

Nelcy

Search history

Search 1: PN=(WO2012/148911) (Results 1)

Search 2: [SP]: 1. a method of maximizing draw solute recovery in an osmotically driven membrane system, the method comprising the steps of: providing a first osmotically driven membrane system comprising a forward osmosis membrane and configured for receiving a first solution on a first side of the membrane and a concentrated draw solution on a second side of the membrane osmotically separating a solvent from the first solution using the concentrated draw solution, thereby forming a second solution on the first side of the membrane and a dilute draw solution on the second side of the membrane, wherein the second solution comprises at least one first ionic species of solute via reverse ion exchange through the membrane separating the dilute draw solution to recover at least one draw solute and the solvent, wherein the recovered solvent comprises at least one second ionic species of solute recycling the recovered at least one draw solute to the first osmotically driven membrane system providing a second osmotically driven membrane system comprising a reverse osmosis membrane pressurizing the recovered solvent in the second osmotically driven membrane system to recover a substantially pure solvent and a concentrated solution comprising the at least one second ionic species of solute recycling the concentrated solution comprising the at least one second ionic species of solute to the first osmotically driven membrane system, wherein the concentrated solution is added to the first solution, thereby resulting in the second solution comprising the at least one first ionic species of solute and the at least one second ionic species of solute balancing the at least one first species of solute with the at least one second species of solute to form additional removable draw solutes and separating the second solution to recover the additional draw solutes and a third solution. 2. the method of claim 1 further comprising the step of recycling the additional draw solutes into the concentrated draw solution. 3. the method of claim 1, wherein the step of separating the dilute draw solution comprises distillation. 4. the method of claim 1, wherein the concentrated draw solution comprises ammonia and carbon dioxide in a molar ratio of at least 1:1. 5. a system for osmotic extraction of a solvent from a first solution, comprising: a forward osmosis system comprising: a first chamber having an inlet fluidly connected to a source of the first solution a second chamber having an inlet fluidly connected to a source of a concentrated draw solution and a semi-permeable membrane system separating the first chamber from the second chamber a first separation system fluidly coupled to the forward osmosis system downstream of the second chamber and configured to receive a dilute draw solution therefrom and to separate the dilute draw solution into draw solutes and a solvent stream a pressure exchanger fluidly coupled to the separation system and configured to pressurize and transport the solvent stream a reverse osmosis system fluidly coupled to the pressure exchanger and comprising: a first chamber configured for receiving the pressurized solvent stream a semi-permeable membrane coupled to the first chamber and a second chamber coupled to the semi-permeable membrane and configured for receiving a solvent fluxed through the membrane, wherein the first chamber of the reverse osmosis unit is fluidly coupled to the first chamber of the forward osmosis unit to provide at least a portion of the first solution and a second separation system fluidly coupled to the first chamber of the forward osmosis system and configured for receiving a concentrated first solution therefrom and removing at least one of draw solutes and a product stream from the concentrated first solution. 6. the system of claim 5 further comprising a recycling system in fluid communication with the second separation system for returning the separated draw solutes to the concentrated draw solution. 7. the system of claim 5, wherein the concentrated draw solution comprises ammonia and carbon dioxide in a molar ratio of at least one to one. 8. the system of claim 5, wherein at least one of the first and second separation systems comprises at least one of a distillation column or a contact membrane. 9. a method of treating wastewater, comprising: introducing wastewater having a high biochemical oxygen demand or a high chemical oxygen demand on a first side of a semi-permeable membrane introducing a concentrated draw solution comprising ammonia and carbon dioxide at a molar ratio of at least one to one on a second side of the semi-permeable membrane to maintain a desired osmotic concentration gradient across the semi-permeable membrane promoting flow of at least a portion of the wastewater across the semi-permeable membrane to form a second solution on the first side of the semi-permeable membrane and a dilute draw solution on the second side of the semi-permeable membrane and introducing at least a portion of the dilute draw solution to a separation operation to recover draw solutes and a solvent stream. 10. the method of claim 9, further comprising introducing the second solution to a secondary process including at least one of an incinerator and an anaerobic digester. 11. the method of claim 10, further comprising providing heat generated during the secondary process to the separation operation. 12. a forward osmosis process comprising the steps of: introducing a first solution comprising a solvent and at least one solute on a first side of a semi-permeable membrane introducing a plurality of seeds to the first solution introducing a concentrated draw solution to a second side of the semi-permeable membrane promoting nucleation of the at least one solute in the first solution and promoting a flow of at least a portion of the solvent across the semi-permeable membrane to form a second solution on the first side of the semi-permeable membrane and a dilute draw solution on the second side of the semi-permeable membrane. 13. the process of claim 12, further comprising the step of directing at least a portion of the dilute draw solution to a separation unit to recover at least one of a solvent stream or draw solutes. 14. the process of claim 13, further comprising the step of reintroducing draw solutes into the concentrated draw solution on the second side of the semi-permeable membrane to maintain a desired molar ratio in the concentrated draw solution. 15. the process of claim 12 further comprising the step of recovering at least a portion of the at least one solute precipitated out of the first solution. 16. the process of claim 15, wherein the step of recovering the precipitated solutes comprises further processing of at least one of the solute or the first solution. 17. a system for the processing of a solution using osmosis, the system comprising: a forward osmosis module comprising: a first chamber in fluid communication with a source of a first solution comprising a solvent and at least one solute a second chamber in fluid communication with a concentrated draw solution and a semi-permeable membrane coupling the first chamber and the second chamber and means for introducing a plurality of seeds into the first chamber, wherein the plurality of seeds cause nucleation of at least a portion of the at least one solute when the first solution is introduced into the first chamber. 18. the system of claim 17 further comprising a separation module in fluid communication with the second chamber for recovering at least one of a solvent stream and draw solutes. 19. the system of claim 18 further comprising means for recycling draw solutes into the concentrated draw solution. 20. the system of claim 17 further comprising a recovery module in fluid communication with the first chamber for recovering precipitated solutes. 21. an apparatus for the treatment of a solution using osmosis comprising: a chamber configured for receiving a first solution comprising a solvent and at least one solute a membrane module disposed within the chamber and comprising a semi-permeable membrane having an exterior surface in fluid communication with the first solution and an interior surface for receiving a concentrated draw solution and means for introducing a plurality of seeds into the chamber, wherein the plurality of seeds cause nucleation of at least a portion of the at least one solute in the first solution in the chamber. (Results 99)

Search 3: TAC=(2 and wastewater) (Results 3)

Search 4: TAC=(2 and direct osmosis) (Results 0)

Search 5: TAC=(2 and ion exchange) (Results 2)

Search 6: TAC=(2 and osmosis) (Results 6)

Title: PROCESS FOR SEPARATING HYDROCARBONS

Abstract: Source: US3819742A ABSTRACT OF THE DISCLOSURE The invention relates to a process for separating mixtures of hydrocarbons, notably conjugated diene hydrocarbons, from mixtures containing the same, by the general technique of permeation or pervaporation through specific membranes. The specific membranes used are formed of a high polymer comprising functional groups chemically combined by covalent bonding within the polymer forming the said membrane, the said groups possessing a physicochemical affinity, notably a capacity to complex, with respect to one of said hydrocarbons and, substantially, the absence of such a capacity with respect to other hydrocarbons of the mixture. For the separation of dienes, such as butadiene and pentadiene, membranes are used containing active nitrile, pyrrolidone, N-substituted groups, such as N-alkyl groups, notably N-methyl or N-methyl-pyrrolidone. The membrane can be obtained, for example, from a vulcanized butadiene-acrylonitrile rubber, which can contain about 5 to 60 percent acrylonitrile, and notably from 20 to 30 percent. The present invention relates to the field of the separation of mixtures of hydrocarbons. The invention relates more particularly to the separation of conjugated diene hydrocarbons from mixtures also containing saturated or simple ethylenic hydrocarbons. The known processes for the industrial separation of hydrocarbons usually make use of the technique of liquidliquid extraction or extractive distillation. In liquid-liquid extraction, for instance, sulphuric acid is used to extract the isobutene from a cut of C₄ hydrocarbons already previously depleted of butadiene. The sulphuric acid in fact permits selective dissolving of the isobutene from the C₄ hydrocarbon mixtures. An example of extractive distillation is that of the separation of dienes in cuts of C₄ and C₅ hydrocarbons, the butadiene being separated from the CY cut and the 1-3 pentadiene from the C₅ cut. In this case, acetonitrile is used as a selective solvent. The petroleum industry also uses N-methyl-pyrrolidone as a solvent for the extraction of butadiene and pentadienes. The drawback to said known separation processes is that their yield decreases in proportion as the extraction or distillation evolves. Furthermore, they imply the use of bulky installations and a large equipment, and are therefore costly. The cost of maintaining said units is also high. Efforts have already been made to overcome these various drawbacks by passing the mixture of hydrocarbons to be separated over porous substrates containing a selective extraction solvent. As an illustration, U.S. Pat. No. 3,244,763 proposes stripping the isobutene from a C₄ hydrocarbon cut by passing the hydrocarbon mixture across a porous substrate impregnated with sulphuric acid. The isobutene is pumped through said substrate owing to the action of the sulphuric acid which is secured thereto. The isobutene can thus be removed from the other side of the wall of the porous substrate, by a solvent such as hexane. Similarly, United Kingdom Pat. No. 1,090,096 suggests a separation treatment which, instead of being applied to hydrocarbons employs hydrometallurgical compounds. More particularly, it deals with the separation of uranyl nitrate from solutions also containing iron nitrate and aluminium nitrate. To carry out separation, the solutions are flowed over a porous support on which there is deposited a coat of polyvinyl chloride plastified with a tributyl phosphate or by other phosphoric esters. In the examples illustrating the prior art which have been mentioned, the selective solvent is only physically integral with the porous support. This is exactly the case of a support impregnated with sulphuric acid. It is the same thing when the porous support is coated with polyvinyl chloride plastified with tributyl phosphate, which acts as a solvent. In polyvinyl chloride, as a matter of fact, the tributyl phosphate forms a simple physical, though intimate, mixture with the macromolecules of the vinyl chloride polymer. The plasticizer is not, however, chemically bonded to the macromolecule. In other cases, it has been suggested that membranes without electrical charges should be used to separate metallic ions. Such membranes carry functional groups adapted to the nature of the ions to be separated. Said separation techniques are illustrated by U.S. Pats. Nos. 3,450,630 and 3,450,631 and obviously do not apply to the separation of hydrocarbon mixtures. Other documents embodying the state of the technique will also be studied in detail hereinafter. U.S. Pat. 2,388,095 relates to a process for refining mineral oils particularly in order to separate iso-olefins from mixtures thereof with normal olefins. The mixtures of gas to be treated is introduced into a high-pressure compartment separated from a low-pressure compartment by a membrane which is maintained on a perforated metal plate. Gas fractions enriched with one or the other components of the mixture are collected on either side of the membrane. The description of U.S. Pat. 2,388,095 mentions that the use of rubber membranes as solid solvents to separate saturated hydrocarbon gases from unsaturated hydrocarbon gases is known. The comparative example given in the patent shows that separation with such a rubber membrane is not satisfactory. U.S. Pat. 2,388,095 suggests other types of solid solvents, notably membranes obtained by the polymerization of isobutylene or by the copolymerization of an iso-olefin such as isobutylene with a conjugated diolefin. Such membranes act as solid solvents with respect to iso-olefins and are therefore unsuitable for separating conjugated diene hydrocarbons from the hydrocarbon mixture containing them. This patent also teaches that rubber membranes are not satisfactory. Furthermore, the process of U.S. Pat. 2,388,095 is only applicable to the separation of gaseous mixtures. United Kingdom Pat. 1,069,231 relates to a process for separating fluid or gaseous mixtures, and notably an improved apparatus for carrying out said process. The technique used depends on the phenomenon of permeation or pervaporation already described in the literature (see United States Pats. 2,540,151 and 2,540,152) wherein one of the constituents of the mixture to be separated dissolves in the membrane and migrates through the latter under the influence of a pressure or concentration gradient. United Kingdom Pat. 1,069,231 is an example of prior document which illustrates the practical application of such a technique. The object of this patent is an apparatus permitting a large, active membrane surface area per unit volume and defines the technological parameters (pressure, thickness of the membrane, etc.) providing the best results. The indications relate neither to the nature of the membranes used nor to that of the mixtures separated. Moreover, the specific examples of United Kingdom Pat. 1,069,231 relate to the purification of sea-water, organic products or the separation of carbon dioxide from certain mixtures. United Kingdom Pat. 1,069,231 does not, therefore, teach means adapted to separate hydrocarbons, and it does not define the membranes which could be suitable for such an application. French Pat. 1,371,343, with its additions 72,416, 72,867 and 72,899, as well as French Pat. 1,568,217 relate to semi-permeable membranes, which contain active groups grafted into the mass. Said groups can be acid or basic groups, such as carboxylic acid groups, or originating in a basic monomer of the pyridine or amine type. Such membranes can be used for ion exchanges in the techniques of electrodialysis or reverse osmosis. Furthermore, their chemical structure is peculiar, as their skeleton consists of a perhalogenated polyolefin. The various aforesaid French patents do not therefore describe membranes which can be used for the separation of mixtures of hydrocarbons. United States Pat. 3,225,107 concerns, generally speaking, a process for separating organic compounds in the form of a liquid mixture by a permeation technique using a polymeric membrane onto the surface of which another polymer has been grafted. Said grafting can be carried out on one and/or the other surface of the membranes, but in any case, as is mentioned in the specification and illustrated in the appended drawings to said Pat. 3,225,107, it concerns membranes consisting of a thick, permeable support and a thin film applied to the surface thereof which provides selective separation. Said surface grafting is effected by the polymerisation of an active monomer according to conventional grafting techniques. When the support has a thickness of from 12.5 to 25 microns, the film grafted on the surface is no thicker than 2.5 microns. The constitution of the membrane is therefore heterogeneous inasmuch as the molecules of the component to be separated first come into contact with the grafted film, then pass through a thick layer of inert, porous material before arriving at the other side of the membrane, having optionally passed through another grafted film if grafting has been effected on both sides of the membrane. Such heterogeneity is an obstacle to the use of such membranes for the separation of certain gaseous or liquid mixtures. In certain cases, in fact, the component to be separated can in actual fact dissolve in the surface grafted film, but it is then stopped by the thick support layer whereby separation cannot take place. If the support layer is porous, the separation level remains insufficient and the overall yield of the operation is low. Finally, United States Pat. 3,225,107 vaguely mentions the application of the process of the separation of various mixtures of hydrocarbons, but it does not teach the means for separating conjugated diene hydrocarbons from mixtures containing same. Other prior documents describing the general technique of permeation are United States Pats. 2,953,502 and 2,981,680. The first is limited to the separation of azeotropic mixtures. The second relates to the separation of various mixtures and has as an object a process using two different types of membranes selective with respect to certain components of the mixture. The apparatus for carrying out said process is described in detail. The process is especially applicable to the separation of azeotropic mixtures, such as water and pyridine. Fractionation of mixtures of hydrocarbons and those containing conjugated diene hydrocarbons is not contemplated in said last patents. Generally speaking, the invention relates to a process for the separation of mixtures of hydrocarbons, which does away with the drawbacks of the industrial technique of selective extraction by solvent and extractive distillation, and makes use of specific polymer membranes applying the general technique of permeation or pervaporation. The invention relates more particularly to a process for the separation of conjugated diene hydrocarbons from mixtures also containing saturated or simple ethylenic hydrocarbons. A particular application of the invention is the separation of butadiene from the isobutene of a petroleum cut of C₄ hydrocarbons. Another application of the invention consists in the separation of isoprene and pentadiene. Another application of the process of the invention consists in the separation of isobutene from a mixture containing isobutene and 1-butene. Other advantages and other possibilities of application will become apparent to those skilled in the art in the detailed description which follows. The object of the invention is a process for the separation of a mixture of hydrocarbons, particularly conjugated diene hydrocarbons, from mixtures containing the same, by the general technique of permeation and pervaporation through an improved membrane, characterized in that the said mixture is contacted with a membrane formed of a high polymer comprising functional active groups chemically combined by covalent bonding within the polymer of which the said membrane is made, the said groups having a physicochemical affinity, notably a capacity to complex with respect to one of said hydrocarbons and, substantially, the absence of such a capacity with respect to other hydrocarbons of the mixture, and that a pressure gradient or chemical potential is applied to the said improved membrane in a known manner, which permits the recovery, on either side of the membrane, of a fraction enriched by the hydrocarbon having selectively passed through the membrane, and a fraction containing, predominantly, the other hydrocarbons of the mixture. The new specific membranes used in the process of the invention can be formed by chemical modification of a well known basis polymer which is a plastic material or an elastomer. Polystyrene, polyethylene, polyvinyl chloride or polytetrafluoroethylene ("Teflon(R)") can, for example, be used as a plastic material. Preference is generally given to elastomer membranes owing to the fact that the macromolecular chains are more mobile and higher coefficients of diffusion are thus obtained. The starting materials for such elastomers are natural and synthetic rubbers, such as, among others, copolymers of ethylene and propylene, butyl rubber, polyisoprenes, polybutadienes, polyoxypropylene. The aforesaid polymers are used in the form of a membrane, that is to say, a thin film. In practice, membranes of a thickness of one thousandth of a millimeter to 0.5 millimeter are suitable. Theoretically, thicker membranes can be used, but they provide lower separation rates. To obtain the best results, a minimum thickness is used, compatible with mechanical strength and long life. It is usual to apply the membrane to a porous support, which contributes to the mechanical strength of the whole. The membrane itself is not, therefore, subjected to mechanical stresses and it can be very thin, as little as one micron for example. The conventional techniques for preparing such membranes from crude basis polymer material are known. A first technique consists in moulding the polymer material under pressure. It does not permit membranes thinner than about one tenth of a millimeter to be obtained, but cross-lining or vulcanization can be effected simultaneously in the press. According to a second technique, which is preferred for the requirements of the invention, a polymer solution is prepared in a solvent such as an aromatic hydrocarbon like benzene, chlorinated solvents such as chloroform, chlorinated aromatic hydrocarbons, etc. The solution also usually contains vulcanization ingredients. A form corresponding to the membrane to be manufactured is soaked in the polymer solution, the concentration of which notably permits the thickness

of the final membrane to be varied. The form is dried gently to evaporate the solvent, first at ambient temperature, then in an oven at 40° C. with nitrogen or another inert gas to prevent oxidation, and finally at temperatures of about 140 to 160° C. It is essential to evaporate all the solvent and to avoid bubbles in order to obtain a thin, continuous membrane. This known technique enables elastomer membranes one hundredth of a millimeter thick to be obtained easily. Generally speaking, and in the case of an elastomer membrane, the use of a vulcanized membrane is suitable for the practical embodiment of the invention. The imperative condition is that the basis membrane which does not contain active groups cannot dissolve in the liquid phase of either of the components of the mixture to be separated. Moreover, an elastomer membrane is fragile if it is not 'vulcanized'. In all cases where one of the components is liquid, a vulcanized membrane should be used. The means for cross-linking or vulcanizing the aforesaid polymer are known in themselves. The operation may be effected with sulphur vulcanizing agents, with peroxides or by irradiation. The preceding observations concern the nature of the basis high polymer used to make the membrane of the invention and the practical modes for embodying it. It is a question of the conditions relating to the substrate of the membrane as the latter should, furthermore, have other characteristics. In the general definition previously given it was stated that the macromolecules of the polymer have chemically functional groups chemically combined by covalent bonding within the polymer, the said groups having a physicochemical affinity with respect to one of the components of the mixture to be separated, and particularly one of the hydrocarbons. The functional groups have as an essential role to increase the selectivity that a membrane constituted of the same basis polymer without functional groups may have with regard to a certain mixture of hydrocarbons. Within the meaning of the present invention, the expression "functional groups chemically combined by covalent bonding within the polymer" means that the functional groups are distributed evenly throughout the polymer mass, as opposed to membranes consisting of a support-skeleton with an active film on the surface thereof. In other words, when a membrane according to the invention is used, the molecules of the selectively separated hydrocarbon pass through the membrane and always come into contact with the same composition of material throughout the total thickness of the membrane, the distribution of functional groups being even in the mass throughout the thickness of the membrane. The functional groups in question can either be fixed chemically by grafting onto the macromolecules of a preexisting high polymer, or directly integrated with the skeleton of the macromolecular chains during polymerization with another monomer as is the case with copolymers where one of the monomers has an active functional group. The following examples of embodiment will be helpful in defining the general notion of physicochemical affinity. In the separation of dienes such as butadiene and pentadiene it is known, through the teachings of extractive distillation, that certain functional groups can be present in the solvents used to permit selective extraction. Thus, pyrrolidone alone does not permit the dienes to be extracted from C₄-C₅ hydrocarbon cuts, whereas N-methyl-pyrrolidone provides selective extraction of butadiene and pentadienes. The presence of the N-substituted group therefore appears to be connected with the selective capacity of the solvent. Similarly, the decisive function played by nitrile groups has been noticed when acetonitrile is used as a solvent for the extraction of dienes from C₄-C₅ hydrocarbon mixtures. The acetonitrile acts by increasing the boiling points of said compounds. In liquid-liquid extraction to separate isobutene, advantage is taken of the property possessed by sulphuric acid to selectively complex isobutene in a C₄ hydrocarbon cut depleted of butadiene. The active role of sulphuric acid should therefore be noted. From the above examples, and others, the nature of functional groups which increase the selectivity of a membrane can be foreseen. These functional groups should be the same as those possessed by a liquid organic solvent having a particular affinity with respect to one of the hydrocarbons of the mixture to be separated. This affinity is the result of the formation of an electronic complex characterized by a resonant structure between the solvent molecules and the molecules of the said hydrocarbon. A practical criterion exists which permits one skilled in the art to examine a posteriori the role of intensifying the selectivity of the active groups. This criterion is that the swelling of a membrane with active groups increases its selectivity towards a given mixture of hydrocarbons. This selectivity is a more effective selectivity than is the selectivity of a membrane with the same basis structure but without active groups. This increase in the swelling of the improved membrane as compared to conventional membranes proves the electronic complex formation between the active groups of the improved membrane and one or several components of the mixture to be separated. Polymers can be obtained in which the active groups are combined with macromolecules, by being chemically bonded thereto, by the usual techniques such as grafting or copolymerization. For the purpose of the grafting which should take place in the basic polymer mass, the polymer and at least one compound providing active groups are contacted with catalysts containing peroxide or diazoic compounds. Simple heating is sometimes sufficient to obtain said grafting. In the case when, as is preferred, elastomer membranes are used, the membrane should retain its elastomeric properties when grafting has ended. For copolymerization, the usual techniques are used, employing radical or ionic catalysts or which employ simple heating. Examples of such techniques will be given hereinafter with respect to particular applications of the process of the invention. It is essential to note that the component selectively separated from the mixture diffuses through the improved membrane, but that after the passage of said component the membrane remains chemically unchanged. It is thought that the molecules of the selectively separated hydrocarbon, whether they be gaseous or liquid, when they are contacted with the membrane, pass through the macromolecules of the membrane in a complexed state, the electronic structure of the selectivity permeating species being different during its diffusion from that of the said species in its normal electronic configuration. When separation is completed the membrane is ready to be reused without further treatment. A fundamental difference is thus observed compared with certain techniques using exchange resins, or others in which it is compulsory to carry out a regeneration treatment to remove the component, selectively fixed on this type of resin. Owing to this property, it can also be understood that the process of the invention is perfectly adapted to continuous operation. Elastomer membranes permit high diffusion coefficients to be obtained, particularly owing to their use at a temperature very much higher than their glass transition point. It should also be noted that following the usual TO vulcanization treatment, the active groups which are grafted or are part of the polymer macromolecule are not modified. In order to increase the yield during separation, it may be advantageous to contact the mixture of components in a liquid state. In a liquid phase, the density of the selectively permeating species is very high and the yield of the separated component increases. Owing to the conditions previously specified with respect to the polymer substrate, the polymer skeleton does not prevent migration of the molecules of the component to be separated. It should also be noted that, during transfer of the component through the membranes, two parameters exert an influence, they are, the electronic interaction of the component with the active groups of the improved membrane and the value of the diffusion coefficient through the membrane. It is understood that the overall action exerted by the membrane on the component to be extracted is the sum of the action of the active groups chemically combined by covalent bonding with the polymer and that of the basis polymer proper. Consequently, the action peculiar to the polymer substrate should be such that it encourages the action of the active groups. Said action can nevertheless be inoperative, or slightly unfavorable. Some examples of application will now be given by way of illustration. For the separation of dienes from hydrocarbon mixtures containing the same, a membrane containing nitrile active groups can be used, and particularly a membrane containing a butadiene acrylonitrile-copolymer. The acrylonitrile content of the copolymer can be in the range of about 5 to 60 percent. It is advantageously from 20 to 30 percent. Some copolymers of this type are known under the name of "Buna N." Others are put on the market by the Socit Plastimer (France) under the name "Butacryl." A membrane containing butadiene-acrylonitrile copolymers has the property of complexing the conjugated dienes owing to the electronic affinity between the nitrile groups and the dienes. Other active groups for the separation of conjugated dienes are of the N-substituted type or the pyrrolidone type. N-alkyl groups, such as the N-methyl group can be mentioned. Examples of compounds providing such active groups are N-methyl-pyrrolidone, N-vinyl-pyrrolidone and maleic N-methyl-imine. When said groups are fixed by grafting onto an elastomer, the membrane obtained has the property of selectively extracting butadiene and pentadiene from the hydrocarbons treated. Polymers bearing N-substituted grafted groups, such as N-methyl groups, can be obtained by the usual techniques previously mentioned. As an example, rubbers modified with N-methyl pyrrolidone were described in the Bull. Soc. Chim. 1961, p. 1433 by Christian Pinazzi, JeanClaude Danjard and Ren6 Pautrat. Such modified rubbers bear a variable number of groups fixed to the molecule, and may notably amount to between 10 and 30 percent by weight based on the initial polymers. The rubbers obtained are converted into said improved membranes by the solvent evaporation technique previously described. Suitable solvents are chlorinated aromatic solvents and heavy ketones. N-substituted groups, such as N-alkyl groups or pyrrolidone groups, can also be grafted onto various plastic materials such as polyacrylonitrile (see, for example, Graft Polymers, p. 78 by Battaerd and Tregear, series Polymer reviews No. 16, Interscience Publ. 1967). A third category of membrane, which is suitable for the separation of isobutene, is prepared from polymers comprising combined or grafted strong acid groups. An example of such polymers is described in French Pat. No. 6941159 which relates to a "process for the preparation of sulphonated polymers and the products obtained." Elastomer substrates suitable for the manufacture of said sulphonated polymers are polybutadiene and polyisoprene rubbers and ethylene-propylene copolymers. Such sulfonic groups can also be fixed onto plastic materials such as polystyrene, polyethylene and polytetrafluoroethylene ("Teflon"). Fixing on polystyrene is described, for instance, in "Chemical Reactions of Polymers, pp. 280-283 by H. M. Fettes, series High Polymers, vol. XIX, Interscience Publ. 1964. All the membranes in this category enable isobutene to be separated from a mixture containing isobutene and 1-butene. According to the invention, it is also advisable to apply a pressure gradient or chemical potential to the membrane to permit migration of the selectively selected component through the said membrane. Said chemical potential gradient can notably be obtained by establishing a difference in partial pressure of the component to be separated on either side of the membrane, a difference in concentration of said component or a difference in temperature. Pressure can advantageously be exerted on the surface of the membrane with which the mixture is in contact, or the vacuum applied to the other surface of the membrane, that is to say, that from which the separated component is collected, or both said means can be applied together. It may also be advisable to use a temperature gradient between the two mediums separated by the membrane. The specific examples hereinafter show, notably, that lowering the temperature enables a higher yield of separated gaseous constituents to be obtained. One of the devices for carrying out the process of the invention comprises, essentially, an enclosure separated by a membrane into at least two compartments, the said membrane being integral with a flat or cylindrical porous support, means for introducing the mixture to be separated into one of the compartments and means in the other compartment for withdrawing the separated components, as well as means for applying a pressure gradient on either side of the said membrane. Thus, in the upstream compartment, the mixture to be separated is caused to reside or circulate at atmospheric pressure, or under pressure, either in the gaseous state or in the liquid state. In the downstream compartment, the separation product, or permeate, is withdrawn by a gas or liquid carrier or extracted under vacuum. The invention will now be illustrated by some of its modes of embodiment with reference to the appended drawings in which: Fig. 1 shows a diagrammatic cross sectional view of a device for carrying out the process with a membrane disposed on a porous support. Fig. 2 is another device embodying a membrane integral with a porous, tubular support. Fig. 3 is a variant of the device of Fig. 2. Fig. 4 is a graph showing the influence of the temperature on the separation rate. As can be seen in Fig. 1, the device comprises an enclosure or chamber 1 separated into an upstream compartment 2 and a downstream compartment 3 by a porous support 4 which can be planar, convex or concave. The portions of chamber defining compartments 2 and 3 are maintained by side flanges 5, 6. A membrane 7 is integral with the porous support 4. A pipe 8 enters compartment 2 to supply the mixture to be separated under pressure. Another pipe 9 is used to withdraw the excess mixture from the upstream compartment 2. A pipe 10 is provided in compartment 3 to extract the permeate. In the device of Fig. 2, chamber 11 is cylindrical in shape. It is separated into an upstream compartment 12 and a downstream compartment 13 by a tubular porous support 14 bearing a membrane 17 about the entire periphery thereof. As is the case in Fig. 1, the mixture to be separated is introduced through pipe 18 and the excess mixture is withdrawn from compartment 12 through pipe 19. Pipe 20 is used to withdraw the permeate from compartment 13. Fig. 3 shows a device similar to that of Fig. 2. In this case, chamber 21 is also cylindrical and the porous support 24 is tubular. However, it is the inner surface of tube 24 which is covered by membrane 27. The upstream compartment 22 is situated within the tube and the downstream

compartment 23 is outside it. The mixture to be separated is introduced through tube 28 and the excess mixture is withdrawn through pipe 29. The permeate is recovered by means of pipe 30. The invention will now be illustrated, without being limited by specific examples of embodiment employing the devices shown in the appended drawings. EXAMPLE 1 A mixture of hydrocarbons consisting essentially of butadiene and isobutene was treated. Rubbers made of butadiene-acrylonitrile polymers, sold by the Societe Plastimer (France) under the name of "Butacryl" were used as membranes. Product BT is a 20 percent acrylonitrile polymer and product BT contains 30 percent acrylonitrile. When vulcanized, said products have the following specific gravity characteristics: Specific gravity: type BT 205: 0.98; type BT 305: 0.99. In the crude state the Mooney viscosity is respectively: With BT 205=45 to 55; with BT 305=50 to 55. The vulcanization formulation used is as follows; the parts being by weight Rubber

-----100 Zinc oxide -----5 Stearic acid -----2 Sulphur -----1.5 Accelerator -----1.5 (cyclohexyl benzothiazyl-sulfenamide) After vulcanization at 1530 C. for 20 minutes, the obtained membranes possess the following characteristics: With BT 305: Modulus at 300 percent elongation: 15.5 kg./cm² Tensile strength: 25 kg./cm.² Elongation (at breaking): 670 percent Swelling by volume in toluene (measured at ambient temperature): 1.60 percent Vulcanized membranes are obtained with BT possesses similar characteristics, with the exception of swelling in toluene, which is 192 percent. The membranes used had a thickness of 150l in the case of those manufactured with BT 205 rubber, and 300At for those made from BT 305 rubber.

As a comparison, membranes were also made of pure polybutadiene containing no acrylonitrile and also having a thickness of 300 g. After vulcanization the cross linking of the membranes was estimated to be about 3.4 percent. The device of Fig. 1 was used with a planar porous support 4 corresponding to the useful surface of membrane 7 equivalent to 38 cm.². The pressure in the upstream compartment 2 was 2 bars. The pressure in the downstream compartment 3 was 0.1 bar absolute, or 7.6 cm. Hg. The gaseous mixture introduced through pipe 8 contained, by volume 36 percent butadiene and 64 percent isobutene. Using a 300g vulcanized membrane made with BT 305, and at 20 degrees C., a diffusion velocity of butadiene of 0.4 g./h. through membrane 7 is measured, with a coefficient of separation of 2.85. With a conventional rubber membrane containing no nitrile groups, at 200 C. a diffusion velocity of 5 g./h. is measured, but the coefficient of separation in two independent measurements is 1.02 and 1.01, which shows that there is no effective separation of butadiene taking into account mistakes in measurements. This example, therefore shows the decisive influence of the presence of nitrile functional groups in the polymer improved membrane. These groups have a structural electronic affinity with respect to butadiene and permitting it to be separated from a butadiene-isobutene mixture. EXAMPLE 2 Example 1 was repeated, treating a mixture comprising 75 percent butadiene and 25 percent isobutene by volume on a membrane containing a butadiene-acrylonitrile copolymer of the type "Butacryl" BT 205 having a thickness of 150 microns. The coefficient of separation measured is between 2.5 and 3 for the following conditions of pressure: Outlet pressure of the permeate: 1 bar Difference in pressure between the upstream compartment and the downstream compartment (pressure gradient): 0.8 bar The useful surface of the membrane was 38 cm.² and the device used was that shown in Fig. 1. Under these conditions, at a temperature of 170 C., the mixture being introduced in the gaseous state and the downstream compartment flushed with nitrogen to entrain the permeate, the rate of separated butadiene measured corresponded to 6.3 tons per year and per M.² of membrane. By operating at 100 C. and using the mixture to be treated in a liquid state, and retaining the sweeping of the downstream compartment with nitrogen, a yield of separated butadiene corresponding to 6.3 tons per year and per M.² of membrane was measured. EXAMPLE 3 This example illustrates the influence of the temperature on the yield of the separated gaseous component. Example 2 was repeated under identical conditions, but the temperature was altered. The results obtained are given in Table I.

TABLE I The influence of temperature on the yield of separated butadiene. Yield g./h., membrane Temperature 0 C.: surface 38 cm.² -----8 -----3.40 -----3.25 11 -----2.40 12 -----2.16 -----1.40 -----0.72 -----0.40 -----0.26 -----0.20 -----0.16 -----0.14 -----0.13 Fig. 4 is a graph showing, in abscissa, the temperature in 0 C. and, in ordinates, the separated butadiene

yield expressed in tons per year and per m.² of the membrane, according to the results given in Table I above. It is seen that the yield increases as the temperature decreases. It may, therefore, be advantageous to work at temperatures in the range of about 5 to 200 C. EXAMPLE 4 To obtain butadiene of a high degree of purity, a mixture containing, by volume, 75 percent butadiene and 25 percent isobutene was treated according to the invention in four successive separation stages. Each of the stages being of the type shown in Fig. 1. The characteristics and conditions of treatment were the same as in example 2. At the outlet of the 4th separation stage there was obtained a butadiene containing less than 1 percent impurities. Equivalent results are obtained by treating the mixture to be separated in a series of devices comprising tubular membranes on porous supports of the type shown in FIGS. 2 and 3. EXAMPLE In this example, a mixture containing 50 percent isoprene and 50 percent cis-trans-1,3-pentadiene by volume was treated. The device used was the type shown in Fig. 1 with an effective membrane surface of 38 cm.². The outlet pressure of the permeate was 0.1 bar and the difference in pressure between the upstream compartment and the downstream compartment (pressure gradient) was 1 bar. The membrane used was a butadiene-acrylonitrile copolymer elastomer membrane of the type Butacryl BT 305 with 30 percent acrylonitrile having a thickness of 150 microns. Under these conditions there was obtained a coefficient of separation of 2.5 and a yield of 1,3-pentadiene separated at 170 C. corresponding to 1 ton/year/m.², the mixture being contacted in the liquid state with the membrane and the separated pentadiene in the gaseous state. With a BT 305 membrane of 300 microns, treating the same mixture under an upstream pressure of 1.4 bar and a downstream pressure of 0.1 bar, a coefficient of separation of 2 plus or minus 0.5 and a pentadiene yield of 1.2 g./h. at 360 C. were obtained. EXAMPLE 6 In this example, a commercial C₄ cut was treated by pervaporation. The device

used is the type shown in Fig. 1, with an effective membrane surface of 44 cm.². The outlet pressure of the permeate is 1.0 bar and the difference in pressure between the upstream compartment and the downstream compartment (pressure gradient) is 0.9 bar. The membrane used is a butadiene-acrylonitrile copolymer elastomer of the type BT 308 containing 30 percent acrylonitrile vulcanized with dicumyl peroxide and having a thickness of 16 microns. The composition of the feed, permeate and the mixture retained on the membrane are given in table II hereafter. TABLE II Mixture C4 cut (feed) retained Permeate Percent: Isobutane -----0.6 0.7 0.2 n-Butane -----3.7 3.9 1.8 1-butene -----12.6 14.1 10.0 Isobutene -----83.8 35.6 21.4 Trans-2-butene -----6.3 6.4 5.8 Cis 2-butene -----6.1 6.0 6.1 Butadiene -----3 6.8 33.4 54.6 Under these conditions, the coefficient of separation

of butadiene with respect to isobutene is 2.6 and the yield of permeate is 26.8 g./h., corresponding to a yield of 52 tons/year/m.². The invention is not limited to the aforesaid examples of embodiment. It can be applied to very diversified separations and, generally speaking to all mixtures of hydrocarbons which, in the prior art, were separated, or could be separated by liquid-liquid extraction or extractive distillation. For all said types of separation the invention teaches the use of improved membranes differing from the conventional ones in the fact that they are made of a high polymer comprising active groups chemically bonded with covalent bonding to macromolecular chains. The said active groups of the membrane having the property of forming electronic complexes with the permeating species, so that they replace the organic phase which forms either the extractant in liquid-liquid extraction operations, or, in the case of extractive distillation, the solvent which raises or lowers the boiling point of the compound to be extracted.

Classifications:

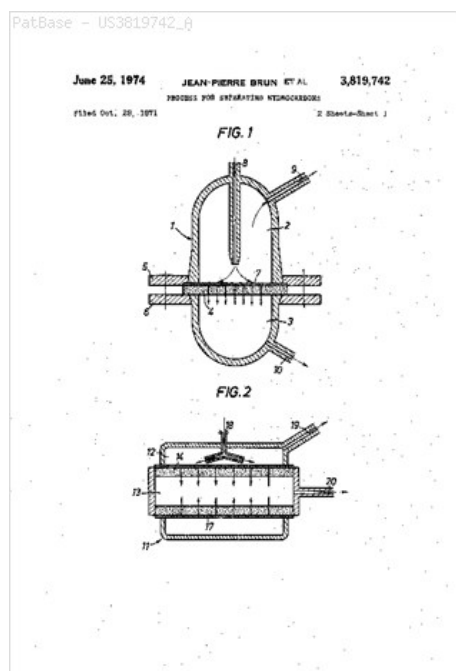
International (IPC 8-9): B01D53/22 B01D71/24 B01D71/82 C07C11/00 C07C11/12 C07C11/16 C07C11/18 C07C7/152 C10G31/00 (Advanced/Invention); C10G (Subclass/Invention)

International (IPC 1-7): B01D13/00 B01D53/22 C07C11/12 C07C7/00 C07C7/01 C07C7/02 C07C7/12 C07C7/152 C08F27/00 C10G31/00

CPC: B01D53/22 B01D53/228 B01D61/362 B01D63/06 B01D71/24 B01D71/82 C07C7/152

European: B01D53/22 B01D53/22M B01D61/36B B01D63/06 B01D71/24 B01D71/82 C07C7/152

US: 208/308 210/640 210/651 422/222 429/17 429/410 585/818 585/860 95/50 96/10 96/12



Publication number	Publication date	Application number	Application date
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DE2154288 A1	19720525	DE19712154288	19711030
DE2154288 B2	19760311	DE19712154288	19711030
DE2154288 C3	19761028	DE19712154288	19711030
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NL7115157 A	19720505	NL19710015157	19711103
US3819742 A	19740625	US19710193494	19711028
US3930990 A	19760106	US19740458129	19740405

Priority:

FR19700039537 19701103 US19710193494 19711028 US19740458129 19740405

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Title: Chlorine-tolerant, thin-film composite membrane

Abstract: Source: US5271843A A semipermeable membrane suitable for reverse **osmosis** applications is prepared by interfacially reacting on a support an aromatic polyamine containing at least three and, preferably, four aromatic nuclei with a polyfunctional amine-reactive compound such as an aromatic polyacyl halide.

Classifications:
International (IPC 8-9): B01D69/12 (Advanced/Invention);
B01D69/00 (Core/Invention)
International (IPC 1-7): B01D61/02
CPC: B01D69/125
European: B01D69/12D
US: 210/500.37 210/654 427/245

Family:

Publication number	Publication date	Application number	Application date
US5271843 A	19931221	US19910756635	19910909

Priority:
US19910756635 19910909

Probable Assignee: FLUID SYSTEMS

Assignee(s): (std): ALLIED SIGNAL INC

Assignee(s): ALLIEDSIGNAL INC ; FLUID SYSTEMS

Inventor(s): (std): CHAU MICHAEL M ; LIGHT WILLIAM G ; SWAMIKANNU A XAVIER

Title: MOLECULAR SEPARATOR

Abstract: Source: US2005167346A The present invention discloses a method and apparatus for separating particles and dissolved matter from a fluid stream. Specifically, the present invention includes a first pressure source which transports untreated fluid into a separator annulus with a filter element disposed therein. The untreated fluid is placed under appropriate pressure sufficient to produce turbulent flow, increased particle kinetics and/or cavitation physics allowing the desired fluid to penetrate and pass into and through the filter media. The filtered fluid is then transported to a collection tank. The contaminant particulate matter retained by the filter media may be removed by the instantaneous reverse pressurization of the separator annulus by a second pressure source thereby removing the contaminant particles away from contact with the filter media, and which may then be transported to a waste collection tank or a concentrator for further treatment.

Classifications:

International (IPC 8-9): B01D17/02 B01D25/00 B01D25/30 B01D29/66 B01D29/68 B01D29/88 B01D36/00 B01D37/00 B01D46/04 B01D61/00 B01D61/14 B01D61/18 B01D61/20 B01D61/58 B01D63/00 B01D63/06 B01D65/00 B01D65/02 B01D65/08 B08B3/04 B08B7/04 B64D11/00 C02F1/00 C02F1/44 C02F9/00 C02F9/08 C12M1/34 E21B43/34 F04B9/113 F04B9/115 (Advanced/Invention); C02F1/32 C02F1/36 C02F1/38 C02F1/44 C02F1/48 C02F101/32 C02F9/02 (Advanced/Non-invention); B01D17/02 B01D29/66 B01D37/00 B01D61/00 B01D61/14 B01D61/18 B01D61/20 B01D63/06 B01D65/00 B08B3/04 B08B7/04 B64D11/00 C02F1/00 C02F9/08 C12M1/34 F04B9/00 (Core/Invention); C02F1/44 (Core/Non-invention)

International (IPC 1-7): B01D65/02 B64D11/00 C12M1/34 **CP:** B01D61/025 B01D61/027 B01D61/58 B01D2313/44 B01D2317/025 B01D2321/00 B01D2321/2075 C02F2103/32 B01D61/22 B01D2313/24 C02F1/44 C02F11/12 C02F2201/006 B01D2313/105 B01D2313/125 B01D17/085 B01D17/0202 B01D61/00 B01D61/14 B01D61/142 B01D61/147 B01D61/18 B01D61/20 B01D63/06 B01D65/00 B01D65/02 B01D65/08 B01D2321/04 B01D2321/2033 B01D2321/2066 B01D2321/2083 C02F1/32 C02F1/36 C02F1/38 C02F1/441 C02F1/444 C02F1/48 C02F9/00 C02F2101/32 E21B43/34 F04B9/113

European: B01D17/02B B01D61/00 B01D61/02D B01D61/02F B01D61/14 B01D61/14B B01D61/14F B01D61/18 B01D61/20 B01D61/22 B01D61/58 B01D63/06 B01D65/00 B01D65/02 B01D65/08 C02F9/00 E21B43/34 F04B9/113 L01D313/44 L01D317/02D L01D321/00 L01D321/04 L01D321/20D L01D321/20F L01D321/20F2 L01D321/20H L01D61/02D L01D61/02F M02F1/32 M02F1/36 M02F1/38 M02F1/44 M02F1/44B M02F1/44D M02F1/48 M02F101/32 M02F103/32 M02F11/12 M02F201/00D8

US: 134/10 134/109 134/110 134/115.00RS 134/115R 134/123 134/13 134/13P 134/34 134/34S 134/56.00RS 134/56R 204/275.1 204/275.100S 204/542 210/106 210/108 210/134 210/134S 210/136S 210/137 210/137S 210/143 210/181 210/181S 210/195.1 210/195.2 210/209 210/223 210/223S 210/241 210/241S 210/251 210/251S 210/253 210/257.1 210/257.100S 210/257.2 210/257.200S 210/258 210/259 210/321.6 210/321.65 210/321.650S 210/321.66 210/321.660S 210/321.69 210/321.690P 210/321.690S 210/321.87 210/322 210/323.1 210/323.2 210/411 210/416.1 210/416.100S 210/433.1 210/456 210/636 210/637 210/641 210/650 210/652 210/741 210/748.01 210/748.02 210/748.1 210/764 210/768 210/770 210/771 210/774 210/785 210/791 210/798 210/804 210/805 210/806 210/85 210/85P 244/118.5 244/118.500P 435/287.1 435/287.100P 55/302 55/419 95/279 95/45 95/46 96/10 96/4 96/9

Family:

Publication number	Publication date	Application number	Application date
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US7459092 BB	20081202	US20040004321	20041203
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US8557116 BB	20131015	US20080257427	20081024
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WO05084189 A2	20050915	WO2005US02134	20050125
WO05084189 A3	20061012	WO2005US02134	20050125

Priority:

US20040540492P	20040130	US20040820538	20040408	US20040004321	20041203
US20070862930	20070927	US20080025523	20080204	US20080099690	20080408
US20080257427	20081024	WO2005US02312	20050125	US20050042235	20050125
US20080257529	20081024	US20080257617	20081024	US20110046410	20110311
US20110224875	20110902				

Probable Assignee: TERVITA LLC

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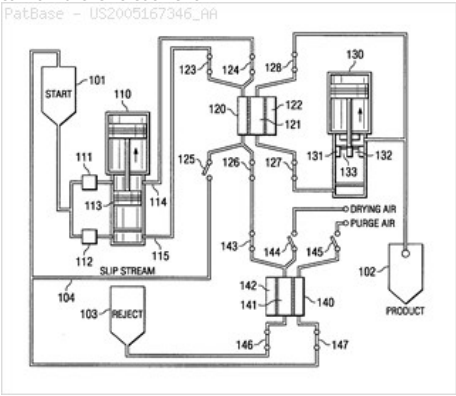
Assignee(s): WILMINGTON TRUST NATIONAL ASSOCIATION COLLATERAL T ; WILMINGTON TRUST NATIONAL ASSOCIATION COLLATERAL TRUSTEE AS ; CCS MIDSTREAM SERVICES LLC ; PLAINFIELD OFFSHORE HOLDINGS XII INC ; PLAINFIELD SPECIALTY HOLDINGS II INC ; JOHNSON RAYMOND F ; JOHNSON MARKLEY D

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Inventor(s): JOHNSON RAYMOND ; JOHNSON MARKLEY

Agent(s): MACRAE AND CO; CARSTENS YEE AND CAHOON LLP; SCOTT L HARPER; CARSTENS AND CAHOON LLP; CARSTENS AND CAHOON; CAHOON COLIN P; WALTER CHAD E; COLIN P; CHAD E; BELL NUNNALLY AND MARTIN LLP; CRAIG J

Designated states: AE AG AL AM AT AU AZ BA BB BE BF BG BJ BR BW BY BZ CA CF CG CH CI CM CN CO CR CU CY CZ DE DK DM DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GG GR GW HR HU ID IE IL IN IS IT JP KE KG KP KR KZ LC LI LK LR LS LT LU LV MA MC MD MG MK ML MN MR MW MX MZ NA NE NI NL NO NZ OM PG PH PL PT RO RU SC SD SE SG SI SK SL SM SN SY SZ TD TG TJ TM TN TR TT TZ UA UG US UZ VC VN YU ZA ZM ZW

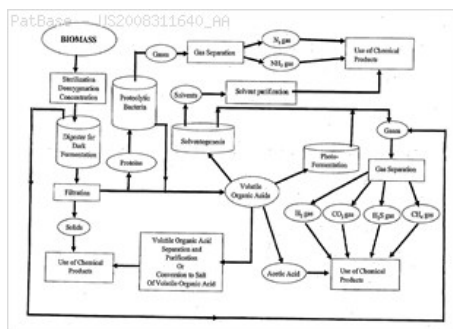


Title: ANAEROBIC PRODUCTION OF HYDROGEN AND OTHER CHEMICAL PRODUCTS

Classifications:

CPC: C12M21/04 C12M29/18 C12M29/20 C12M45/04 C12M45/20 C12M47/18 C12P3/00 Y02E50/343

US: 435/168 435/168P 435/252.1 435/252.100S 435/286.1 435/286.100S 435/290.4 435/290.400S 435/303.2 435/303.200S



Family:

Priority:

Probable Assignee: ANAEROBE SYSTEMS

Inventor(s): (std): COX MARION E ; COX STEVEN M ; MCDONALD JEREMY N ; NONDORF LAURA M

Designated states: AE AG AL AM AT AU AZ BA BB BE BF BG BJ BR BW BY BZ CA CF CG CH CI CM CN CO CR CU CY CZ DE DK DM DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GW HR HU ID IE IL IN IS IT JP KE KG KM KN KP KR KZ LC LI LK LR LS LT LU LV LY MA MC MD MG MK ML MN MR MW MX MZ NA NE NG NI NL NO NZ OM PG PH PL PT RO RU SC SD SE SG SI SK SL SM SN SY SZ TD TG TJ TK TN TR TT TZ UA UG US UZ VN YU ZA ZM ZW

Title: A novel method for the generation of water with reduced ionic solutes

Abstract: Source: GB200620970A A device comprising one or more proximal and distal chambers separated by a selectively permeable membrane which has a restricted but not absolute restriction of porosity with respect to dissolved solutes. This device is designed to generate a solution with a reduction in the concentration of these solutes distal to this membrane by the processes of forward and/or reverse **osmosis**. Such devices can further utilize those solutes initially present on the proximal side of the membrane but which have crossed the membrane themselves so that they then act as osmotic drivers and so facilitate the further movement of solutes across the membrane.

Classifications:
International (IPC 8-9): B01D61/00 C02F1/44 (Advanced/Invention)
CPC: B01D61/025 B01D61/002 B01D61/005 C02F1/445 C02F2103/08 B01D61/00 C02F1/44
European: B01D61/00B B01D61/00B10 B01D61/02D C02F1/44F M02F103/08

Family:

Publication number	Publication date	Application number	Application date
GB200620970 A0	20061129	GB20060020970	20061021
GB2442941 A1	20080423	GB20060020970	20061021

Priority:
GB20060020970 20061021

Probable Assignee: MONRO PHILIP P

Assignee(s): (std): MONRO PHILIP P ; MONRO PHILIP PETER

Assignee(s): PHILIP PETER MONRO

Inventor(s): (std): MONRO PHILIP PETER

Inventor(s): PHILIP PETER MONRO

Title: SODIUM MANAGEMENT FOR HEMODIALYSIS

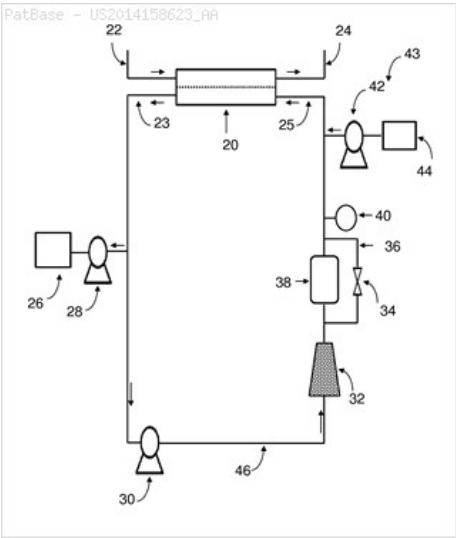
Abstract: Source: US2014158623A Systems and methods for managing the sodium concentration of a dialysate fluid during hemodialysis therapy and adjusting sodium concentration using a sodium management system to generate a sodium-modified fluid. The systems and methods also provide a mechanism for controlled addition of sodium ions to the dialysate to generate a predetermined total sodium concentration in a dialysate.

Classifications:

International (IPC 8-9): A61M1/14 A61M1/16 (Advanced/Invention)

CPC: A61M1/1656 A61M1/287

US: 210/647 210/96.2



Family:

Publication number	Publication date	Application number	Application date
AU2014212140 AA	20140807	AU20140212140	20140202
CN104994894 A	20151021	CN201480007132	20140202
EP2950837 A1	20151209	EP20140746222	20140202
IN02534KN2015 A	20160205	IN2015KN02534	20150803
US2014158623 AA	20140612	US20130757794	20130202
WO14121168 A1	20140807	WO2014US14356	20140202

Priority:

US20120735348P 20121210 US20130757794 20130202 WO2014US14356 20140202

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Inventor(s): (std): GERBER MARTIN T ; LURA DAVID B ; MEYER THOMAS E ; PUDIL BRYANT J

Agent(s): FB RICE; HUGHES ANDREA MICHELLE; HAHN ROGER

Designated states: AE AG AL AM AO AT AU AZ BA BB BE BF BG BH BJ BN BR BW BY BZ CA CF CG CH CI CL CM CN CO CR CU CY CZ DE DK DM DO DZ EC EE EG ES FI FR GA GB GD GE GH GM GN GQ GR GT GW HN HR HU ID IE IL IN IR IS IT JP KE KG KM KN KP KR KZ LA LC LI LK LR LS LT LU LV LY MA MC MD ME MG MK ML MN MR MT MW MX MY MZ NA NE NG NI NL NO NZ OM PA PE PG PH PL PT QA RO RS RU RW SA SC SD SE SG SI SK SL SM SN ST SV SY SZ TD TG TH TJ TM TN TR TT TZ UA UG US UZ VC VN ZA ZM ZW