

## PURIFICACIÓN BIOLÓGICA DE BIOGÁS: ANÁLISIS BIBLIOMÉTRICO

El biogás es un combustible obtenido mediante digestión anaeróbica de biomasa cuyo uso más extendido es su inyección directa en la red de gas natural y, en menor medida, aunque con grandes expectativas, como combustible de automoción. También se contempla su uso in-situ como combustible para la generación de calor y electricidad.

El biogás precisa ser purificado antes de su uso. Los distintos procesos de purificación van dirigidos a la eliminación de impurezas y elementos corrosivos ( $H_2S$ ) que puedan dificultar su utilización y disminuir su eficiencia como combustible.

Actualmente, existen distintas tecnologías de purificación bien establecidas y otras más novedosas están siendo objeto de interés creciente y se encuentran a nivel de investigación y desarrollo. Entre ellas, cabe destacar la purificación de biogás mediante procesos biológicos, cuyo objetivo principal es la eliminación del contenido de  $CO_2$ . En este apartado, hemos abordado un estudio bibliométrico sobre esta temática que nos va a permitir visualizar cuál es la situación actual de la tecnología y quiénes son los actores más destacados. Para ello se ha hecho uso de las bases de datos de Web of Science.

A nivel mundial se han identificado 134 publicaciones científicas relativas a la purificación biológica de biogás. En el 60% participan instituciones europeas. La evolución temporal del número de publicaciones se muestra en la Figura 1, apreciándose que se trata de una tecnología novedosa y en auge, de modo que el 96% de los artículos se publicaron a partir de 2012.

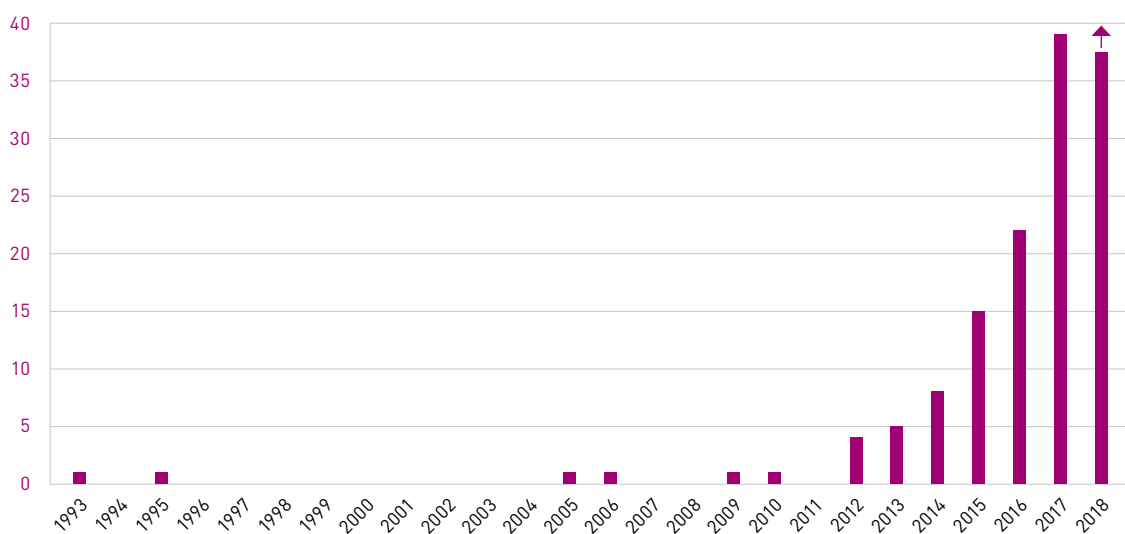


Figura 1. Nº artículos a nivel mundial distribuidos por año de publicación

Los países con tres o más publicaciones se recogen en la Figura 2. A la cabeza se encuentra China, seguida de España, Dinamarca, Italia y EE.UU. Las instituciones con investigaciones en este ámbito son muy numerosas. Las actuales líderes son la Universidad de Valladolid, la *Technical University of Denmark* y la *Jiaying University* (Figura 3). A estas tres instituciones les corresponde el 36% de las publicaciones totales. En España destaca, además, la Universidad de León.

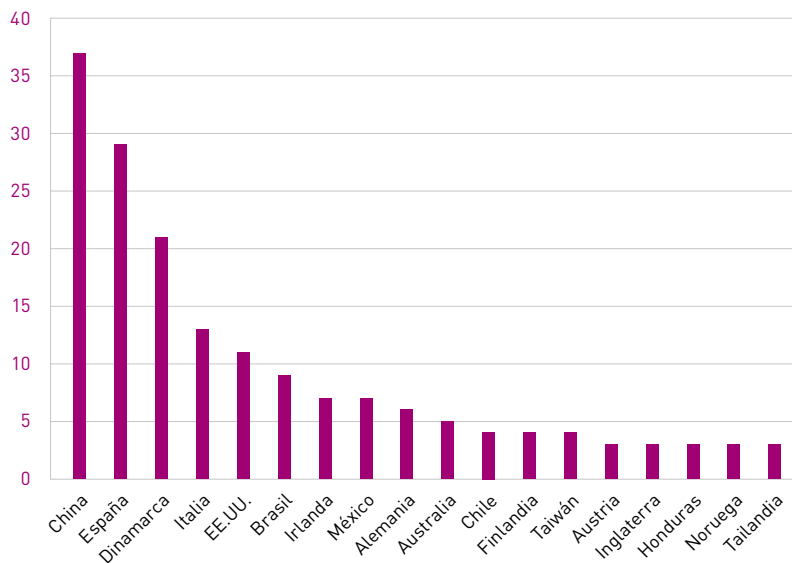


Figura 2. Nº artículos de los países con al menos tres publicaciones

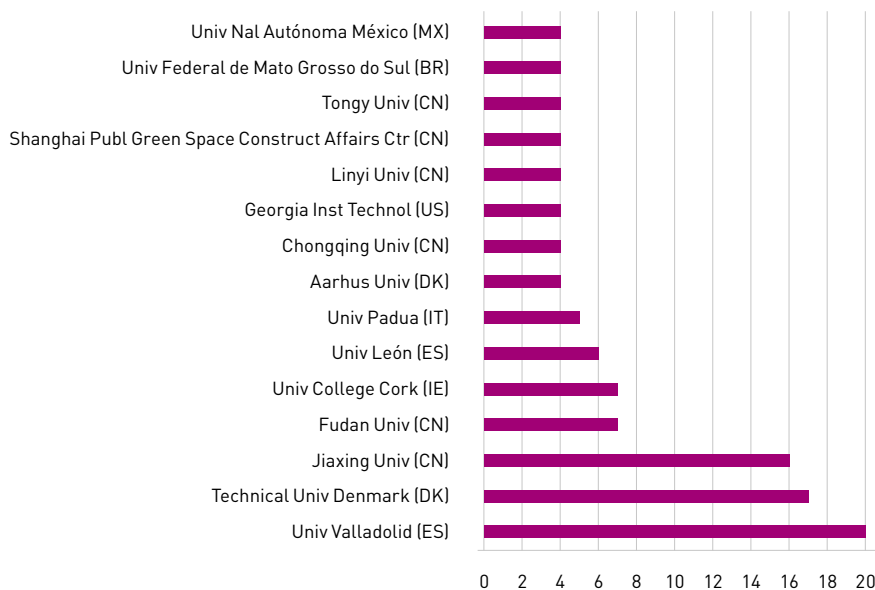


Figura 3. Nº artículos de las instituciones con al menos cuatro publicaciones

Si se clasifican las publicaciones en función del método de purificación biológica de biogás a que refieren, se obtiene la Figura 4. En ella se aprecia que los sistemas fotosintéticos son los más estudiados. Estos corresponden, principalmente, a sistemas basados en microalgas que fijan el CO<sub>2</sub> del biogás, obteniéndose biometano. Muchos de estos sistemas se emplean, además, en el tratamiento de digestatos procedentes de la digestión anaeróbica de lodos de EDAR, utilizándose sistemas simbióticos de algas y bacterias, así como de algas y hongos.

Tras los sistemas fotosintéticos, los relativos a los quimioautótrofos son los más numerosos. Éstos se refieren al uso de bacterias hidrogenotróficas capaces de reducir el CO<sub>2</sub> del biogás a metano con inyección de hidrógeno adicional. Se distinguen procesos in-situ, donde la producción de biogás y su purificación se realizan en un solo reactor, y procesos ex-situ, donde estos procesos tienen lugar sucesivamente en reactores distintos.

Aunque con menor número de publicaciones, los sistemas bioelectroquímicos (BES, *bioelectrochemical systems*) son fruto de investigación creciente en este ámbito. Aquí se engloban procesos de electrometanogénesis biológica, en los que a partir del CO<sub>2</sub> del biogás e hidrógeno se genera metano por la acción combinada de bacterias y electricidad. Asimismo, se incluyen procesos de captura y regeneración de CO<sub>2</sub> por métodos bioelectroquímicos. Finalmente, cabe destacar la identificación de algunas publicaciones relativas a otros procesos de fermentación microbiana en los que se obtienen precursores químicos valiosos a partir del CO<sub>2</sub> del biogás. Entre ellos, cabe mencionar su combinación con hidrógeno para obtener ácidos grasos volátiles (VFA) por la acción de acetógenos y la obtención de ácido succínico a partir de azúcares.

Finalmente, en la Tabla 1 se detallan las líneas de investigación de las instituciones de la Figura 3 a modo de las palabras clave identificadas en sus publicaciones.

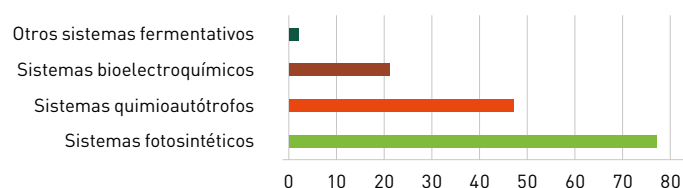


Figura 4. Nº artículos distribuidos por el tipo de sistema de purificación biológica de biogás a que se refieren

Tabla 1. Líneas de investigación de las instituciones de la Figura 3<sup>1</sup>

Institución	Palabras clave de las publicaciones
Univ Valladolid (ES)	Algal-bacterial photobioreactor, digestate treatment, nutrients recovery, wastewater treatment (main research line)
	Hydrogenotrophic archaea
Technical Univ Denmark (DK)	Acetogens, gas fermentation, biosuccinic acid production
	Hydrogenotrophic methanogenesis, ex-situ biogas upgrading, metagenomics, in-situ biogas upgrading, coke oven gas biomethanation (main research line)
	Microbial electrochemical technologies, CO <sub>2</sub> alkaline and acid regeneration, wastewater treatment
Jiaying Univ (CN)	Microalgal-fungal cultures, wastewater treatment, nutrient removal, microalgal strains, LED mixed wavelength ratio
Fudan Univ (CN)	Microalgae, Chlorella sp., nutrient removal, biogas slurry, wastewater treatment, LED light wavelength
Univ College Cork (IE)	Ex-situ biological methanation
	Microalgal biogas production and upgrading, seaweed
Univ León (ES)	Algal-bacterial photobioreactor, digestate treatment
Univ Padua (IT)	Hydrogenotrophic methanogenesis, ex-situ biogas upgrading
Aarhus Univ (DK)	In-situ microbial methanation
Chongqing Univ (CN)	Biological methanation, methanogenic archaea
	Algae, seaweed
Georgia Inst Technol (US)	Methanogenic bioelectrochemical systems
Linyi Univ (CN)	Microalgae, Chlorella vulgaris, Scenedesmus obliquus, Neochloris oleoabundans, Selenastrum bibrainum, algal-bacterial systems, wastewater treatment, biogas slurry
Shanghai Publ Green Space Construct Affairs Ctr (CN)	Microalgal systems, microalgal-fungal systems, microalgal-bacterial systems, wastewater treatment
Tongy Univ (CN)	Hydrogenotrophic methanogenesis, Methanothermobacter thermoautotrophicus, coke oven gas biomethanation, in-situ biogas upgrading
Univ Federal de Mato Grosso do Sul (BR)	Microalgal-bacterial, Chlorella vulgaris; wastewater treatment
Univ NaI Autónoma México (MX)	Microalgal-bacterial systems, alkaline conditions

<sup>1</sup> Los colores de las palabras clave se corresponden con los tipos de sistemas de purificación biológica de biogás de la Figura 4

# ANÁLISIS DE PATENTES

En el tercer trimestre de 2018 se han identificado en la base de datos WPI (World Patent Index) 207 familias de patentes sobre tecnologías de conversión de la biomasa para la producción de energía, excluyéndose las invenciones con ámbito de protección exclusivamente asiático. Cabe señalar que el 74.9% de las familias se refiere a tecnologías termoquímicas. El 20.3% y el 6.8% hacen referencia a tecnologías bioquímicas y químicas, respectivamente. La tecnología de combustión es la que cuenta con mayor número de resultados, 40.1% del total, seguida de la de pirólisis/gasificación, con el 39.6% (Tabla 2).

**Tabla 2.** Número de familias de patentes clasificados por tecnologías

Tipos de tecnologías de conversión de la biomasa	Nº Familias
Tecnologías termoquímicas	155
Combustión directa	83
Gasificación/pirólisis	82
Tecnologías bioquímicas	42
Digestión anaeróbica	24
Fermentación de azúcares	18
Tecnologías químicas (transesterificación, Fischer-Tropsch, síntesis de metanol)	14
<b>Nº TOTAL FAMILIAS DE PATENTES</b>	<b>207</b>

**Nota:** Alguna invención puede incluirse en más de una tecnología

En la Tabla 3 se muestra la distribución de documentos por ámbitos de protección. En el primer lugar del ranking se encuentran las solicitudes internacionales (PCT), con 87 documentos; en segundo lugar se encuentra EE.UU., con 57. En tercer lugar y a gran distancia, se encuentra Rusia, con 21 documentos. En España, en el periodo analizado, se publicaron 2. En la Tabla 4 se recogen los ámbitos de protección más representativos de las invenciones correspondientes a las distintas tecnologías.

**Tabla 3.** Ranking por países

	País	Nº Documentos
1	PCT	87
2	EE.UU. (US)	57
3	Rusia (RU)	21
4	Alemania (DE)	15
	EP	15
5	Brasil (BR)	11
6	Francia (FR)	8
7	Japón (JP)	5
	Finlandia (FI)	4
8	Reino Unido (GB)	4
	Polonia (PL)	4
	Australia (AU)	3
9	Canadá (CA)	3

**Tabla 4.** Ámbitos de protección más solicitados por tecnologías

	Tipos de Tecnología (Nº Documentos)		
	Termoquímicas	Bioquímicas	Químicas
PCT	67	24	6
EP	12	3	0
Alemania (DE)	13	2	0
Brasil (BR)	8	0	3
Canadá (CA)	3	1	0
EE.UU. (US)	47	9	4
Finlandia (FI)	4	0	2
Francia (FR)	7	0	0
Japón (JP)	5	0	0
Polonia (PL)	4	0	0
Reino Unido (GB)	3	1	0
Rusia (RU)	18	3	1

En los Apartados posteriores se presenta una selección de los documentos de patente identificados este trimestre.

# TECNOLOGÍAS TERMOQUÍMICAS

## Patentes

COMBUSTIÓN DIRECTA		
Nº Publicación	Solicitante (País)	Contenido técnico
EP3372126	Inovalp (FR)	<b>Cooking appliance.</b> This cooking appliance comprises: - a combustion duct having a first end zone and a second end zone opposite; - a set of orifices rings formed at the periphery of the combustion duct; - Air supply means of the combustion duct; a tank, mounted on the first end zone; - a combustion grate; remarkable in that the set of orifice rings is distributed along the combustion duct so that the rings of orifices present total areas differentiated and adjusted along the combustion pipe so as to maintain complete combustion of the wood pellets.
WO2018162849	Confort Domo France (FR)	<b>Portable cooking device, of the barbecue or plancha type.</b> The invention relates to a portable cooking device, of the barbecue or plancha type, which is fed by pellets, comprising: -a base box, forming an ash pan, -a plate disposed above the box, provided with an opening in line therewith, -a peripheral sleeve positioned on the plate, -a burner in the form of a receptacle having walls and a bottom that are perforated and equipped centrally with a hollow shaft at the perforated wall for supplying air to the inside, wherein the walls, bottom and hollow shaft delimit an annular space intended to receive the pellets to be consumed, the burner resting by way of its upper end edge on the upper edge of the skirt, -and a grill or cooking plate disposed above the burner.
WO2018159818	Mitsubishi Materials Corp (JP)	<b>Fuel pellets, production method for fuel pellets, production method for solid biomass fuel, production method for halal fertilizer, modified biomass char, production method for modified biomass char, production method for hydrogen, and method for producing oil by alga.</b> Fuel pellets for use as a fuel which are characterized by comprising a compression-molded object of palm petioles that are some of palm branches and leaves that have grown around palm fruit bunches, the compression-molded object having been torrefied; and a production method for the fuel pellets which comprises a squeezing step in which palm petioles that have grown around palm fruit bunches are squeezed to obtain sap and a squeeze residue, a crashing step in which the obtained squeeze residue is crashed, a drying step in which the crashed palm petioles obtained in the crashing step are dried to regulate the water content, a torrefaction step in which the dried crashed palm petioles are torrefied, a pulverization step in which the torrefied crashed palm petioles are pulverized, and a pelletizing step in which palm-derived lignin is added to the obtained pulverized palm branches and leaves and the resultant mixture is compression-molded to form pellets.
WO2018151693	Polkar Orman Ueruenleri Ve Enerji AS (TR)	<b>Green MDF production technique from sustainable source and energy.</b> Here it is described how the renewable MDF board production technique can be brought into existence without causing any discomfort on the environment, health and commercial acquisition. This technique is relying on a basic principle which is supplying the wood raw material, resin and energy from renewable sources. The realisation of the Green MDF production technique is possible by the preference of the right raw material, the choice of resin without any harmful effect on health and the application of Cogen-w which is a combined power and energy generation procedure.
WO2018113880	Aduro AS (DK)	<b>A combi stove and use of a combi stove.</b> Disclosed is a combi stove arranged for combusting both logs and granular material. The combi stove comprises a common combustion chamber arranged so that both the logs and the granular material may be combusted in the common combustion chamber. The combi stove further comprises ash collecting means arranged under the combustion chamber and a front aperture through which logs may be placed in the combustion chamber. Also the combi stove includes a granular material combustion area arranged in the combustion chamber, wherein the granular material combustion area comprises a bottom combustion surface including bottom airflow apertures arranged to enable an airflow to the granular material during a combustion of the granular material in the granular material combustion area, wherein the granular material combustion area is at least partly surrounded by a granular material area sidewall comprising sidewall airflow apertures arranged to enable an airflow to flue gasses generated during a combustion of the granular material in the granular material combustion area, and wherein at least a part of the granular material area sidewall is releasable from the granular material combustion area. Furthermore, a use of a combi stove is disclosed.

Nº Publicación	Solicitante (País)	Contenido técnico
WO2018158599	MBH Biomassza Kazan Kft (HU)	<b>Pellet furnace equipped with a burner provided with grate and method for the continuous maintenance of burning therein.</b> Pellet furnace equipped with a burner provided with grate, comprising a burning space in which the pellets are received on the grate, and an incinerator unit arranged close to the burning space, wherein the interior of the burning space designed as a sluice burner comprises a lower grate and an upper grate arranged in different heights, said grates can be removed from the burning space in lateral direction and during such removal of the grates any ash thereon cannot follow the space receiving the lower and upper grates, and for receiving the dropping of the collected ash an ash collector is arranged under the burning space.
WO2018160767	Magic Heat Llc (US)	<b>Fire pit apparatus.</b> The apparatus includes a base having a shell surrounding a hollow interior. A flange extends outward from the upper end of the shell, and a panel extends across the hollow interior of the shell. An orifice extends through the shell above the panel. The fire pit apparatus has an upper body including an enclosure. A rim extends inward from the upper end of the enclosure. An inner wall defining a burn chamber extends downward from the rim to form an annular passage. A permeable plate extends across the enclosure forming a recess for receiving the flange of the base. An aperture extends through the enclosure adjacent the lower end permitting air to enter the annular passage, and a port extends through the wall adjacent the upper end permitting air to exit the annular passage and enter the burn chamber.
WO2018149651	General Electric Technology GmbH (CH)	<b>System and method for firing a biofuel.</b> A method of firing a biofuel is provided. The method includes: introducing the biofuel into a combustion chamber having a first stage and a second stage; combusting the biofuel in a suspended state while flowing from the first stage to the second stage; and introducing a first air stream and a second air stream into the combustion chamber at the first stage and at the second stage, respectively, to facilitate combustion of the biofuel.
PL125914	Kolton Wojciech Przed Producyjno Handlowo Usługowe Kolton Spolka Cywilna (PL)	<b>Central heating furnace.</b> The subject of the application is a central heating furnace for pellet heating intended for continuous combustion. The central heating furnace is a cuboid with a rectangular base in which the housing has a combustion chamber of the pellet in the lower part and a container for the pellets is mounted above it, the container for pellets connected by a pipe with the burner, and the upper furnace base has a container hopper for pellets, and the front two-part wall is mounted pivotably, where the furnace's operating reagent is mounted in the upper part of the wall, while the furnace control unit is embedded in the back of the upper base secured by the cover.
PL419876	Univ Technologiczno Przyrodniczy Im Jana I Jędrzeja Sniadeckich W Bydgoszczy (PL)	<b>Pellet burner for industrial furnace and method of operation of the burner.</b> The subject of the solution is a pellet burner for an industrial furnace and a burner operation method for generating thermal energy by burning solid fuel in the form of pellets. The pellet burner for an industrial furnace has a housing with holes of diameter (d3) whose symmetry axes are at an angle $\alpha$ to the x-axis and are evenly distributed around the perimeter of the housing in the distance $r$ and along its height at a distance h, in the region of the chamber formed between the inside surface of the shell and the outer surface of the housing. Between the inner surface of the jacket and the outer surface of the housing, a chamber is located from which pressurized air (p2) is forced into the inside of the housing in which the pressure (p1) prevails, through the holes (d3) from maintaining the condition $p2 > p1$ .
WO2018144096	Queston Inc (US)	<b>A biomass coal fuel and method of producing same.</b> Disclosed is a method of producing biomass coal fuel. The method is directed to applying calcium carbonate to biomass forming a mixture, where the mixture is then compressed under elevated temperatures to form biomass fuel. The biomass fuel is added to coal to form a biomass coal fuel. The biomass fuel is formed from a mixture containing biomass and calcium carbonate results in the neutralization of organic acids found in the biomass and coal. Accordingly, upon combustion of the burning biomass coal fuel, a reduction in acidic by-products occurs.
EP3361152	Riener Karl Stefan (AT)	<b>Biomass furnace.</b> The invention relates to a biomass furnace, comprising: a combustion chamber with floor; an air supply disposed in the bottom area of the firebox; a flue gas collecting portion disposed above the firebox; and a flue gas duct which leads flue gas from the firebox downwards and after a change of direction up into the flue gas collecting area.

Nº Publicación	Solicitante (País)	Contenido técnico
RU2660226	Fed Gosudarstvennoe Byudzhethnoe Nauchnoe Uchrezhdenie Fed Nauchnyj Agroinzhenernyj Tsentr Vim Fgbnu (RU)	<b>Solid fuel thermal power generator.</b> Invention relates to power engineering, namely to heating and power generation systems and can be used: in air heating and power supply systems for agricultural facilities (farms, greenhouses, workshops, granaries, vegetable stores, fruit and mushroom dryers), dwellings, warehouses, arbors in arctic conditions of operation and as an autonomous energy source for greenhouse farms. Solid-fuel thermal power generator consists of an air compressor, a fuel burner, an electric generator and an expansion machine in the form of a turbine for driving a compressor. It is equipped with an ejector made with a mixing chamber of air and combustion products of fuel, the burner is made in a pellet version with a solid fuel bunker and is used to obtain a working mixture from air and pellet combustion products that is fed to the turbine to drive the compressor and electric generator. EFFECT: as a result of the operation of the heat and power generator, the thermal energy of the waste products of combustion of pellets is efficiently used while generating heat and electricity.
WO2018135660	Wind Smile Co Ltd (JP)	<b>Production method for solid fuel, solid fuel production system, and solid fuel.</b> The production method for a solid fuel according to one aspect of the present invention comprises: a spray step for spraying heated oil over fragments of solid biomass so as to impregnate the solid biomass fragments with the oil; and a molding step for subjecting the solid biomass fragments impregnated with the oil to compaction molding so as to produce a solid fuel.
WO2018123108	Chugai Ro Kogyo Kaisha Ltd (JP)	<b>Combustion device and biomass fuel.</b> A combustion device that introduces a biomass fuel into a combustion chamber and combusts the biomass fuel. A bamboo material into which at least 20 wt% of bark has been mixed is used as the biomass fuel.

## PIRÓLISIS/GASIFICACIÓN

Nº Publicación	Solicitante (País)	Contenido técnico
DE102018000212	Plueckhahn Wolfgang (DE)	<b>Transporting agglomerated biomass with simultaneous use of both upper and lower conveyor belt run, impacted by force-controlled flap mechanism, comprises pushing pressure roller by conveyor belt over rod holding bolt of the flap.</b> Technical field of the invention: Improvement of the thermo-physical properties of pellets made from biomass, using a specific heat treatment, which leads to an increase in the calorific value and an improved resistance to moisture absorption and thus allows external storage of the post-torrefied pellets without quality degradation. The possibilities as fuel for power plants are particularly promoted by the lignin-comparable energy expenditure of about 15 kWh / t for the grinding. They allow a complete replacement of existing fossil fuels and contribute to a significant reduction of greenhouse gases. Innovation: The use of the special conveyor flap mechanism provides financial benefits that add to the overall cost of a torrefaction facility, and thus make this technology the expected breakthrough in industrial application. Drawing: The drawing of the flap mechanism including the list of references is part of the innovation.
RU2663144	Fed Gosudarstvennoe Unitarnoe Predpriyatie Tsentr Ekspluatatsii Obektov Nazemnoj Kosmicheskoy Infras (RU)	<b>Method of gasification of solid fuel and device for its implementation.</b> Invention relates to chemical technology and heat power engineering based on the processing of local low-grade carbon-containing raw materials, including bituminous (wood, peat, brown coals, various wastes), by gasification to produce a combustible gas containing carbon monoxide and hydrogen, for subsequent use as a power gas in transport and power plants. Method involves processing solid particulate fuel in a gasifier as part of two co-operating inclined rotating cylindrical reactors, in each of which a process of gasification is carried out in a dense layer with a successive alternation of phases (regimes) - the phase of the reversed process and the phase of the direct process, the reactors working in phase. Reactors operate in a two-cycle operating cycle with a synchronous phase change. Phase change in the reactors is effected by rotating them in a vertical plane to ensure reversible movement of the fuel. Each reactor is equipped with a steam-water jacket with a perforated inner wall of the working chamber for injecting superheated steam into the activation zone, as well as an expansion piston to maintain the fuel layer and regulate the volume of the buffer zone with a hollow stem for gas extraction. Cooling of the fuel gas is carried out by means of heat exchangers for water evaporative and air cooling of the gas. Obtained activated carbon is accumulated in the buffer zone, and the vapor-gas mixture is transported to the anti-phase reactor, where the gasification of the activated carbon layer reversibly moving from its buffer zone is completed in a direct process with counter filtration of the produced gas, which is withdrawn from the reactor and after the cooling is supplied to the consumer. EFFECT: technical result consists in increasing the completeness of fuel processing, the quality and calorific value of the resulting fuel gas, reducing heat losses, as well as increasing the compactness, economy, reliability and durability of the gasifier.

Nº Publicación	Solicitante (País)	Contenido técnico
WO2018158717	K TECK SA (CH)	<b>Loading system for pyrolysis machines.</b> System for loading a pyrolysis reactor with organic matrices of various nature and/or waste material to be used on pyrolysis machines, constituted by an outer cylinder provided with a feeding hole, an inner cylinder serving as a shutter, said cylinders being such as to slide into each other, a head provided with gaskets and fixed to the inner cylinder. The inner cylinder is connected to an actuator of the electrical or hydraulic type with a control unit connected to a position and/or speed and/or pressure sensor.
WO2018157971	L'Air Liquide (FR)	<b>Process for producing synthesis gas by gasifying solid carbon carriers.</b> A process for producing synthesis gas by gasifying a carbon carrier in a slurry having a significant content of phosphorus. According to the invention, the phosphorus compounds dissolved in the liquid phase of the suspension are at least partly precipitated by treating the suspension by increasing the pH of the suspension and/or increasing the concentration of metal cations in the suspension, before the suspension is heated further and subsequently applied to the gasification reactor.
WO2018154591	Jain Pankaj (IN)	<b>Method &amp; apparatus for continuous production of charcoal from waste.</b> Present invention proposes a method and apparatus for continuous production of charcoal from waste where the method and apparatus comprises of continuously feeding the waste into a receptacle where the receptacle is connected to an assemblage of metallic ducts, which have one or more openings, heated by an external source and the assemblage of metallic ducts is fitted with a pushing mechanism to transport the waste from the proximal end connected to the receptacle to the distal end of the assemblage.
WO2018149736	Pyro &Tech Srls (IT)	<b>Separated chambers pyrolysis furnace.</b> The present invention is directed to an apparatus for domestic hot water and electricity production by the use of a natural organic fuel, the apparatus comprising a separated chambers pyrolysis furnace comprising: a) a pyrolysis chamber wherein the fuel is heated, substantially in the absence of oxygen at a temperature capable of causing pyrolysis of fuel; b) a combustion chamber of the pyrolyzed fuel, wherein the pyrolyzed fuel is burned in the presence of an air flux. The invention is also directed to an apparatus for the production of domestic hot water and electricity, which apparatus comprises: the above defined furnace; b) a heat exchanger connected to the exit of the exhausted gas, wherein domestic water is heated; c) a power generator connected with the exit of syngas, wherein syngas produced in the pyrolysis chamber is used as a fuel.
EP3363881	Ava Green Chemistry Dev GmbH (DE)	<b>Method for performing a hydrothermal carbonisation reaction.</b> As part of the hydrothermal carbonization biomass is converted into biochar, the yield of the reaction depends on the reaction conditions. The reaction conditions also include the duration of the carbonation reaction, ie the period of time during which the slurry of water and biomass remains in the reaction tank and is exposed to pressure and temperature. This should be chosen so that the largest possible dry residue of carbonized material remains in the slurry. It has been found that the amount of dry residue during the carbonation reaction changes in a substantially similar curve as the pH of the slurry. However, since the dry residue is difficult to determine during the on-going reaction, while the pH can be readily monitored throughout the reaction period, the reaction is stopped at a maximum of the pH which closely approximates a maximum of dry residue in biochar.
EP3363877	Lurii Valerii (RU) et al.	<b>Duplex process for rapid thermochemical conversion of carbonaceous raw materials.</b> The invention belongs to processes of converting carbonaceous raw materials to produce gaseous, solid, and liquid energy carriers and can be used in municipal, agriculture, wood processing industry, in the mining and petrochemical industries and other industries for thermochemical conversion of carbon-containing wastes from these industries to produce combustible gas, solid and liquid fuels, sorbents and other products. The process provides for the use of a vortex gasifier to produce hot generator gas, used as a heat carrier for the process of pyrolysis of raw material in the reactor, in which char and vapor gas are produced as a result of thermochemical reaction, a purification device to treat produced in the reactor vapor gas, and an apparatus for separation of vapor gas into different components. During the operation of the pyrolysis reactor, hot generator gas is fed into the upper part of the reactor and then proceeds to the bottom of the reactor through a gas duct inside the pyrolysis reactor until it reaches the distributor, through which it exits and travels up to the exit of the reactor, with simultaneous feed of raw material into the upper part of the reactor and movement of raw materials down the sloping mesh shelves. Effective thermochemical conversion of raw material is achieved in the countercurrent of raw material and heat carrier. The vapor gas formed in the pyrolysis reactor is supplied to the purification and separation units, while the char descends into the hopper from which it is released by a screw conveyor and/or sluice feeder to be sent to consumers or to the gasifier to obtain the heat carrier.



Nº Publicación	Solicitante (País)	Contenido técnico
WO2018147281	Univ Shinshu et al. (JP)	<b>Hydrocarbon production method, production apparatus therefor, production system therefor, and biocrude production method.</b> To provide: a hydrocarbon production method with which it is possible to efficiently manufacture a hydrocarbon by using biomass, thus suppressing a carbon resource loss; a production apparatus therefor; a production system therefor; and a biocrude production method. [Solution] The present invention is characterized by being provided with: a pre-processing step for obtaining a biocrude by performing solvolysis by mixing at least a biomass and a solvent; and a fluid catalytic cracking step for performing fluid catalytic cracking by using the biocrude obtained in the pre-processing step and a hydrogen donor as raw materials.
WO2018142211	Ariunbat Tserendash (MN)	<b>Device for treating coal and domestic wastes.</b> The present invention relates to obtain syngas and its by products from coal, domestic wastes, sludge, and all other combustible wastes by fast pyrolysis at high temperature. Screw shaped thin structure is welded on outside wall of outer reactor tube as well as inside wall of inner reactor tube in order to enhance heat exchange of the reactor. The inner reactor tube rotates while outer reactor tube is stationary. High temperature fire flowed through inner reactor tube as start, after fire moved out from that, the fire flow makes U turn and flow back through outer annulus of the pyrolysis reactor. Therefore, substantiality of this new invention, that the heat is homogeneously transferred 360° of the device. In other words, annular pyrolysis reactor heated from inside in beginning and then from outside. Furthermore, a flexible screw is fixed on outer wall of reactor tube, which pushes feeding material along the reactor tube. Pyrolysis reactor body has ceramic wool insulator to keep high temperature in reactor. Annular reactor is placed inside the reactor body and annulus profile is created between them. In result, advantage of this invented device is annular reactor is heated from all side and heat energy is used very efficiently.
RU2659924	Miklyaev Yuriy Mikhajlovich (RU)	<b>Solid carbon-containing waste pyrolysis utilization method and waste treatment system for its implementation.</b> The invention relates to the field of the carbon-containing materials thermal processing and is intended for the solid municipal waste utilization. Waste processing system comprises pyrolysis unit including at least two pyrolysis units, prepared waste to the reactors supplying conveyor line, carbonaceous residue into the receiving hopper transporting conveyor line. In the drum reactor, the cylindrical combustion chamber is arranged coaxially and is coupled with the reactor working volume internal heating circuit. Near the reactor cylinder inner wall along its entire length auger conveyor is located, under reactor the auger conveyor-cooler is located. Thermal effect on the prepared waste is carried out consistently in two stages: first, removing the surface (capillary) water at temperature of 120-150 °C, and then applying thermal destruction in the temperature range 200-450 °C with the raw materials in the drum reactor continuous stirring. Separating the steam-gas mixture into water and fuel fractions. EFFECT: enabling increase in the thermal destruction efficiency at low pyrolysis temperatures, increase in the reactors specific productivity, and reduction in energy costs.
WO2018125753	Ensyn Renewables Inc (US)	<b>Demetallization of liquid biomass.</b> Methods, processes, systems, or apparatus are provided to remove contaminants such as metals and chlorine present in a pyrolysis stream to form reduced-contaminant liquid biomass. In certain embodiments, for example, a metal chelating agent is dissolved into a metal-containing pyrolysis stream condensate to form metal chelate complex, followed by filtering to obtain the reduced-contaminant liquid biomass.
WO2018120067	Univ Hong Kong (CN)	<b>Waste biomass-derived metal-free catalysts for oxygen reduction reaction.</b> A method for preparing a metal-free catalyst for an Oxygen Reduction Reaction comprises the steps of mixing together waste biomass (solid or liquid) and a catalyst to form a uniform powder or slurry; performing fast catalysis carbonization by heating the uniform mixture to obtain a highly porous carbonaceous intermediate material; blending the carbonaceous intermediate with melamine to form a carbon structure; performing nitrogen-rich compound modification by heating the carbon structure; and doping nitrogen into the carbon structure. The resulting catalyst has a hierarchical porous carbon structure with relatively high nitrogen doping and no metal.

Nº Publicación	Solicitante (País)	Contenido técnico
RU2655319	Federalnoe Gosudarstvennoe Byudzhethnoe Obrazovatelnoe Uchrezhdenie Vysshego Obrazovaniya Vyatskij Go (RU)	<b>Solid fuel gasifier.</b> The present invention relates to a utility system and small power engineering, it can be used for the destruction of solid domestic waste (SDW) and the production of clean fuel gas by the use of a gasifier. Declared result is provided by the constructive performance of the gasifier of solid fuel, which includes a horizontally installed thermal furnace with a built-in plate feeder with plates of gray cast iron with a number of openings for the fluidized bed of fuel, a sealed hopper for collecting ash and waste processing, in the front part is provided with a gas burner with a double cover with a horizontal partition for the heat exchanger located around the gasifier wall, the gasifier and the heat exchanger being in the form of a cone with a baffle sheet, and the cast iron plate of the feeder, having holes for the fluidized bed, is constantly blown by the primary air through the sealed box, the throttle and the fan, thus ensuring a temperature regime on the feeder plate not exceeding 460 °C. EFFECT: technical result of the invention consists in the production of a pure combustible gas containing methane, ethane, hydrogen, nitrogen and complex CH with a higher calorific value; in eliminating the need for heat treatment of waste and packaging; in the implementation of a one-time gas withdrawal and the use of a simplified gas purification scheme.
WO2018115593	Aalto Univ Foundation SR (FI)	<b>Hydrothermal conversion of biomass.</b> Method of hydrothermally converting a biomass feedstock, comprising the steps of subjecting the feedstock to partial wet oxidation in a partial wet oxidation unit, recovering from the unit a downstream product, and feeding at least a part of the downstream product to a thermochemical conversion reactor, where it is subjected to supercritical water gasification or hydrothermal liquefaction to produce biomass conversion products. The present process can be used for treating biomass, such as lignocellulosic biomass, from various fields of industry, as well as biomass from agriculture, for producing valuable products, such as bio-oil and syngas.
EP3339398	Commissariat a L'énergie Atomique et aux Energies Alternatives (FR)	<b>Hydrothermal liquefaction device.</b> The present invention relates to a device for hydrothermal liquefaction of a composition based on biomass, comprising: - an enclosure defining a volume VE, comprising three successive zones Z1, Z2 and Z3: the zone Z1 being provided with an input E Z1 of a composition based on biomass, and being at a temperature T Z1 and at a pressure P Z1, the zone Z2 corresponding to a reaction zone by hydrothermal liquefaction of the biomass at a temperature T Z2 and at a pressure P Z2, the zone Z3 being provided with an outlet S Z3 of the products resulting from the reaction by hydrothermal liquefaction of the biomass, and being at a temperature T Z3 and at a pressure P Z3, two pistons P1 and P2, independently sliding one of the other between the zones Z1, Z2 and Z3 so as to bring the biomass-based composition from the zone Z1 to the zone Z3, the pistons P1 and P2 being able to be spaced apart from one another so to set a variable volume V and lower than VE - external heating means of the zone Z2 - means for activating the pistons P1 and P2 making it possible to vary the volume V.
DE102016125286	Univ Rostock (DE)	<b>Production of bio-coal involves performing hydrothermal carbonization of biomass.</b> In a process for producing biochar by hydrothermal carbonization of biomass, gases or liquids containing decomposition products from the ongoing hydrothermal carbonization process are removed. A device according to the invention for producing biochar is designed and set up for carrying out a method according to the invention. The device according to the invention preferably has a line which connects a process vessel of the device to an analyzer for supplying gases or liquids taken from the process vessel and containing decomposition products of the hydrothermal carbonization process. wherein in the line at least one controllable by a control device valve is arranged.

# TECNOLOGÍAS BIOQUÍMICAS

## Patentes

DIGESTIÓN ANAERÓBICA		
Nº Publicación	Solicitante (País)	Contenido técnico
RU2664457	Obshchestvo S Ogranichennoj Otvetstvennostyu Nauchno Proizvodstvennoe Predpriyatie Resurs M (RU)	<b>Solar biogas plant.</b> The invention relates to biochemistry. Solar biogas plant is proposed for fermenting biomass to produce biogas. Installation contains a reactor placed in a tank with water to form a water jacket, a charging hatch for receiving the initial biomass, pipeline for the discharge of the finished organic product with the discharge hatch, the mixing device in the reactor, the solar collectors connected to the tank, the thermostat and the biogas collection system. And in the water jacket there are containers of a thermal battery with a phase-transfer heat-accumulating compound with a melting point equal to the average value of the optimal temperature range of the selected fermentation regime. EFFECT: invention ensures maintenance of a round-the-clock optimum isothermal regime for fermentation of biomass only due to the heat of solar radiation, as well as a reduction in the overall dimensions of the reactor and its compactness.
EP3354718	Herbst Umwelttech GmbH (DE)	<b>Device and method for creating biogas.</b> The invention relates to a method and a biogas plant for producing biogas, preferably from rice straw, wherein a substrate in two reactors is fermented circulating, so that a methane production from cellulose and / or lignocellulose substrate can be improved.
GB2559099	Biotech Energy Services Ltd (GB)	<b>Modular system.</b> A digester module comprising a vessel for carrying out anaerobic digestion and a frame for storing and holding the vessel, characterised in that the vessel and frame are adapted to be connectable to other modules to achieve different processing capabilities. The vessel may be a 2 metre diameter HDPE tube such as is used in large scale sewage pipes, with an end cap 8 for connection to other modules comprising a weir 10 provided at the outlet. A method of using the digester module and a system comprising a plurality of such digesters in a modular format is also described.
WO2018135952	Hoegskolen i Soeroest Norge et al. (NO)	<b>Apparatus and method for treatment of wet organic matter to produce biogas.</b> Apparatus for treatment of wet organic matter to produce biogas, comprising a closed reactor for anaerobic digestion of the wet organic matter. The anaerobic reactor comprises two vertical 5 tubes, a vertically arranged outer tube defining a first reactor chamber enveloping a vertically arranged inner tube which is divided into a first region and a second region of a second reactor chamber by a vertical partitioning wall. The first reactor chamber comprises a particle retaining unit connecting the first and the second reactor chambers. The anaerobic reactor exhibits a top discharge pipe for gas developed in either 0 of the two reactor chambers. A method for treatment of wet organic matter is also contemplated.
DE102017000576	Reule Waldemar (DE)	<b>Biological process and plant for the production of methane.</b> Biological process for the production of methane from carbon dioxide-containing gas streams and / or from industrial and agricultural biomass and / or biogenic residues (feed biomass) and integrally produced biomass from algae and phototrophic bacteria (algal biomass) by anaerobic fermentation and a suitable plant for implementation. The vegetable biomass, is the gigantic basis for the production of food and feed, but also of industrial products, of pharmaceuticals and cosmetics and for the production of usable energy. In addition to the products, large quantities of residues are produced, and the products themselves usually accumulate as residues after their use. From many of these residues, suitable energy sources such as biogas or Biomethane, but also recyclables, eg. As biopolymers and proteins and lipids and their monomers, vitamins, dyes and organic acids and solvents and oxygen u. v. m. win. The invention addresses this problem and provides such an economical and sustainable process. The task is solved by an efficient process, which produces biomethane as the main product from external biomass, but also from carbon dioxide, which is produced as regenerative (or even fossil) carbon dioxide in many industrial processes, which are fed into the natural gas grid as an energy carrier or chemical raw material can, but also with at least one valuable substance from the group of amino acids, peptides, lipids and carbohydrates or a mixture of substances with these substances and a fertilizer product in the form of a nutrient solution or suspension or a salt mixture and oxygen recovered from water become. The method comprises the process steps shown in the drawing generating phototrophic biomass with sunlight and with carbon dioxide as carbon source and water as electron donor with release of usable oxygen from water, 2) conversion of the phototrophic (and external) biomass Anaerobic fermentation in methane and carbon dioxide and 3) Separation of the gas mixture in carbon dioxide to obtain the phototrophic biomass and in methane for injection into the natural gas network. An important advantageous feature of the method is thus also that when carrying out the invention no carbon dioxide (greenhouse) is emitted from the processing of biomass. The method is suitable for the economical production of biomethane from biomass residues of some kind, from plant biomass, but also from carbon dioxide-containing.

Nº Publicación	Solicitante (País)	Contenido técnico
WO2018136018	Istanbul Teknik Univ (TR)	<b>Method for increasing methane yield in anaerobic digesters by adding cellulolytic bacteria cocktail (CEBAC-G) prepared with rumen fluid obtained from hornless goats.</b> The invention is related to a method for increasing methane yield in anaerobic digesters, by adding a cellulolytic bacteria cocktail (cebac-g) prepared with rumen fluid of hornless goats, that has been developed in order to increase methane yield in a system by increasing the hydrolysis efficiency at a maximum level, in anaerobic digesters that are treating lignocellulosic waste, such as animal manure, agricultural waste, energy plants, food residue, sewage sludge, household wastewater and industrial wastewater. The invention is a method for increasing methane yield in anaerobic digesters by adding cellulolytic bacteria cocktail (cebac-g) prepared from rumen fluid of hornless goats, comprising the steps of obtaining the rumen fluid from hornless goats, obtaining specific cellulolytic bacteria cocktail by inoculation of the medium with bacteria such as Firmicutes, Clostridiaceae, Bacteroidales, Ruminococcaceae, Prevotellaceae, Lachnospiraceae, Synergi stales, Fibrobacter, Lentisphaeria, Spirochaetes and Actinobacteria.
WO2018124988	Istanbul Teknik Univ (TR)	<b>A method for improvement of methane production from microalgae.</b> The invention is particularly related with a method, which use bioaugmentation with anaerobic rumen fungi at varied ratios of inoculums on the performance of anaerobic digesters of microalgae biomass for increasing methane production. In that proposed method the composite obtain that 4 isolated species of anaerobic rumen fungi of Orpinomyces sp., Piromyces sp. And Anaeromyces sp., Neocallimastix frontalis were selected and these species were mixed. After that, mixture of rumen fungi containing 4 species was added into the anaerobic digesters fed with microalgae Haematococcus pluvialis at different inoculums ratios: %1 (F1), 5% (F2), 10% (F3), 15% (F4) and 20% (F5) (v/v).
WO2018134391	Univ Bielefeld (DE)	<b>Production of biogas from algae.</b> This invention relates to a method for production of biogas. The present invention also relates to the use of algae for production of biogas and a system for production of biogas.
WO2018122000	Luxembourg Institute of Science and Tech List (LU)	<b>Biological agent for enrichment of anaerobic digestion reactors, method of preparing such biological agent and bio-augmentation process with said agent.</b> Biological agent for bio-augmentation of an anaerobic digestion reactor, named first anaerobic digestion reactor, comprising a mixture of microorganisms including at least 10 % of relative abundance in said mixture, of a unique Cloacimonetes sp. This agent is prepared by enrichment of a biological sample in a separate reactor fed with carbohydrate-rich substrate and oxygenated gas. Said agent comprising this unique Cloacimonetes sp. is able to restore and stabilize the biogas production of an anaerobic digestion reactor after acidosis, in a very short time.
WO2018115596	Avefori OY (FI)	<b>Method and system for manufacturing methanol from organic waste.</b> The invention relates to a method for manufacturing methanol from organic waste, wherein - producing biogas from organic waste in a biogas reactor via anaerobic digestion, - enriching biogas, - producing syngas in a syngas reactor, - decreasing the temperature of syngas with a syngas cooler, - condensing syngas for separating excess water from syngas, - producing methanol in a methanol synthesis reactor [26] utilising a methanol synthesis catalyst, - decreasing the temperature of manufactured methanol with a methanol cooler, - condensing mixed gas in a second condenser for separating carbon dioxide and hydrogen of methanol from methanol. At least as the methanol synthesis reactor, the method uses a spiral reactor, using a reaction volume arranged from a pipe in a spiral form, with a catalyst arranged in this reaction volume. The invention also relates to a corresponding system.
RU2655795	Golubenko Mikhail Ivanovich (RU)	<b>Device for producing pig breeding sewage wastes biogas and fertilizers.</b> The invention relates to a method for disposing of organic waste using an anaerobic digestion apparatus of pig breeding sewage with production of biogas and fertilizers. Device includes a cylindrical sealed container with an opening in the lid for supplying the sewage and a branch pipe in the bottom for the discharge of the liquid fraction with a discharge valve, inclined perforated plate, fixed above the bottom at an angle to the axis of the hollow shaft, nozzles for supplying compressed air from the power source. Nozzles are perpendicularly mounted on the shaft at the same distance from each other and are made in the form of tubes bent at the end at a right angle in a direction opposite to the intended rotation of the shaft due to the energy of the compressed air emerging from the nozzles. Length of the nozzles is increased from top to bottom in the direction of the inclined perforated plate. Angle of inclination of the perforated plate to the axis of the shaft is oriented towards the outlet of the discharge closed conduit to discharge the spent solid fraction of the sludge used as a fertilizer, when rotating the shaft driven by the motor. Discharge pipeline is tilted to its axis, stepped, with the diameter of the steps decreasing in the direction of movement of the spent sludge, and has a discharge device in the form of a shaft with a screw, for the collection of biogas produced during the fermentation process. Under the cover of the tank are installed gas collecting pipes, connected together by means of a common branch pipe. EFFECT: invention makes it possible to intensify the process of cleaning livestock sewage, while performing water protection measures of the environment.

## FERMENTACIÓN DE AZÚCARES

Nº Publicación	Solicitante (País)	Contenido técnico
ES2675810	Abengoa Res SL (ES)	<b>Procedimiento de extracción y funcionalización en una sola etapa de la lignina insoluble presente en biomasa residual.</b> Procedimiento de extracción y funcionalización en una sola etapa de la lignina insoluble presente en biomasa residual. La presente invención se refiere a un procedimiento de extracción y funcionalización en una sola etapa de la lignina insoluble presente en los subproductos de la obtención de bioetanol por fermentación de azúcares procedentes de biomasa. Por tanto, la invención se podría encuadrar en el campo del aprovechamiento industrial de subproductos y la valorización de los mismos.
WO2018165014	Regrut Thomas A (US)	<b>Sustainable energy production.</b> To reduce the overall environmental impact of a residence or commercial facility, a system is provided for integrating energy usage. In such a system, there is a system for capturing solar energy; a system for fermenting biomass and concentrating the fermentate, generating carbon dioxide and ethanol; a system for storing excess energy for subsequent release; and a system for growing biomass. In integrating the systems, the captured solar energy is used as heat and electrical power. Excess energy beyond an instantaneous energy requirement is stored in the system for storing excess energy. Ethanol produced is used as a fuel. Carbon dioxide that is produced is provided to the system for growing biomass. Instantaneous energy deficiencies are reduced by releasing stored excess energy.
WO2018142002	Abengoa Bioenergía Nuevas Tecnologías SA (ES)	<b>Polypeptides with polysaccharide monooxygenase activity and use thereof for the production of fermentable sugars.</b> The invention relates to: polypeptides with polysaccharide monooxygenase activity; a host cell expressing said polypeptides, preferably a Myceliophthora thermophila cell that recombinantly expresses at least one of said polypeptides; an enzymatic composition comprising at least one of said polypeptides, preferably together with other cellulolytic enzymes; the use of said host cell, of at least one of the polypeptides with polysaccharide monooxygenase activity or of the enzymatic composition for the degradation of cellulosic biomass; and a method for producing bioproducts, preferably bioethanol, comprising the use of said host cell, of at least one of the polypeptides of the invention or of the enzymatic composition of the invention.
US2018216140	Shulman Alvin D (US)	<b>Method for employing corn plant material comprising cobs in the manufacture of ethanol.</b> Ear corn is picked from corn fields by ear corn harvesters and transported to a central shelling station associated with an ethanol manufacturing facility. Shelled corn from the central shelling station is processed into ethanol at the ethanol manufacturing facility, and corn cobs from the central shelling station are burned to provide process heat for the ethanol manufacturing process. Energy is conserved and costs are reduced during the picking and shelling of the ear corn and by the burning of cobs for process heat.
WO2018136218	Kansas State Univ Research Foundation (US) et al.	<b>Catalysts and methods for converting methyl ethyl ketone to butene.</b> Catalysts and methods are provided for producing high yields of butene. The inventive catalysts are bifunctional catalysts having both hydrogenation and dehydration functionalities. Preferred catalysts generally comprise elemental copper or a copper-containing compound supported on a sodium-modified aluminosilicate zeolite. The catalysts are useful in methods of reacting methyl ethyl ketone and hydrogen to produce high yields of butene. The present invention provides a simplified, renewable route to butene, with a number of practical applications.
WO2018114758	DSM IP ASSETS BV (NL)	<b>Improved yeast strains for ethanol production.</b> This invention relates to a recombinant cell, preferably a recombinant yeast cell comprising: a) a gene coding for an enzyme having glycerol-3-phosphate dehydrogenase activity, wherein said enzyme has a cofactor dependency for at least NADP+ and/or for NADPH; b) a gene encoding an enzyme having at least NAD+ dependent acetylating acetaldehyde dehydrogenase activity (EC 1.2.1.10); and c) a mutation or disruption in at least one gene selected from the group of GPD1 and GPD2. Said cell is suitable for ethanol production, has a reduced glycerol production at high ethanol yield.
WO2018106792	Novozymes AS (DK) et al.	<b>Improved processes for production of ethanol from xylose-containing cellulosic substrates using engineered yeast strain.</b> Provided herein are recombinant host cells having a heterologous polynucleotide encoding a hexose transporter and a heterologous polynucleotide encoding a xylose isomerase, wherein the cells are capable of fermenting xylose in the presence of glucose and under oxygen limited growth. Also described are processes of fermenting saccharified material using the recombinant cells to produce ethanol at higher yields.
WO2018100101	Univ College Dublin National Univ of Ireland Dublin et al. (IE)	<b>Conversion of lignocellulose to bioethanol.</b> Use of nucleotide diphospho sugar-epimerase (NDPSE) enzyme in the production of bioethanol from lignocellulose is described. Methods of producing 5 bioethanol from lignocellulose are 5 also described.

# TECNOLOGÍAS QUÍMICAS

## Patentes

Nº Publicación	Solicitante (País)	Contenido técnico
WO2018157183	Binder Matthias (AT)	<b>Method for producing a fatty acid alkyl ester.</b> The invention relates to a method for producing a fatty acid alkyl ester, in particular a fatty acid methyl ester. According to said method a substance is produced using fat and/or oil, and said fat and/or oil is subjected to transesterification to produce the fatty acid alkyl ester, a nonpolar solvent being added to the substance prior to esterification and/or transesterification.
RU2016152705	Univ Russian Oil & Gas (RU)	<b>Method for obtaining biodiesel fuel.</b> The invention relates to the production of fuels from renewable raw materials. This method for producing biodiesel fuel lies in the fact that oil is mixed with a low alcohol to obtain a mixture, then the transesterification process is carried out using water and a catalytically active membrane consisting of a diffusion layer made on the basis of a polymer that is permeable to low alcohols and glycerol, as well as a connecting layer made of a porous polymer and a catalytically active layer formed by a lipolytic microorganism, wherein the porous polymer is selected from woven or non-woven materials of polyethylene fibers, polypropylene, polytetrafluoroethylene, polyamide, wherein said mixture is brought into contact with the catalytically active membrane layer and the water is brought into contact with the diffusion layer of the membrane, after which the product of the contact of said mixture with the catalytically active layer is subjected to evaporation to remove unreacted alcohol to obtain the desired biodiesel fuel, and the product of the contact of water with the diffusion layer is separated into water and glycerin. EFFECT: improvement of the technology for obtaining biodiesel fuel, which is provided by the lipolytic microorganism, which is in active state during the entire contact time, and the product is obtained in a sufficiently high yield.
WO2018156289	Exxonmobil Res & Eng Co (US)	<b>Diesel boiling-range fuel blend and methods of making the same.</b> Diesel boiling-range fuel blends including renewable diesel, biodiesel, and petrodiesel, where the diesel boiling-range fuel blend is capable of producing a minimal volume change of at least one swellable elastomer in a diesel boiling-range fuel system are provided herein. Methods of making the diesel boiling-range fuel blend as well as methods of reducing swellable elastomer shrinkage are also provided herein.
BR102016028508	Univ Estadual de Campinas (BR)	<b>Micro-reactor for biodiesel synthesis.</b> Micro-reactor comprises microchannels and static elements, where the elements are arranged perpendicular to the fluid flow, are 100 $\mu$ m wide (L2), 1000 $\mu$ m long (L3) and the distance between them (L1) is 1000 picometers, 1500 picometers wide, 200 picometers high, 411 mm longitudinal length and 13 channels.
MY156279	Univ Putra Malaysia (MY)	<b>A method of producing biodiesel using oil containing high content of free fatty acids.</b> A method of producing biodiesel comprises the steps of reacting an oil with an alcohol under heating in the presence of solid catalysts; wherein the oil has free fatty acid content not less than 3% by weight percentage and the solid catalysts are calcined bismuth vanadyl phosphates.
WO201811557	Neste OYJ (FI)	<b>A multicomponent diesel composition.</b> The invention discloses novel diesel fuel compositions comprising a renewable diesel component, a fossil diesel component and an oxygenate component, as well as methods for manufacture and use of a combination of a renewable diesel component, and an oxygenate component for reducing particulate matter emissions.
US2018178202	Crystaphase Products Inc (US)	<b>Heterogeneous catalyst for transesterification and method of preparing same.</b> A transesterification catalyst that is heterogeneous and a method for preparing said transesterification catalyst are provided. The catalyst can be used in a variety of transesterification reactor configurations including CSTR (continuous stirred tank reactors), ebullated (or ebullating) beds or any other fluidized bed reactors, and PFR (plug flow, fixed bed reactors). The catalyst can be used for manufacturing commercial grade biodiesel, biolubricants and glycerin.
BR102016019466	Univ Federal da Grande Dourados (BR)	<b>Process of characterization of alkyl esters oil (biodiesel).</b> Processing alkyl ester oil involves using 5.0-10.0 % magnesium oxide with respect to oil, activating in muffle furnace at 300° C for 4 hours, adding Arachis hypogaea and methanol, cooling in oil bath at 65° C for 1 hour. The catalyst is separated by decantation and centrifugation. The oil phase containing the biodiesel is extracted with n-hexane, and dried with magnesium sulfate.



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