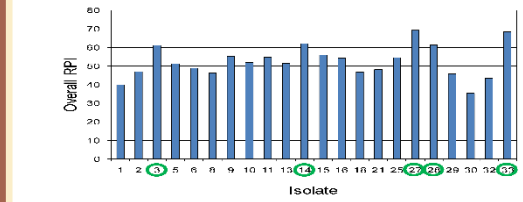
Novel Yeast Strains

Using directed evolution, several strains of Scheffersomyces stipitis are generated that better utilize xylose and glucose for improved ethanol production. These improved strains are obtained by culturing the yeast on hydrolyzates of differing concentrations of xylose, ethanol, and by-products.

(Manufacturing, Energy)

Docket No: 183.11 & 54.16

Contact: Renee.Wagner@usda.gov



Benefits

- This is a native xylose-fermenting yeast that has not been genetically modified
- Yeast strains are evolved and selected to be tolerant of diverse nutrient environments and inhibitory hydrolyzates of lignocellulosic biomass
- Strains ferment both glucose and xylose in enzyme hydrolyzates produced from 20% solids loading acid or base pretreatments

Applications

- These strains could be used to ferment both hexose and pentose sugars to produce ethanol from the lignocellulosic corn hull fiber generated in corn to ethanol plants or from corn stover
- The strains can also be used to produce ethanol from base- or acid-pretreated switchgrass and other forms of herbaceous lignocellulosic biomass
- Stains can also be used to produce ethanol from base or acid-pretreated woody biomass residues

Synthetic Promoter for Xylose-Regulated Gene Expression in Saccharomyces Yeasts

Synthetic promoters for use in Saccharomyces yeast to control gene expression in response to the presence of xylose. Upon xylose availability, the prokaryotic DNA binding protein is released from the synthetic promoter, allowing gene expression.

(Manufacturing, Energy, Materials)

Docket No: 283.12

Contact: Renee.Wagner@usda.gov

Benefits

- These synthetic promoters will allow tunable control of gene expression for engineering *Saccharomyces* yeasts for efficient xylose fermentation

Applications

- Lignocellulose-based processing where it is desirable to use a *S. cerevisiae* strain for ethanol, advanced biofuels or renewable chemicals production