IOWA STATE UNIVERSITY

OF SCIENCE AND TECHNOLOGY

Hydropowered Turbine System

APPLICATION AREAS

Power Generation

ABSTRACT

Hydroturbines have long been used for power generation. While hydroelectric power generation has some advantages over other energy sources (such as low carbon footprint after construction and a continuous energy supply), large hydroelectric power systems (those that generate 10 MW or more) require significant amounts of capital to construct, and may have environmental and cultural impacts (e.g., loss of property, scenic or historic sites, farmland and wildlife habitat through reservoir construction) that make new projects difficult to initiate. In addition, drought or other factors can reduce the amount of power that is generated by these systems. Smaller size hydroturbine systems—which include pico (<5 kW), micro (5-100 kW), mini (100 KW to 1 MW) and small (1 to 10 MW) ranges—also suffer from drawbacks such as relatively high capital costs, inefficiency, impacts on downstream water quality and wildlife (fish), and costly maintenance. To overcome these drawbacks, a researcher has developed an improved hydroturbine runner design for use in hydropowered turbine systems. This design incorporates a divergent flow passageway between turbine blades for exit flow kinetic energy recovery, and also includes a turbine blade angle adjustment mechanism for smoothing the entrance flow stream pattern and reducing flow turbulence energy loss. As result, the efficiency of the hydroturbine is improved and there is reduced impact on water quality and wildlife.

BENEFITS

- Efficient (peak efficiency on pico-scaled demonstration head is 85%)
- Eco-friendly (improves turbulent mixing and aeration for better water quality and is less harmful to wildlife)
- Economical (reduces costs related to manufacturing, plant construction, and operation and maintenance)
- Versatile (suitable for pico- to medium-scale projects)

RELATED TECHNOLOGY

This technology is related to ISURF #2455, Free Standing Hydroelectric Power Generation System

INVENTOR

Dr. David T. Kao

INTELLECTUAL PROPERTY STATUS (February 2011)

Patents issued: US Patent Nos. 5,780,935 and 6,239,505

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IOWA STATE UNIVERSITY

OF SCIENCE AND TECHNOLOGY

Hydropowered Turbine System

APPLICATION AREAS

Power Generation

ABSTRACT

A hydroelectric power generation system consists of two essential components, namely a hydraulic-turbine and an electric power generator which is connected to the hydroturbine through a long, sealed shaft to prevent water from entering the generator housing. While hydroelectric power generation has some advantages over other energy sources (such as low carbon footprint after construction and a continuous energy supply), large hydroelectric power systems (those that generate 10 MW or more) require significant amounts of capital to construct, and may have environmental and cultural impacts (e.g., loss of property, scenic or historic sites, farmland and wildlife habitat through reservoir construction) that make new projects difficult to initiate. In addition, drought or other factors can reduce the amount of power that is generated by these systems. Smaller size hydroturbine systems—which include pico (<5 kW), micro (5-100 kW), mini (100 kW to 1 MW) and small (1 to 10 MW) ranges—also suffer from drawbacks such as relatively high capital costs, inefficiency, impacts on downstream water quality and wildlife (fish), and costly maintenance. To overcome these drawbacks, a researcher has developed a hydroelectric power generation system in which a vertical needle valve is used for flow regulation and control is also used as the housing of the electric generator. This approach enables the the hydroturbine and electric generator to be combined in a single compact and free-standing unit, and has broad applicability for hydroelectric power generation systems with ranges of 1 to 80 m for the water head and power outputs of kW to MW on new or existing dams. This system also enables open flow passage with no cavitation, minimizing injury and mortality of passing fish.

BENEFITS

- Efficient (up to 8% more efficient than other turbine types)
- Economical (savings of 35-66% on station costs are possible)
- Environmentally friendly (improves water quality and minimizes fish injury)
- Versatile (has utility for systems with outputs ranging from kW to MW)
- Simple (easy installation and maintenance)

RELATED TECHNOLOGY

This technology is related to ISURF #1962, Hydropowered Turbine System

INVENTOR

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INTELLECTUAL PROPERTY STATUS (February 2011)

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Bacteria for Bioremediation of Odors in Waste Lagoons

APPLICATION AREAS

Odor Control

ABSTRACT

Anaerobic waste lagoons are commonly employed for management of livestock waste because they can treat high waste load rates, do not require aeration, and can be operated at lower costs than aerobic waste lagoons. However, anaerobic waste lagoons are often associated with noxious odors arising from the anaerobic digestion of complex volatile organic compounds (VOC), which creates environmental problems and impacts neighboring homes or businesses. Researchers at ISU have isolated and identified a new species of bacteria, Rhodobacter PS9, which may utility for odor control of anaerobic waste lagoons. This organism propagates easily and can be readily stored, transported and used, making it an excellent candidate for bioremediation. The bacteria utilitzes odor and odor forming toxic compounds, such as volatile fatty acids and phenolic compounds, as substrates. As a result of this metabolic activity, odors are reduced and toxic compounds are broken down into harmless by-products. This bacterial strain also has potential for treatment of industrial wastes containing volatile fatty acids and phenolic compounds.

BENEFITS

- Robust (the bacteria are easy to propagate, store and transport)
- Effective (bacterial metabolism of VOC and other toxic compounds results in a significant decrease their concentration)
- Simple (works under naturally occurring conditions and does not require addition of antibiotics or other exogenous compounds)

REFERENCE

1: Do, Young S., Thomas M. Schmidt, James A. Zahn, Eric S. Boyd, Arlene de la Mora, and Alan A. DiSpirito. 2003. Role of *Rhodobacter* sp. Strain PS9, a Purple Non-Sulfur Photosynthetic Bacterium Isolated from an Anaerobic Swine Waste Lagoon, in Odor Remediation. Appl. Environ. Microbiol. **69**:1710-1720.

INVENTORS

Drs. Alan A. DiSpirito, Young S. Do, Gregory J. Phillips, and James A. Zahn

INTELLECTUAL PROPERTY STATUS

Patent issued: US Patent No. 6,489,156

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IOWA STATE UNIVERSITY
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Technology for Compact, Environmentally Friendly Air Conditioners and Heat Pumps

APPLICATION AREA

Space Conditioning Equipment Manufacturers; Chemical Processing and Power Generation Equipment Manufacturers

ABSTRACT

Currently available heat and mass exchangers, key components in absorption heat pumps, are large and expensive to build. In spite of their favorability as environmentally friendly alternatives to chlorofluorocarbon (CFC)-based air conditioners, their size and expense make them viable only for very large scale operations. To overcome this drawback, ISU researchers developed a new design for heat and mass exchangers that are compact, modular, versatile, easy to design and fabricate, and can be constructed using existing heat transfer technology and extremely simple heat transfer surfaces. These heat and mass exchangers could be uniformly used for almost all components in an absorption heat pump, including absorbers, desorbers, condensers, evaporators and rectifiers.

BENEFITS

- Environmentally friendly (reduces use of ozone-depleting CFCs)
- Economical (fluids and exchangers used are inexpensive, and operational costs are low)
- Versatile (has utility for a variety of industries that rely on thermal systems)

INVENTOR(S)

Dr. Srinivas Garimella

INTELLECTUAL PROPERTY STATUS

Patents issued: US Patent Nos. 6,802,364 and 7,066,241

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Static Granular Bed Reactor

APPLICATION AREAS

Wastewater Treatment

ABSTRACT

Wastewater from a variety of industries such as chemical, pulp and paper, pharmaceutical, dairy, brewery, and meatpacking has been successfully treating using a variety of anaerobic treatment systems. While these systems offer a number of advantages over aerobic treatment systems, such as more efficient cost of operations, anaerobic systems suffer from drawbacks such as requiring complex operation and control equipment and the need for expensive post-treatment of effluent. To overcome these drawbacks, ISU researchers have developed continuous process for wastewater treatment called a static granular bed reactor (SGBR) that provides improved treatment of wastewater and only requires a pump for feeding wastewater into the reactor. The SGBR has demonstrated high chemical oxygen demand (COD) removal efficiencies (greater than 90%) with effluent total suspended solids (TSS) below 100 mg/L after treating a variety of wastewaters. As a consequence, the SGBR has utility for high-rate anaerobic wastewater treatment for a variety of industries.

BENEFITS

- Simple (does not require mixers, separators, or other sophisticated equipment and uses a continuous process)
- Effective (produces high quality effluent, with COD removal of greater than 90%)
- Economical (can use smaller reactor volume for same performance compared to other systems)

REFERENCE(S):

1: Eric A. Evans and Timothy G. Ellis. 2010. Experimental validation of the static granular bed reactor for industrial waste anaerobic treatment. J. Environ. Eng. **136**:1139-1146.

2: Mach, K. F. E., Evans, E. A., Roth, M. J., and Ellis, T. G. (2003). "Fundamentals of the static granular bed reactor." Asian WaterQual2003, Asia-Pacific Regional Conf., International Water Association, Bangkok, Thailand.

INVENTOR(S)

Drs. Timothy G. Ellis and Kristin F. Mach

INTELLECTUAL PROPERTY STATUS

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Method and Apparatus for Filtering Gas With a Granular Filter Bed

APPLICATION AREAS
Biomass, Gas Turbine, Chemical and Refinery Industries, and Advance Power Systems

ABSTRACT
The lack of durable, low-cost filters to clean high temperature gas streams is a major hurdle in commercializing advanced power systems based on biomass and coal. Filtration schemes that are the subject of investigation to overcome this difficulty include ceramic barrier filters and moving bed granular filters. Ceramic filters suffer from several drawbacks including cost and fragility, as well as the need for periodic regeneration to remove accumulated dust. Moving granular bed filters that have been developed are expensive and have not fully solved the dust carryover problem. To address these deficiencies, **ISU researchers have developed a moving granular bed filter that employs a counterflow of gas and particles that substantially reduces the problem of dust carryover in the gas disengagement regions**. The filter design also incorporates a screen at the disengagement interface between the exiting gas and the granular bed, and results in an increased gas flow rate through the filter. In addition, the filter apparatus incorporates a unique tangential gas inlet that significantly reduces the pressure drop through the filter compared to conventional perpendicular gas inlets.

BENEFITS

- Efficient (decreases dust carryover in gas disengagement and allows higher temperature gas effluents to be used)
- Effective (tangential gas inlet reduces pressure drop compared to traditional gas inlets)
- Economical (smaller and less costly filters can be used due to higher gas flow)

REFERENCE(S):
Conference proceedings: "Filtration Efficiency of a Moving Bed Granular Filter", Joseph A. Ritzert, Robert C. Brown, and Jerod Smeenk, 2004, Proceedings of the Science in Thermal and Chemical Biomass Conversion Conference, Victoria, B.C., Canada.

INVENTOR(S)
Dr. Robert C. Brown (Mechanical Engineering), Mr. Corey Wistrom (Mechanical Engineering), and Mr. Jerod Smeenk (Mechanical Engineering)

INTELLECTUAL PROPERTY STATUS
Patent issued: US Patent No. 7,309,384

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Iron Catalysis in Oxidations by Ozone

APPLICATION AREAS

Oxidation of Aqueous Waste Streams, Water Treatment, Food Treatment and Processing

ABSTRACT

Ozone is recognized as potent and effective oxidizing agent, and has a number of commercial uses, including use as an industrial oxidant and water treatment. Ozone is attractive as an oxidant or a disinfectant because it is one of the most active and readily available oxidants, and because the formation of molecular oxygen as a by-product makes it environmentally friendly. However, ozone is not always as fast or efficient as chemical oxidants, since ozone can degrade during the reaction and cause incomplete oxidation. To overcome these limitations, ISU researchers have developed a method for using iron as an effective catalyst in oxidations mediated by ozone. By reacting iron(II) with ozone, nearly instantaneous and complete oxidation of substrates such as alcohols, ethers, aldehydes, nitriles, sulfides and sulfoxides occurs, making this a particularly useful process for waste water treatment, water purification, and other similar applications.

BENEFITS

- Rapid rate of catalysis (oxidation occurs nearly instantaneously)
- Environmentally friendly (ozone naturally decomposes to oxygen, and no toxic halogenated compounds are produced)
- Simple (catalyst is formed *in situ* using commercially available materials at the point of ozone generation)
- Versatile (may be used for any application and/or substrates for which ozone is used as an oxidant)

INVENTOR(S)

Drs. Andreaja Bakac (Ames Laboratory) and Oleg Pestovsky (Ames Laboratory)

INTELLECTUAL PROPERTY STATUS

Patent issued: US Patent No. 7,618,546

REFERENCE(S):

Publication: "Aqueous Fe^{IV}=O: Spectroscopic Identification and Oxo Group Exchange", Oleg Pestovsky, Sebastian Stoian, Emile L. Bominaar, Xiaopeng Shan, Eckard Munck, Lawrence Que, Jr., and Andreja Bakac, 2005, Angew. Chem. Int. Ed. 44:6871-6874.

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OF SCIENCE AND TECHNOLOGY

Improved Recovery of Oil from Soybeans During Processing

APPLICATION AREAS

Soybean Processing

ABSTRACT

Soybean processing methods currently use hexane to extract and recover soybean oil at efficiencies near 95%. However, hexane use suffers from safety and environmental drawbacks, and the costs for implementing this approach at soybean processing plants are high. Because of these drawbacks, aqueous extraction processing (AEP) of soybeans has been examined as an alternative approach. AEP, while environmentally friendly, is less efficient than hexane extraction. To overcome this limitation, ISU researchers have developed an improved AEP using enzymes to facilitate recovery of oil. This enzyme-assisted AEP, or EAEP, results in highly efficient extraction and capture of soybean oil from extruded soybean flakes, soybean flour, and cream.

BENEFITS

- Efficient (EAEP results in 90% oil extraction recovery compared to 60-75% obtained using AEP methods)
- Effective (can be used to recover free oil from "cream")
- Environmentally friendly (obviates the use of the toxic solvent hexane)

REFERENCES

1: "Destabilization of the Emulsion Formed during Aqueous Extraction of Soybean Oil", Ramon Morales Chabrand, Hyun-Jung Kim, Cheng Zhang, Charles E. Glatz, and Stephanie Jung, 2008, J. Am. Oil. Chem. Soc. **85**:383–390.

2: "Enzyme-Assisted Aqueous Extraction of Oil and Protein from Soybeans and Cream De-emulsification", J. M. L. N. de Moura, K. Campbell, A. Mahfuz, S. Jung, C. E. Glatz, and L. Johnson, 2008, J. Am. Oil. Chem. Soc. **85**:985–995.

3: "Demulsification of oil-rich emulsion from enzyme-assisted aqueous extraction of extruded soybean flakes", J. Wu, L.A. Johnson, and S. Jung, 2009, Bioresource Tech. **100**:527–533.

INVENTORS

Drs. Lawrence A. Johnson, Charles E. Glatz, Stephanie Jung, Buddhi Prasad Lamsal, Jianping Wu, and Cheng Zhang

INTELLECTUAL PROPERTY STATUS (November 2010)

Patents pending

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Decolorization of Polyester Fiber and Textiles

APPLICATION AREAS

Textile Processing
Textile Recycling

ABSTRACT

Colored polyester fiber and textiles exhibit high color retention and wash fastness. Removing colorant from mismatched dye batches, or making textiles and fibers based on colored polyester available for recycling, is a major challenge for the industry. Currently there is no efficient method available which completely removes the colorant from the material without the use of hazardous chemicals. **Iowa State University researchers have developed a method which completely removes colorant from polyester textile material, making it available for recycling or subsequent dye lots.** The technology utilizes standard dyeing conditions and has the advantage of recycling the chemistry after use.

BENEFITS

- Environmentally friendly (recyclable, water based chemistry)
- Effective (complete color removal)
- Simple (use of standard dyeing conditions with simple chemistry)

INVENTOR(S)

Dr. John Verkade and Mr. Reed Oshel

INTELLECTUAL PROPERTY STATUS

Patent application filed

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Novel Method for Conversion of Celluose to High-Value Materials

APPLICATION AREAS

Biobased Production of High-Value Chemicals

ABSTRACT

Petroleum has long been the starting point for the production of many high-value chemicals such as ethylene glycol, but diminishing petroleum supplies and environmental concerns are driving research into ways to use renewable sources for making these types of compounds. Biomass is abundant and renewable, but methods to hydrolyze cellulose and related carbohydrate materials for production of small molecules often require the use of harsh or expensive reagents such as strong acids or enzymes since cellulose is usually not soluble in conventional solvents and is also refractory to chemical or biological treatments. Conventional acid hydrolysis methods have also suffered from the high cost of building corrosion resistant plants, acid recovery, and generation of chemical wastes. To overcome these drawbacks, ISU researchers and their collaborators at the Iowa Energy Center have developed a novel method for the conversion of cellulose and related carbohydrate materials to high-value materials. This method, which involves heating under pressure a mixture of cellulose and low-molecular-weight alcohol, does not require pretreatment of the starting material and can be used to produce ethylene glycol, propylene glycol and other low molecular weight materials without the use of expensive reagents, metal catalysts, hydrogen gas or enzymes. In addition, this method produces alkyl glucosides and levoglucosan that can be converted into glucose for subsequent production of ethanol and other products.

BENEFITS

- Effective (conversion of biomaterials to alcohol-soluble products is high)
- Simple (avoids the use of metal catalysts, hydrogen gas or enzymes)
- Environmentally friendly (does not produce toxic wastes)
- Robust (relatively insensitive to the presence of impurities)

REFERENCE

Poster Presentation: "Supercritical conversion of cellulosic materials to glycosides", Alyse A. Hurd, Ronald C. Holtan, and Walter S. Trahanovsky, 235th ACS National Meeting, New Orleans, LA, April 6-10, 2008.

INVENTOR(S)

Walter S. Trahanovsky, Ronald C. Holtan, Kyle W. Quasdorf, Norman K. Olson, Alyse A. Hurd, and Joseph A. Marshall

INTELLECTUAL PROPERTY STATUS (April 2012)

Patent pending

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OF SCIENCE AND TECHNOLOGY

Conversion of Cyclic Amines into Lactams for Synthesis of Nylons and Other Polymers

APPLICATION AREAS

Synthesis of Nylons and Other Polymers

ABSTRACT

Lactams are used for a wide variety of commercial applications, such as precursors for the production of solvents, nylons, and other polymers. Caprolactam is a particularly important lactam that is used as a precursor for Nylon-6, of which millions of tons are sold each year. However, the traditional commercial process for production of caprolactam uses highly corrosive sulfuric acid and generates ammonium sulfate as a by-product. So-called "green" methods for production of caprolactam give relatively high yields, but require expensive high pressure equipment. To overcome these drawbacks, ISU and Ames Laboratory researchers have developed a process for the conversion of cyclic amines (typically 5-, 6-, and 7-membered rings) into lactams that can be used for the synthesis of nylons and other commercially important polymers. This process uses Au/SiO_2 to catalyze the reaction of cyclic amines with oxygen at low pressures and uses starting materials that do not require lengthy syntheses.

BENEFITS

- Enables synthesis of lactams used for a variety of commercial applications
- Process does not use highly corrosive sulfuric acid or generate ammonium sulfate by product
- Does not require high pressure equipment
- Uses different starting materials than traditional routes to lactams

INVENTORS

Drs. L. Keith Woo (Chemistry) and Robert J. Angelici (Chemistry and Ames Laboratory)

INTELLECTUAL PROPERTY STATUS (February 2011)

Patent pending

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Efficient Polymer Solar Cells

APPLICATION AREA

Solar Cell Manufacturing

ABSTRACT

So-called first generation photovoltaic or solar cells are based on the use of crystalline silicon wafers. While improvements in efficiency have been made with these types of solar cells, their high cost has driven research into materials that would be cheaper to use. Second generation photovoltaic technologies with the potential to be more economical to manufacture include thin-film, organic (polymer or oligomer), and hybrid organic-inorganic cells. Organic photovoltaics (OPV) have a number of advantages, including manufacturability (roll-to-roll processes on flexible substrates are possible), low-temperature processing, high optical absorption coefficients, and tunability. Unfortunately, OPVs suffer from low power conversion efficiencies, with 7% being among the highest documented experimentally. To address this problem, ISU researchers have developed for a process to produce a thin and uniform light-absorbing layer on textured substrates that improves the efficiency of polymer solar cells by increasing light trapping. While the use of textured substrates is commonly used in conventional, silicon-based solar cells, attempts to use textured substrates in polymer solar cells have not been successful because they require expensive extra processing steps or technically challenging coating technologies that can result in a light-absorbing layer with air gaps or sub-optimal coating thickness in the valleys or on the ridges of the substrate pattern; these solar cells can have poor performance due to a loss of charges and short circuiting at the valleys and ridges. The technology developed by the ISU team overcomes these drawbacks by optimizing the dimensions of the underlying topographical features, enabling a conformal photovoltaic active layer to be coated on the textured substrate. As consequence, light trapping is enhanced, resulting in more efficient power conversion compared to flat solar cells. Light captured at the red/near infrared band edge is also increased compared to flat solar cells.

BENEFITS

- Efficient (light trapping is more effective compared to flat solar cells without compromising electrical characteristics)
- Economical (does not require extra processing steps or technically challenging coating technologies)

REFERENCES:

1: "On realizing higher efficiency polymer solar cells using a textured substrate platform", Kanwar S. Nalwa, Joong-Mok Park, Kai-Ming Ho, and Sumit Chaudhary. 2010. Adv. Mat.
DOI: 10.1002/adma.201002898.

2: "Design of Light-trapping Microscale-textured Surface for Efficient Organic Solar Cells", Nalwa, K. S. and S. Chaudhary. 2010. Optics Express **8**: 5168-6178.

INVENTOR(S)

Dr. Sumit Chaudhary and Mr. Kanwar Singh Nalwa (both of Electrical and Computer Engineering)

INTELLECTUAL PROPERTY STATUS (January 2011)

Patent pending

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Hybrid Tandem Junction Solar Cells

APPLICATION AREA

Photovoltaics

ABSTRACT

Organic photovoltaic (OPV) cells used to convert solar energy into electric energy have been the subject of intense research because of their potential to enable much more inexpensive manufacturing, in terms of materials and processes used, compared to conventional inorganic photovoltaic cells. However, OPV suffer from two major drawbacks. First, they are much less efficient than inorganic devices due primarily to the limited range of photon wavelengths that can be absorbed by the materials used for light absorption. Second, OPV are susceptible to performance degradation by the atmosphere (i.e., oxygen and moisture) as well as short wavelength UV light. To overcome these drawbacks, ISU researchers have developed hybrid tandem junction solar cells. These devices consist of an inorganic solar cell coated with a transparent conducting layer on which an organic solar cell is deposited. The inorganic solar cell can be an amorphous or nanocrystalline semiconductor, and either p-n or n-p heterojunctions can be used between the two cells. This structure offers better solar conversion efficiency through optimizing the bandgap or absorption of each of the solar cells while also improving stability of the organic cell since high energy photons are absorbed primarily in the higher energy gap inorganic cell, preventing them from degrading the organic cell. The organic solar cell is also protected from moisture and oxygen as an impermeable barrier is created by the inorganic cell. In addition, the devices can be manufactured using roll-to-roll methods on plastic transparent substrates. As a consequence, more robust, efficient and economical photovoltaic devices may be enabled.

BENEFITS

- Efficient (efficiency of 14% or more is achievable)
- Robust (inorganic cells block damaging rays from reaching organic cell while creating an impervious barrier)
- Versatile (multiple materials and solar cell combinations can be used)
- Economical (amenable to screen printing or roll-to-roll manufacturing)

INVENTOR(S)

Drs. Vikram L. Dalal, Joseph Shinar and Ruth Shinar

INTELLECTUAL PROPERTY STATUS (June 2011)

Patent pending

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Selective Oxidation of Organic Substrates to Partially Oxidized Products

APPLICATION AREAS

Utilization of abundant and inexpensive compounds as catalysts for oxidation of alcohols to aldehydes or ketones with ozone.

ABSTRACT

Ozone is recognized as a potent and effective oxidizing agent with numerous commercial uses as described in the marketing brief of ISURF 03338 to which patent 7,618,546 issued. Further research by Iowa State University and Ames Laboratory researchers discovered the potential for selective oxidation in an environmentally friendly way to obtain, for example, aldehydes or ketones. The versatile properties of aldehydes or ketones make them valuable starting materials for numerous products, and the application of the environmentally friendly and simple process eliminates toxic compounds.

BENEFITS

- Rapid and controlled rate of catalysis
- Environmentally friendly (ozone naturally decomposes to oxygen)
- Versatile (may be used for any applications and/or substrates for which ozone is used as an oxidant)

INVENTOR(S)

Drs. Andreja Bakac (Ames Laboratory) and Oleg Pestovsky (Ames Laboratory)

INTELLECTUAL PROPERTY STATUS

Patent application

REFERENCE(S):

Publication: "Aqueous FeIV=O: Spectroscopic Identification and Oxo Group Exchange", Oleg Pestovsky, Sebastian Stoian, Emile L. Bominaar, Xiaopeng Shan, Eckard Munck, Lawrence Que, Jr., and Andreja Bakac, 2005, Angew. Chem. Int. Ed. 44:6871-6874.

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Depolymerization of Polylactic Acid

APPLICATION AREAS

Recycling of postconsumer polylactic acid based plastic through a simple and efficient depolymerization process.

ABSTRACT

The continuous growth of polymers made from biorenewable materials to reduce the dependency on petroleum feedstock has also generated demand in a "cradle to cradle" process, enabling efficient and economical recycling of plastics. Polylactic acid (PLA) products are made from corn starch and/or sugar cane and are potentially biodegradable under controlled methods. However, reclaiming virgin monomers from postconsumer plastics to generate renewed plastic material is preferred over degradation. Current methods to depolymerize PLA are energy intensive and not sufficient. Iowa State University researchers have developed a simple method for postconsumer PLA based plastic to be recycled in an efficient and economical process. This technology enables depolymerization of PLA at very high rates therefore, effectively reducing the process/cycle time for recovery of the monomer and enabling cost effective recycling of PLA. The process uses simple compounds and moderate energy at fast reaction speed to depolymerize PLA. Iowa State University is seeking industry partners to commercialize this technology.

BENEFITS

- Efficient (depolymerization at high rates)
- Economical (reduced process/cycle time)
- Simple (moderate energy and chemical input)

INVENTOR(S)

Drs. Gowrishankar Srinivasan and David Grewell

INTELLECTUAL PROPERTY STATUS

Patent application has been filed

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