

최신 미국특허 등록 목록

■ Method of manufacturing a particulate filter with regularly spaced micropores

- Patent number : WO 2008/112888
- Inventors : J.C. Wolfe and P. Ruchhoeft
- Applicant : University of Houston, USA
- Abstract : This patent provides details a method of manufacturing a particulate filter with regularly spaced micropores. Various embodiments disclose devices and methods for fabricating microporous filters. In the process described, sheet-membrane substrates are exposed to energetic particle radiation through a mask and the damaged regions are removed using a suitable developer. The required depth of field is achieved by using energetic particles to minimize diffraction and a particle source with a suitably small diameter. Referring to the accompanying figure, a beam (3) of energetic particles impinges on a substantially planar mask (2) perforated by stencil openings (4). A structured beam of transmitted 'beamlets' (5) damages the non-planar membrane substrate (1) in a highly uniform array of regularly spaced regions.

■ High selectivity, polymer nano-porous particle membrane structures

- Patent number : WO 2008/112745
- Inventors : C.V. Funk and D.R. Lloyd
- Applicant : Board of Regents, The University of Texas System, USA
- Abstract : High selectivity, polymer nano-porous particle membrane structures, or 'ZeoTIPS membranes' have been developed. They are useful for both water purification (removal of salts and dissolved organics) and gas

separation. This patent describes these membrane structures and the methods that are used to fabricate them. Such membranes may be composed of at least one nano-porous particle type; a microporous polymer matrix; and pores ranging from about 0.3 nm to about 1 nm. The methods of fabricating these particle membranes involves mixing at least one nano-porous particle type into a homogeneous solution of a polymer and a diluent at an elevated temperature to form a mixture, and cooling the mixture to solidify a microporous polymer matrix.

■ Energy efficient system and method for wastewater treatment

- Patent number : WO 2008/115444
- Inventors : P.M. Sutton
- Applicant : Shaw Environmental & Infrastructure Inc, USA
- Abstract : The subject of this patent is a wastewater treatment system (300). It includes an aerobic membrane bioreactor (302) and an anaerobic digester system (305), connected to receive wasted solids continuously from the aerobic membrane bioreactor, and also connected to return effluent (from the anaerobic digester system) to the aerobic membrane bioreactor (302). The solids retention time (SRT) in the bioreactor is maintained so that it is greater than the time needed to achieve growth of organisms suitable for converting carbonaceous biochemical oxygen demand (CBOD) into cell mass, but less than the time at which substantial decay of the organisms occurs. The system and process may further include an optional pretreatment unit and/or phosphorus and/or nitrogen removal downstream of the membrane

bioreactor system.

■ Zeolite membrane structures

- Patent number : WO 2008/110844
- Inventors : G.J. Bratton and C.D. Murton
- Applicant : Phoenix IPR Ltd, UK
- Abstract : In this patent a method is provided for forming zeolite membranes in the internal surfaces of a plurality of conduits in a cylindrical porous ceramic monolith. The conduits extend from one end of the monolith to the other. The method involves a series of steps: flowing a pretreatment liquid, including a zeolite initiating agent into the conduits; causing at least part of a carrier liquid component of the treatment liquid to flow from the conduits into and through the body of the monolith to the exterior; and causing zeolite crystals to be deposited in the porous internal surfaces of the conduits as the carrier liquid component flows into the monolith. The substrates may be pre-conditioned for membrane formation by forming an aqueous suspension of zeolite particles and passing this suspension alternately through the tubular conduits and out through their walls. This is done in such a way so as to deposit a layer of zeolite particles on the inner surfaces of the tubular conduits. The porous substrates are treated in chambers arranged annularly, for example, and the suspension is supplied to the chambers from a first common manifold via respective delivery tubes and is recovered via a second set of tubes leading to a second common manifold. The first and second manifolds and the supply and recovery tubes are configured so that the branch path to and from each chamber is substantially the same. After pre-conditioning, formation of the membranes may be achieved by depositing or crystallising a zeolite membrane on the zeolite particles (by gel crystallisation). Details are also provided of a membrane structure that comprises a tubular porous ceramic monolith containing tubular conduits each with an internal diameter of 5 mm to 9

mm (formed within the monolith, with a zeolite membrane applied to the internal surface of each of the conduits), in which there are four conduits and the monolith is longer than 600 mm or there are five or more conduits. This patent also provides details of methods for removing water from organic liquids and for the purification of water using the membrane structures described. Examples include the removal of residual water from ethanol or butanol or the production of water with a high purity.

■ Liquid-phase and vapour-phase dehydration of organic/water solutions

- Patent number : WO 2008/118584
- Inventors : Y. Huang, J. Ly, T. Aldajani and R.W. Baker
- Applicant : Phoenix IPR Ltd, UK
- Abstract : Processes for dehydrating an organic/water solution by pervaporation or vapour separation using fluorinated membranes form the subject of this patent. The processes are particularly useful for treating mixtures containing light organic components, such as ethanol, isopropanol or acetic acid. One embodiment of apparatus useful for performing the process described by this patent is shown in the accompanying figure. Referring to the diagram, a feed-stream (21), composed of a liquid organic/water mixture, is passed into a membrane separation unit (20) and flows across the feed side (22) of membrane (23). Under a vapour pressure difference between the feed (22) and permeate (24) sides of the membrane, water passes preferentially to the permeate side, and a stream (25), enriched in water vapour, is withdrawn in the gas phase from the permeate side (24). The remaining liquid residue stream (26) is withdrawn from the feed side (22). The stream (25) may be condensed in a condenser (27), cooled by line (28) containing a coolant, to yield a liquid condensate stream (29). The residue stream (26) is withdrawn as the dehydrated product.

■ **Process for forming microporous membranes**

- **Patent number** : WO 2008/118580
- **Inventors** : I.H. Romdhane and S.L. Ciliske
- **Applicant** : 3M Innovative Properties Co, USA
- **Abstract** : This invention concerns a method for forming a microporous membrane with a micro-structure. Dope and coagulant formulations are simultaneously cast, where the coagulant formulation diffuses into the dope formulation through an interface effecting a phase inversion to form a micro-structure. A schematic cross-sectional representation of a multi-layer extrusion die (200) that is capable of forming multi-layer sheets is shown in the accompanying figure. The multi-layer extrusion die includes an extrusion head (220) disposed adjacent to a back-up roll (240). The rotatable back-up roll receives extruded layers from the extrusion head. In some embodiments, the backup roll may optionally use a liner (260) to support the co-extruded layers (that is, sheet) as they proceed to form a microporous membrane. The extrusion head (220) includes a dope formulation cavity (320), and coagulant formulation cavities (300, 340), ending in extrusion slots that serve as pathways for co-extruding the dope and coagulant formulations. The dimensions of the extrusion slots may be conveniently established by placing precision metal shims of a necessary thickness between bars of the die. In carrying out the processing method detailed by this patent, a dope formulation is introduced into cavity 320 so as to subsequently form a dope formulation layer. Similarly, a coagulant formulation may be introduced into cavities 300 and/or 340 to subsequently form coagulant formulation layers on one or more surfaces of the dope formulation layer.

■ **Process for enriching the aroma profile of a non-alcoholic beverage**

- **Patent number** : WO 2008/099325
- **Inventors** : A.M Magalhães Mendes, L.M. Palma Madeira and M. Dias Catarino
- **Applicant** : Universidade do Porto, Portugal

- **Abstract** : This invention covers a process for enriching the aroma profile of a beverage – especially beer and wine – by extracting the aroma from the original beverage and subsequently adding it to the beverage, after total or partial ‘de-alcoholisation’. The original beverage (1) is fed to a membrane separation module (4), the permeate side (5) of which is under vacuum, created by a pump (12). The feed contacts the membrane’s surface and the aromas are selectively permeated to the permeate side of the membrane, where they suffer evaporation. The vapour permeate stream (5) is condensed (10) at an appropriate temperature (which can be cryogenic). After the aroma extraction, the beverage (6) is fed to a de-alcoholisation unit (14) which produces a non-alcoholic drink (15). Finally, the extracted aromas (10) are added to the de-alcoholised beverage. In this way an aroma enriched product (16) is obtained without considerably increasing its alcohol content.

■ **Membrane-based filtration process and design**

- **Patent number** : WO 2008/098309
- **Inventors** : F. Zha, D.O. Cameron, A. Nygard and W.T. Johnson
- **Applicant** : Siemens Water Technologies Corporation, USA
- **Abstract** : The subject of this patent is a membrane filtration system. As shown on page 14 it incorporates a feed-containing vessel (7) and a membrane module (6), including one or more hollow permeable membranes (8) for filtering the feed liquid (located in the vessel). Also included is a means for applying a pressure differential across the walls of the membranes to induce filtration; a feed liquid reservoir (9) that is connected to the membrane module (6); a source of feed liquid (12); a source of gas (10); and means (11) for selectively producing a flow of gas from the gas source and a flow of feed liquid from the feed liquid source (12) through the membrane module (6) into the feed liquid reservoir (9). The flow of gas produces bubbles within the feed liquid to clean the membranes (8).

■ **Use of acoustic signals to measure membrane fouling in spiral-wound modules**

- Patent number : WO/2008/103864
- Inventors : W.E. Mickols, M.S. Kobeltz, D.J. Moll and D.B. Streeter
- Applicant : Dow Global Technologies Inc, USA
- Abstract : This patent describes a way of measuring membrane fouling in spiral-wound modules by using acoustic signals. The patent provides details of a spiral-wound module assembly that comprises a permeate collection tube, at least one membrane envelope wound around the permeate collection tube, an outer module housing, and at least one acoustic transducer located adjacent to the permeate collection tube. Several embodiments are disclosed, including one that involves a stand-alone probe that has been adapted so that it can be inserted into the permeate collection tube. In several other embodiments, one or more transducers are secured to the inner surface of the permeate collection tube. This invention further covers a method of measuring membrane fouling within a spiral-wound module. It involves the following steps: transmitting an acoustic signal from a location adjacent to the permeate collection tube; receiving an 'echo signal' (which is generated by the transmitted acoustic signal when it is reflected from an interface within the module); providing a reference signal corresponding to a known state of membrane fouling; comparing the echo signal with the reference signal; and determining the state of membrane fouling based on the comparison of the echo signal and reference signal.

■ **Fluid filter with polymeric membrane and metal supports**

- Patent number : WO 2008/103241
- Inventors : A. Diprizio, P. Matthews and J.I. Arno
- Applicant : Entegris Inc, USA and Advanced

Technology Materials Inc, USA

- Abstract : This invention covers a fluid filter that makes use of a polymeric membrane supported by metallic screens. The device is contained in a housing. The supports have apertures through which fluid can pass. The metallic supports are created in such a way that at least one of their surfaces is substantially free from burrs - so as not to damage the membrane material. This smooth surface is in contact with the polymeric membrane. One or more indexing protrusions can be added along the circumference to restrict the relative movement between the supports (and to align the apertures of the two supports). A perspective cross-sectional view of an embodiment of the filter detailed by this patent is shown in the accompanying figure. The filter housing (10) is about 28 mm (1.1 inches) tall. It includes a narrow neck portion (13) that has been adapted to connect to a conduit to create fluid channel between the filter and a regulator. The neck has a diameter of about 6 mm (0.25 inches), and a length of about 19 mm (0.75 inches). It is preferably welded to the conduit but it also could be connected using a metal face-seal or compression fittings. Beginning at the lower portion of the neck portion, the filter housing tapers outwardly, in the shape of a frustum, with the filter membrane (50) positioned at the base of the frustum. In one embodiment, the base of the frustum has a diameter of about 20 mm (0.77 inches), although other sizes are within the scope of the invention. In the preferred embodiment, the outer surface of the lower portion of the filter housing (10) contains a screw thread (18). A retainer nut (20) has the corresponding screw thread (22) along its inner, upper portion. The set of screw threads allows the retainer nut to be screwed onto the filter housing. While this configuration is preferable - because it is easy to assemble and simplifies repairs and membrane replacement - other configurations are also possible.

■ Structure and maintenance of UF or MF membrane modules

- Patent number : WO 2008/101816
- Inventors : J.-P. Jover, C. Goudal and P. Thomas
- Applicant : OTV SA, France
- Abstract : The technique detailed by this patent can be applied to membrane modules that are used for the ultrafiltration (UF) or microfiltration (MF) of liquids such as water. It covers at least one assembly of membrane modules, extending essentially in a vertical plane, and at least one duct. The modules each include an elongated body provided at both (opposite) ends with lower and upper removable end-pieces - each having at least one tapping that enables a connection to be established with the duct. The assembly's ducts also extend in a vertical plane.

■ Insert device for multi-well plate

- Patent number : WO 2008/106515
- Inventors : D. Eddington, K.-H. Nam and S.C. Opegard
- Applicant : The Board of Trustees of the University of Illinois, USA
- Abstract : This patent describes an assembly that is composed of a multi-well test plate containing a plurality of wells, each with an opening and a base surface. An insert plate that has a plurality of inserts is positioned so that it can be aligned with a corresponding part of the wells, whereby the insert plate can be 'nested' with the multi-well plate. Each of the inserts includes a supply port; an exhaust port; a bottom portion, having a plurality of channels extending between the supply port and the exhaust port; and a gas permeable membrane covering the bottom portion. Each of the inserts is sized to position the gas permeable membrane at a desired distance from the base surface of the multi-well test plate when the test plate and the insert plate are coupled to one another.

■ Portable haemodialysis apparatus

- Patent number : WO 2008/104108
- Inventors : F.A. Alkanhal, China
- Applicant : F.A. Alkanhal, China
- Abstract : The subject of this patent is a portable haemodialysis apparatus that is designed to run continuously. It is composed of a housing (1); a multifunctional pump (2); a dialyser (3); a backward dialysis membrane filter (8); a waste-fluid bag (5) and a catheter. The apparatus also includes an electrode for measuring blood urea concentration. This electrode interfaces with a microcomputer (20). The microcomputer is also connected to valve-controlling unit (21), which is part of the catheter of the fluid outlet (of the backward dialysis membrane filter). The microcomputer incorporates a memory card.

■ Improved inorganic membrane

- Patent number : WO 2008/106028
- Inventors : C.R. Fekety, W. Liu, Z. Song and J.M. Whalen
- Applicant : Corning Inc, USA
- Abstract : An inorganic membrane has been developed that has an improved pore structure. The membrane may have a mean pore size of up to about 100 nm and a mean particle size that ranges from around 10 nm to about 100 nm. In one embodiment, the membrane comprises α -alumina and is formed by providing a coating slip comprising δ -alumina; applying this coating slip to a support surface to form a coating layer; drying the coating layer; and firing the dried coating layer at a temperature of at least 1000°C to convert at least a portion of the δ -alumina to α -alumina, and to form an inorganic membrane.

■ Improved liquid filtration media

- Patent number : WO 2008/109117
- Inventors : G. Chen, H.J.C. Gommeren and L.M.

Knorr

- **Applicant** : E.I. Du Pont De Nemours and Co, USA
 - **Abstract** : This invention covers a liquid filter with a composite medium that has a nano-web adjacent to – and optionally bonded to – a microporous membrane. The membrane is characterised by an LRV value of 3.7 at a rated particle size, and the nano-web has a fractional filtration efficiency of greater than 0.95 at the rated particle size of the membrane. The nano-web also has a thickness efficiency ratio of greater than 0.01 at that efficiency. The nano-web acts to provide depth filtration, pre-filters particles and extends the service life of the membrane.
- **Process for continuously producing ethanol**
 - **Patent number** : WO 2008/089299
 - **Inventors** : J. Laviolette, USA
 - **Applicant** : J. Laviolette, USA
 - **Abstract** : A process has been developed for producing ethanol. It uses a vacuum process and selectively permeable membranes to increase ethanol production efficiency. In the process described, yeast converts sugar to ethanol under anaerobic conditions within a process chamber void of oxygen and filled with a nitrogen gas (N₂) or any non-oxygen-containing gas. A glucose solution is fed into the process chamber to a yeast solution to ferment. A selectively permeable membrane filters ethanol away from the yeast and out of the process chamber. The removal of ethanol from the process chamber keeps the yeast alive, enabling it to constantly produce ethanol. The accompanying figure shows an example of an ethanol producing device (10). It includes a fermenting chamber (12) that is void of oxygen and filled with a non-oxygen-containing gas. Air within the fermenting chamber is removed through a vacuum line (16) and N₂ (30) is fed into the fermenting chamber through a hose (20). A bundle (14) of tubes (32) is disposed within the fermenting chamber. Each of the tubes is fabricated from a selectively permeable membrane that allows ethanol (24) to migrate through the tubes and into the fermenting chamber where it is exhausted through the outlet (22). The system shown uses a pressure differential between a pressure P1 within the tubes, and a pressure P2 within the fermentation chamber to draw ethanol through the selectively permeable membrane of the tubes and into the fermentation chamber.
 - **Modified porous membranes**
 - **Patent number** : WO 2008/091658
 - **Inventors** : D.T. Tsou and M.M. Pacheco
 - **Applicant** : Whatman Incorporated, USA
 - **Abstract** : This invention covers a method of modifying the pores of a porous membrane. It involves contacting the membrane with a pore-modifying agent. This changes the pore opening at the first surface of the membrane, making it different to the pore opening at the second surface of the membrane. This invention also covers a porous membrane that has a first surface and a second surface. A plurality of pores extend between these two surfaces.
 - **Method of controlling RO membrane bio-fouling in drinking-water production**
 - **Patent number** : WO 2008/091453
 - **Inventors** : S.W. Najmy, D.J. Love and C.D. Gartner
 - **Applicant** : Dow Global Technologies Incorporated, USA
 - **Abstract** : This patent provides details of a method of controlling RO membrane bio-fouling in a drinking-water production process. A method of treating water for municipal use is described. It involves treating the feed-water stream on the feed-side of an RO membrane with a non-oxidising, bromine-containing biocide in the absence of a reduc-

ing agent. This is done in order to reduce or prevent bio-fouling of the membrane. The produced water stream on the permeate side is monitored for the presence of bromine-containing compounds. This approach offers a number of advantages claim the inventors. These may include the preservation of the membrane, production of water that meets applicable regulations for safe drinking and a simplified approach to processing, without additional steps required to remove the biocide or its degradation products from the produced water.

■ **Integral sweep controller for gas membrane separation device**

- Patent number : WO 2008/094990
- Inventors : D. Barnette, T. Fox, M. Honath, C. Cuta, C. Geisz and J. Burban
- Applicant : Flair Corporation, USA
- Abstract : In this patent, a method and apparatus are provided for controlling the amount of purging that occurs within a membrane separation device. The membrane separation device includes separation and sweep-controlling components. Within the membrane separation component, a major portion of the non-permeate gas is sent out of the device, while a minor portion is diverted for use as a sweep gas. The sweep gas is controlled by a valve that cycles with a device, such as a compressor. Thus, the membrane separation device is on when the compressor is on and is off when the compressor is off. As such, the membrane separation device is not required to sweep at all times. The accompanying figure provides a view of the membrane dryer (100a) with an integral sweep controller (100b), according to an embodiment of this invention. Also shown is a sweep manifold (130); a sweep control orifice (140), for metering the appropriate amount of sweep air; a sweep port fitting (145), and a valve (135) for controlling the sweep air. The valve may be an on-off valve, such as a solenoid valve. Compressed air, containing water vapour, enters a membrane head (105) of the dryer through the wet air inlet

(1). The compressed air passes through a membrane dryer bundle (110), which is housed within a membrane dryer bowl or shell (115). The bundle, which may be wound helically or in another shape, is specifically designed to attract water vapour, and in one embodiment of this invention, may comprise a bundle of hollow fibres. A water vapour partial pressure differential is present between the inside of the membrane dryer hollow fibres and the outside of the membrane dryer hollow fibres - so that water vapour will migrate to the outside of the hollow fibres. In this way, as the compressed air passes through the inside of the membrane fibres, the water vapour is absorbed on the inside of the fibre wall and passes quickly through the walls of the fibre to the outer portion of the membrane fibres. In order to perform a continuous filtering and drying process, the outer layers of the membrane fibres must be purged of water vapour.

■ **Treatment of wastewater using dual-stage membrane bioreactors**

- Patent number : WO 2008/093287
- Inventors : W. Edwards, C.C. Bezuidenhout and W. Leukes
- Applicant : Water Research Commission, South Africa
- Abstract : The subject of this patent is a wastewater treatment process. The patent describes the steps of providing an acclimation membrane bioreactor system (2, 4) for developing a desired micro-organism population inoculum. The system is connected (interruptible fluid flow) to an effluent hydrolysis system (3). This enables the flow of micro-organisms from the bioreactor system to be regulated independently from the effluent flow through the hydrolysis system.

■ **Tubular braid and composite hollow-fibre membrane**

- Patent number : WO 2008/097011
- Inventors : M.-S. Lee, J.-K. Yoon, S.-H. Choi

and Y.-C. Shin

- **Applicant** : Kolon Industries Incorporated, Korea

- **Abstract** : A tubular braid and a composite hollow-fibre membrane form the subject of this patent. The tubular structure is made by braiding yarns. A yarn is made by combining a thin filament and thick filament. The latter is made up of a plurality of mono-filaments that have a fineness of 0.01-0.4 denier, while the thick filament comprises at least one mono-filament having a fineness of 3-50 denier. The composite hollow-fibre membrane, which uses the tubular braid, possesses excellent water permeability characteristics, high mechanical strength, good filtration reliability, great peeling strength, low dope permeation and high stiffness. The accompanying diagram shows the structure of the composite hollow-fibre membrane detailed by this patent. The tubular braid (10) functions as a reinforcing material and a polymer resinous thin-film (20) is coated on the surface of tubular braid. The thin filament (included in the tubular braid) leads to a high peeling strength between the tubular braid and the polymer resinous thin-film.

■ Method of treating liquid waste

- **Patent number** : WO 2008/096166

- **Inventors** : C.P. Jones and P. Chandler

- **Applicant** : Edwards Limited, UK

- **Abstract** : A method of treating a liquid waste that contains target species is described by this patent. The liquid is first conveyed through a housing containing a catalyst for removing either a reducing agent or an oxidising agent from the liquid. The liquid is then conveyed to a reverse osmosis (RO) or nanofiltration (NF) membrane to obtain a retentate rich in the target species and a permeate lean in the target species. The retentate is returned to the liquid upstream from the membrane, while the permeate may be subject to further treatment, for example,

in a neutralisation plant. The apparatus is composed of a housing (12) containing a catalyst (14) for removing either the oxidising agent or a reducing agent from the liquid waste. In the drawing, the housing is mounted on a tool (10), but it may be located adjacent to the tool, or further downstream from the tool, depending on how rapidly the oxidising agent (or reducing agent) needs to be removed from the liquid waste. A purge gas is conveyed through the housing to remove any gaseous by-products generated by the removal of the oxidising agent or reducing agent from the liquid waste. The liquid waste is pumped from the tank (16) by a pump (18), and subsequently conveyed to a second housing (20) containing a filter membrane (22) - which may be either a RO or a NF membrane. The pump raises the pressure of the liquid waste above the osmotic pressure so that the liquid waste is divided by the membrane into a retentate and a permeate. The retentate, rich in target species contained in the liquid waste, is returned to the tank (16) by conduit (24). The permeate, lean in these target species, is conveyed by another conduit (26) to a permeate storage vessel or tank (28). This tank may be periodically drained or replaced by an empty tank to enable the permeate to be removed for further treatment.

■ Filtration system

- **Patent number** : WO 2008/096108

- **Inventors** : D.A. Theron, A.J. Mcmonagle, M.A. McNulty and S.A. Barrie

- **Applicant** : H2Oil & Gas Ltd, UK

- **Abstract** : This patent covers a system that includes a vessel for housing at least two filtration elements. One or more of the filtration elements is a reverse osmosis membrane or a nanofiltration membrane and one of the other filtration elements is a microfiltration (MF) or ultrafiltration (UF) membrane. The vessel has an inlet port for providing a liquid feed to the filtration elements, an outlet port for directing a permeate produced by the ele-

ments from the vessel and an outlet port for directing a concentrate produced by the elements from the vessel. A number of vessels can be provided in a parallel and/or a series arrangement and they can be arranged so as to allow regeneration of the MF or UF membranes from another vessel in the arrangement.

■ Reinforced ion-exchange membrane

• Patent number : WO 2008/095509

• **Inventors** : E. Middelma and J.H. Balster

• **Applicant** : Redstack BV, The Netherlands

• **Abstract** : This invention relates to a reinforced ion-exchange membrane. It is composed of a porous support matrix onto which is laminated a polymeric film. The porous support matrix has no electrical resistance as measured in the six-compartment configuration and the polymeric film comprises a polymer functionalised with charged moieties in a degree of at least 50%.