

Señor
JEFE DE LA DIVISIÓN DE NUEVAS CREACIONES
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
E. S.D.

EXPEDIENTE No. 02.021258

ASUNTO: Solicitud de Patente de Invención denominada PROCESO DE REMOCIÓN DEL ACIDO SULFHIDRICO EN CORRIENTE GASEOSA Y MEDIOS PARA DESARROLLARLO.

Solicitante: CORPORACIÓN PARA EL DESARROLLO DE LA BIOTECNOLOGÍA
CORPORACIÓN BIOTEC.

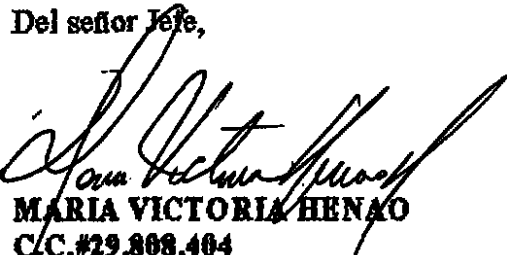
TASAS EXAMEN DE PATENTABILIDAD

MARIA VICTORIA HENAO HERNÁNDEZ, identificada con cédula de ciudadanía No.29.808.404 de Sevilla, Valle, abogada en ejercicio con Tarjeta Profesional No. 22.057 del C.S.J., obrando como apoderada de la CORPORACIÓN PARA EL DESARROLLO DE LA BIOTECNOLOGÍA CORPORACIÓN BIOTEC, por medio del presente memorial me permito anexar lo siguiente:

- 1) El poder que me faculta como apoderada y además me autoriza para continuar con el trámite de solicitud de registro de la Patente de Invención denominada PROCESO DE REMOCIÓN DEL ACIDO SULFHIDRICO EN CORRIENTE GASEOSA Y MEDIOS PARA DESARROLLARLO.
- 2) El recibo de Tasas Oficiales por valor de TRESCIENTOS TREINTA Y CINCO MIL PESOS (\$335.000) MCTE, para el examen de patentabilidad de la Patente de Invención de la referencia.
- 3) Certificado de la Cámara de Comercio de la CORPORACIÓN PARA EL DESARROLLO DE LA BIOTECNOLOGÍA CORPORACIÓN BIOTEC, vigente y original

Por lo anterior, solicito muy amablemente se sirvan reconocerme personería y se ordene el examen de patentabilidad de la patente de la referencia y para lo cual se me puede notificar en la CALLE 13 #9-33 OFC. 405, TEL. 091-2823326, BOGOTÁ, D.C. - Email. henaohermandez@telesat.com.co.

Del señor Jefe,


MARIA VICTORIA HENAO
C.C.#29.808.404
T.P. 22.057 DEL C.S.J.

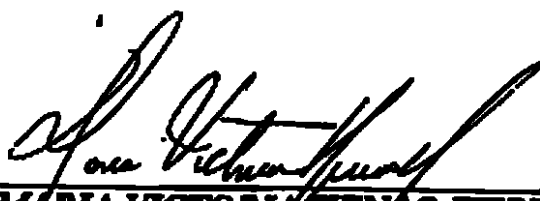
Señor
Jefe de la División de Nuevas Creaciones
Superintendencia de Industria y Comercio
E. S. D.

MYRIAM SANCHEZ MEJIA mayor de edad, identificadas como aparece al pie de mi firma, obrando en nombre y representación de la sociedad **CORPORACION PARA EL DESARROLLO DE LA BIOTECNOLOGIA CORPORACION BIOTEC**, corporación sin ánimo de lucro, con domicilio Cali, Valle, atentamente manifiesto a usted que confiero poder especial, amplio y suficiente a la Doctora **MARIA VICTORIA HENAO HERNANDEZ** abogada en ejercicio con T.P. No. 22.057, identificada con cédula No. 29.808.404 de Sevilla (V), para continuar con el trámite de solicitud de registro de la patente de invención denominada **PROCESO DE REMOCION DEL ACIDO SULFHIDRICO EN CORRIENTE GASEOSA Y MEDIOS PARA DESARROLLARLO**. Expediente No. 02021258, todo de acuerdo al Artículo 69 del C.P.C.

La apoderada queda facultada para recibir, cancelar, transigir, desistir, renunciar, sustituir, hacer modificaciones y revocar sustituciones.


MYRIAM SANCHEZ MEJIA
C. C. # 31.212.595

ACEPTO:


MARIA VICTORIA HENAO HERNANDEZ
T/P. # 22.057 del C. S. J.

ocel.

**DILIGENCIA DE PRESENTACION PERSONAL
Y RECONOCIMIENTO**

En Santiago de Cali a

09 DIC. 2008

HOLMES RAFAEL CARDONA MONTOYA, Notario Validuno (21)

del circuito de Santiago de Cali, hace constar que el

escrito que se anexa fue presentado personalmente

por Miriam Sanchez Mejia

Identificado con la C.C.N.º 31212595

Espedida en Cali quien además

Declaró que su contenido es cierto y verdadero y que la

firma y la huella que en él aparecen son auyas


Firma DocuSign



República de Colombia

Departamento del Valle

Santiago de Cali

Notario Validuno

Holmes Rafael Cardona Montoya

REPUBLICA DE COLOMBIA

CERTIFICADO DE EXISTENCIA Y REPRESENTACION
DE ENTIDADES PRIVADAS SIN ANIMO DE LUCRO

EL SUSCRITO SECRETARIO DE LA CAMARA DE COMERCIO CALI

C E R T I F I C A :

NOMBRE:

CORPORACION PARA EL DESARROLLO DE LA BIOTECNOLOGIA CORPORACION
BIOTEC

CLASE DE PERSONA JURIDICA:

CORPORACION

DOMICILIO: CALI VALLE

DIRECCION NOTIFICACION JUDICIAL: UNIVERSIDAD DEL VALLE-SEDE
MELENDEZ.EDIFICIO CREE 2o PISO

CIUDAD: CALI

C E R T I F I C A :

CONSTITUCION: QUE POR CERTIFICACION PROCEDENTE DEL
DEPARTAMENTO ADMINISTRATIVO JURIDICO DIVISION ASUNTOS
DELEGADOS DE LA NACION GOBERNACION DEL VALLE
DE MARZO----- 21 DEL AÑO 1997, INSCRITA EL 25 DE ABRIL-----
DEL AÑO 1997 BAJO EL No. 01031 DEL LIBRO I, CONSTA QUE SE LE
RECONOCIO PERSONERIA JURIDICA POR RESOLUCION No. 00271 DE
AGOSTO---- 09 DEL AÑO 1995 DEL:
DEPARTAMENTO ADMINISTRATIVO JURIDICO DIVISION ASUNTOS
DELEGADOS DE LA NACION GOBERNACION DEL VALLE
A LA:
CORPORACION PARA EL DESARROLLO DE LA BIOTECNOLOGIA CORPORACION
BIOTEC

C E R T I F I C A :

VIGENCIA: TERMINO INDEFINIDO

C E R T I F I C A :

OBJETO: LA CORPORACION BIOTEC TIENE COMO MISION FUNDAMENTAL,
CREAR Y DESARROLLAR CAPACIDAD DE INVESTIGACION, DESARROLLO Y

PRODUCCION EN BIOTECNOLOGIA RELACIONADA CON SALUD, ALIMENTOS, MEDIO AMBIENTE Y PRODUCTOS AFINES PARA LA POBLACION COLOMBIANA Y CAPACIDAD DE GESTION Y ENLACE PARA IMPULSAR LA INTEGRACION ENTRE EL GOBIERNO, LA EMPRESA PRIVADA Y LA COMUNIDAD EN GENERAL A NIVEL NACIONAL O INTERNACIONAL DENTRO DE PARAMETROS DE DESARROLLO SOSTENIBLE Y DE ACUERDO CON LAS NECESIDADES A CORTO Y LARGO PLAZO DE LA SOCIEDAD.

C E R T I F I C A :

FORMA DE ADMINISTRACION: ASAMBLEA GENERAL, CONSEJO DIRECTIVO, DIRECTOR.

FUNCIONES DE LA ASAMBLEA GENERAL; ENTRE OTRAS: A. TRAZAR LAS POLITICAS Y LINEAMIENTOS GENERALES PARA EL MEJOR CUMPLIMIENTO DE LOS OBJETIVOS DE LA CORPORACION BIOTEC. B. ELEGIR DOS MIEMBROS DEL CONSEJO DIRECTIVO. E. APROBAR LA DISOLUCION DE LA CORPORACION BIOTEC, CONFORME A LO DETERMINADO EN LOS PRESENTES ESTATUTOS.

FUNCIONES DEL REPRESENTANTE LEGAL - DIRECTOR: A. FOMENTAR ACTIVIDADES QUE REALICEN LOS OBJETIVOS DE LA CORPORACION. B.... C. CUMPLI Y HACER CUMPLIR LOS PRESENTES ESTATUTOS Y LOS REGLAMENTOS DE LA CORPORACION BIOTEC, SUJETOS A LAS LIMITACIONES DE LA LEY. D.... E. CELEBRAR LOS ACTOS Y CONTRATOS QUE SEAN NECESARIOS, PARA LA CORRECTA OPERACION DE LA CORPORACION Y CON AUTORIZACION DEL CONSEJO DIRECTIVO, CUANDO EXCEDAN DE LA CUANTIA QUE ESTE LE SENALE. F.... G.... H. PRESENTAR, CONJUNTAMENTE CON EL REVISOR FISCAL LOS ESTADOS FINANCIEROS Y LOS BALANCES DE LA CORPORACION BIOTEC. I. EJERCER LOS DERECHOS QUE CORRESPONDAN A LA CORPORACION COMO TITULAR DE ACCIONES Y DEMAS TITULOS VALORES. J....

C E R T I F I C A :

DOCUMENTO: Certificado

NRO: S/N

FECHA: 1997/03/21

ORIGEN:

DEPARTAMENTO ADMINISTRATIVO JURIDICO DIVISION ASUNTOS

DELEGADOS DE LA NACION GOBERNACION DEL VALLE

FECHA INSCRIPCION: 1997/04/25

NRO. 1031 LIBRO: 01

FUERON NOMBRADOS:

DIRECTOR: MIRYAM SANCHEZ MEJIA

C.C. No. 31.212.595

REPRESENTANTE LEGAL

C E R T I F I C A :

C E R T I F I C A :

DOCUMENTO: Acta NRO: 07
 FECHA: 2000/04/07
 ORIGEN:
 ASAMBLEA GENERAL DE SOCIOS
 FECHA INSCRIPCION: 2000/10/25 NRO. 02004 LIBRO: 01
 FUERON NOMBRADOS:

CONSEJO DIRECTIVO

PRINCIPALES SUPLENTES

UNIVERSIDAD DEL VALLE: OSCAR
 ROJAS R.-CESAR AUGUSTO
 LONDONO-IVAN ENRIQUE RAMOS

LEVAPAN: HECTOR MEZA
 C.C. 14,958,236

SECRETARIA DE AGRICULTURA DEL
 DEPARTAMENTO DEL VALLE:
 BEATRIZ OROZCO
 C.C. 29,331,910

SMURFIT CARTON DE COLOMBIA
 S.A.: JORGE BERRIO
 C.C. 8,290,852

UNIVERSIDAD TECNOLOGICA DEL
 CHOCO: HECTOR DAMIAN MOSQUERA

C E R T I F I C A :

DOCUMENTO: Acta NRO: 07
 FECHA: 2000/04/07
 ORIGEN:
 ASAMBLEA GENERAL DE SOCIOS
 FECHA INSCRIPCION: 2000/10/25 NRO. 02004 LIBRO: 01

FUERON NOMBRADOS:
 BKR FERNANDEZ Y ASOCIADOS INTERNATIONAL
 REVISOR FISCAL FIRMA

C E R T I F I C A :

DOCUMENTO: Documento Privado NRO: -----
FECHA: 2000/09/20
FECHA INSCRIPCION: 2000/10/25 NRO. 02005 LIBRO: 01

LA FIRMA BKR FERNANDEZ Y ASOCIADOS INTERNATIONAL
NOMBRE A:

OWER ANTONIO CASSETTA V.
C.C. 16,783,454
REVISOR FISCAL PRINCIPAL

EDISON ARANTES ROSAS ROJAS
C.C. 16,727,080
REVISOR FISCAL SUPLENTE

C E R T I F I C A :

FUNCIONES DEL REVISOR FISCAL: A. PRESENTAR AL CONSEJO DIRECTIVO, CONJUNTAMENTE, CON EL DIRECTOR, LOS ESTADOS FINANCIEROS Y BALANCES ANUALES DE LA CORPORACION BIOTEC. B.... C. REVISAR LOS LIBROS Y ESTADOS FINANCIEROS DE LA CORPORACION BIOTEC Y SUMINISTRAR A LA ASAMBLEA Y AL CONSEJO DIRECTIVO LAS ACLARACIONES O INFORMES QUE LE SEAN SOLICITADAS. D. ESTABLECER LAS NORMAS DE CONTROL QUE PERMITAN AUDITAR LAS OPERACIONES CONTABLES Y FINANCIERAS DE LA CORPORACION. E.....

C E R T I F I C A :

DEL PATRIMONIO Y LA FORMA DE HACER LOS APORTES: 1. EL CONJUNTO DE TODOS SUS BIENES, DERECHOS DE INDOLE ECONOMICO Y FRUTOS EN LA CARTA DE CONSTITUCION CONSTARA EL APOORTE PATRIMONIAL INICIAL DE LA CORPORACION. 2. LA POSESION Y ADQUISICION DE TODA CLASE DE BIENES, AJUSTANDOSE EN SUS ACTOS DE DISPOSICION Y ADMINISTRACION A LAS NORMAS QUE LE SEAN APLICABLES Y DESTINANDO SUS FRUTOS A LOS FINES QUE LE SON PROPIOS, TODO ELLO DE CONFORMIDAD CON LOS PRESENTES ESTATUTOS. 3. LOS INTERESES O BENEFICIOS GENERADOS POR SUS ACTIVIDADES REGULARES. 4. LOS APORTES, AUXILIOS Y TRANSFERENCIAS QUE SE OTORGUEN POR ENTIDADES PUBLICAS DE CUALQUIER ORDEN. 5. LAS DONACIONES, HERENCIAS Y LEGADOS QUE SE OTORGUEN POR PERSONAS NATURALES O JURIDICAS DE CARACTER PRIVADO. 6. CUALQUIER OTRO INGRESO QUE TENGA TAL CARACTER SEGUN ESTOS ESTATUTOS.

C E R T I F I C A :

C E R T I F I C A :

QUE NO FIGURAN INSCRIPCIONES POSTERIORES A LA FECHA DEL PRESENTE CERTIFICADO, QUE MODIFIQUEN TOTAL O PARCIALMENTE SU CONTENIDO.

LOS ACTOS DE REGISTRO QUEDAN EN FIRME CINCO (5) DIAS HABILES DESPUES DE LA FECHA DE SU INSCRIPCION, SIEMPRE Y CUANDO, DENTRO DE DICHO TERMINO NO SEAN OBJETO DE RECURSOS EN LA VIA GUBERNATIVA.

DE CONFORMIDAD CON EL DECRETO 2150 DE 1.995 Y LA AUTORIZACION IMPARTIDA POR LA SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO, LA FIRMA MECANICA QUE APARECE A CONTINUACION TIENE PLENA VALIDEZ PARA TODOS LOS EFECTOS LEGALES.

EN CONSTANCIA EXPIDO EL PRESENTE EN CALI A LOS 30
DIAS DEL MES DE SEPTIEMBRE DEL AÑO 2,003 HORA: 17:00:50:11

EL SECRETARIO.



39 6

SUPERINDUSTRIA Y COMERCIO
Radicacon : 02021250 00060001 Folios: 6
Fecha (AMD): 2003-12-26 16:45:42
Tramite : 002 PATENTES B 1 REGISTRO/ 530 PETICION
Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 03 - 94,772
FECHA : DICIEMBRE 26 DE 2003

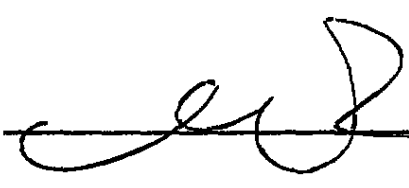
***** CONSIGNACION *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PAGO	Vr. PAGO
CORPORACION BIOTEC	CONSIGNACION	BANCO POPULAR	050-00110-6	11889928	05/12/2003	335,000.00

***** CONCEPTO *****

CANT. RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1 50005-01-01 SOLICITUDES	05 EXAMEN DE PATENTABILIDAD DE INVEN	335,000.00
	TOTAL :	\$ 335,000.00

SOM: TRESCIENTOS TREINTA Y CINCO MIL PESOS

RESPONSABLE : 

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

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**SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISIÓN DE NUEVAS CREACIONES**

2020
Bogotá, D.C.,

Doctor
JORGE E VERA VARGAS
Corporación para el Desarrollo De La Biotecnología
(Apoderado)

ASUNTO	Radicación	02-21258
	Trámite	002
	Evento	001
	Actuación	430
	Oficio	6281
	Folios	

Como resultado del examen de fondo, realizado con fundamento en el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica:

Documentos estudiados:

Los textos estudiados fueron la descripción (Folios: 11 a 20) y las reivindicaciones 1 a 12 (folios: 21ª 22).

La presente solicitud no reivindica prioridad.

Objeto de invención:

El objeto de la presente solicitud se refiere a un proceso para la remoción de ácido sulfhídrico y conversión microbiológica en una corriente gaseosa a partir de un soporte fijo o empaque de bagazo de caña que comprende:

- ♦ La inoculación del bagazo antes de disponerlo en el reactor
- ♦ Mantener una Temperatura de 15 a 30°C
- ♦ Mantener una humedad del soporte entre 50 y 75%
- ♦ Controlar la variación del pH del soporte de 7 hasta llegar a 2
- ♦ Oxidar biológicamente el ácido sulfhídrico desprendido del soporte
- ♦ Neutralizar el material lixiviado,

donde los microorganismos con los que se inocula el bagazo se seleccionan de microorganismos provenientes de biosólidos aeróbicos. Así mismo se reclama el aparato para llevar a cabo dicho proceso.

El objeto de la solicitud definido anteriormente se clasificó en la IPC B01D 53/52 Y B01D 53/84

Claridad de la solicitud:

El artículo 30 de la Decisión 486 de la Comisión de la Comunidad Andina establece que: "Las reivindicaciones definirán la materia que se desea proteger mediante la patente. Deben ser claras y concisas y estar enteramente sustentadas por la descripción."

Las reivindicaciones podrán ser independientes o dependientes. Una reivindicación será independiente cuando defina la materia que se desea proteger sin referencia a otra reivindicación anterior. Una reivindicación será dependiente cuando defina la materia que se desea proteger refiriéndose a una reivindicación anterior. Una reivindicación que se refiera a dos o más reivindicaciones anteriores se considerará una reivindicación dependiente múltiple."

La reivindicación 8 reclama un proceso en donde el sulfato de calcio al cabo de 4 horas se acumula sobre un 95%. El hecho que el sulfato se acumule sobre un 95% es un resultado que se podría alcanzar con otros procesos no relacionados con la presente invención. Así pues, que los procesos se deben definir a través de las características técnicas de sus operaciones, que permiten hacer diferencia de la materia que existe en el estado de la técnica y no mediante el resultado esperado. En este caso ¿cuáles son las características específicas de este proceso que permiten alcanzar tal resultado?

La reivindicación 10 reclama un proceso en donde la adición del inoculo permite remover hasta un 99.9% del ácido sulfhídrico por oxidación biológica.

El porcentaje de remoción es un resultado a alcanzar, pero no constituye una característica técnica que defina la invención, éste resultado puede aparecer siempre y cuando se acompañe de las características que llevan a alcanzarlo. El decir que se añade el inoculo tampoco es una característica que distinga la invención por cuanto no se establece ¿Qué tiene de especial dicho inoculo? que permite alcanzar el "resultado esperado".

Según lo anterior las cláusulas en mención no pueden ser consideradas claras a la luz del artículo 30 de la Decisión 486.

Adicionalmente la descripción no revela de una manera suficiente la invención como para que un tercero pueda reproducirla y llegar a los mismos resultados, teniendo en cuenta que el no puede establecer con exactitud cual puede ser el "inoculo de biosólidos aeróbicos seleccionados".

La

Determinación del estado de la técnica:

El artículo 16 de la Decisión 486 de la Comisión de la Comunidad Andina establece que "El estado de la técnica comprenderá todo lo que haya sido accesible al público por una descripción escrita u oral, utilización, comercialización o cualquier otro medio antes de la fecha de presentación de la solicitud de Patente o, en su caso, de la prioridad reconocida.

Sólo para el efecto de la determinación de la novedad, también se considerará dentro del estado de la técnica, el contenido de una solicitud de patente en trámite ante la oficina nacional competente, cuya fecha de presentación o de prioridad fuese anterior a la fecha de presentación o de prioridad de la solicitud de patente que se estuviese examinando, siempre que dicho contenido esté incluido en la solicitud de fecha anterior cuando ella se publique o hubiese transcurrido el plazo previsto en el artículo 40".

Considerando que la fecha de presentación de solicitud de patente en estudio es 8 de marzo de 2002, se buscaron documentos del estado de la técnica relacionados, con fecha de publicación anterior a esta.

Se hizo la búsqueda de documentos relevantes en el estado de la técnica, entendiendo como estado de la técnica la definición provista en el artículo 16 de la Decisión 486 de la Comisión de la Comunidad Andina y las excepciones fijadas en el artículo 17 de la misma.

Se encontró como anterioridades (documentos cuya fecha de publicación es anterior a la fecha de presentación de la primera solicitud de patente sobre la cual se reivindica prioridad o de la fecha de presentación de esta solicitud) que pueden afectar la patentabilidad del objeto de la presente solicitud:

Nº	Documento	Título	Fecha de Publicación
1	CA2312557	Two stage hybride Biofiltration	2001-07-01
2	JP02126917	Deodorizing Methods	1990-05-15
3	US5747331	Process and apparatus for the purification of gases	1998-05-05

Evaluación de los requisitos de Patentabilidad:

El Artículo 14 de la Decisión 486 de la Comisión de la Comunidad Andina el cual establece: "Los Países Miembros otorgarán Patentes para las invenciones, sean de producto o de procedimiento en todos los campos de la tecnología siempre que sean nuevas, tengan nivel inventivo y sean susceptibles de aplicación industrial".

Se procedió a evaluar los requisitos de novedad, nivel inventivo y aplicación industrial con el fin de establecer la patentabilidad de la invención reivindicada en la solicitud en estudio.

Evaluación de Nivel Inventivo:

El artículo 18 de la Decisión 486 de la Comisión de la Comunidad Andina establece que "Se considerará que una invención tiene nivel inventivo, si para una persona del oficio normalmente versada en la materia técnica correspondiente, esa invención no hubiese resultado obvia ni se hubiese derivado de manera evidente del estado de la técnica".

El Nivel Inventivo se evaluó por comparación entre lo solicitado y encontrado en el estado de la técnica y que se relaciona con el objeto reivindicado y de acuerdo con la definición de nivel inventivo del Artículo 18 de la Decisión 486 de la Comisión de la Comunidad Andina.

La reivindicación 1 y sus dependientes reclaman un proceso para la remoción de ácido sulfhídrico y conversión microbiológica en una corriente gaseosa a partir de un soporte fijo o empaque de bagazo de caña que comprende: La inoculación del bagazo antes de disponerlo en el reactor, mantener determinadas condiciones de temperatura y humedad (aspersión) al interior de un reactor, controlar la variación del pH del soporte de 7 hasta llegar a 2, oxidar biológicamente el ácido sulfhídrico desprendido del soporte y neutralizar el material lixiviado ;donde los microorganismos con los que se inocula el bagazo se seleccionan de microorganismos provenientes de biosólidos aeróbicos y donde se efectúa un arrastre y neutralización del lixiviado. Las reivindicaciones 11 y 12 reclaman el biofiltro donde se lleva a cabo la degradación del contaminante el cual puede estar dispuesto en baterías de 2 o más. En la descripción se menciona claramente que los microorganismos preferentes para la oxidación pertenecen al genero Thiobacillus.

El documento CA2312557 ó D1, revela la necesidad de remover el ácido sulfhídrico de los efluentes industriales y menciona el uso de bacterias del genero Thiobacillus para la degradación de dicho contaminante. Así mismo divulga el uso de biofiltros empaquetados con matrices orgánicas o inorgánicas y estables a pH inferiores a 7.

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De igual manera durante la degradación de los contaminantes se emplea la humectación del compuesto entrante así como la remoción por arrastre del producto degradado. Así mismo, en la figura 2 se muestra claramente como se puede presentar la disposición de 1 o más biofiltros.

El Documento JP02116917 o D2, divulga un biofiltro conteniendo microbios que degradan los componentes malolientes de las aguas residuales de las plantas de tratamiento de aguas y donde se emplea humectación del biofiltro y donde se efectúa una neutralización del lixiviado.

El documento US5747331 o D3 revela el concepto de poner en contacto sustancias gaseosas contaminantes tales como el H₂S con microorganismos capaces de degradarlos usando biofiltros o birreactores empaquetados con una matriz orgánica en donde se inmovilizan los microorganismos pertenecientes preferiblemente al género Thiobacillus.

Como se puede observar el problema técnico que se pretendía resolver, que era remover el ácido sulfhídrico en ambientes gaseosos contaminados empleando biofiltración, usando microorganismos del género Thiobacillus inmovilizados sobre una matriz orgánica y manteniendo condiciones de operación que permiten el crecimiento del microorganismo, resulta obvio partiendo de las anterioridades D1 a D3. Esto teniendo en cuenta que la principal diferencia entre el proceso reclamado en la presente solicitud y los divulgados en las anterioridades es el tipo de matriz empleada, la cual constituye un residuo reconocido de la industria azucarera y que por ello puede constituir un candidato óptimo a emplear como matriz de biofiltros ampliamente conocidos en el estado de la técnica. De la lectura de la solicitud no se encuentra cual es el aporte a la técnica de la presente invención, por cuanto no se revela si al emplear este tipo de matriz se van a obtener resultados sorprendentes respecto a los que se obtienen en los procesos de las anterioridades o, si los microorganismos de biosólidos aeróbicos seleccionados exhiben características inesperadas (diferentes a los M.O de las anterioridades) que contribuyen a una mayor eficiencia del proceso de bioconversión.

Tampoco se muestran en la solicitud datos experimentales que permitan establecer que la capacidad del proceso, su eficiencia y demás características de la invención representan un salto cualitativo sobre la forma en la que se ha resuelto el mismo problema en el estado de la técnica.

De acuerdo con lo anterior se establece que el objeto de esta solicitud podría resultar obvio para una persona del oficio normalmente versada en la materia y derivarse de manera evidente del estado de la técnica.

Nº	Documento	Relvindicaciones afectadas	Requisito que afecta
1	CA2312557	1 a 12	Nivel inventivo
2	JP02126917	1 a 12	Nivel inventivo
	US5747331	1 a 12	Nivel inventivo

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta días contados a partir de la fecha de la notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única N° 10 de 2001.


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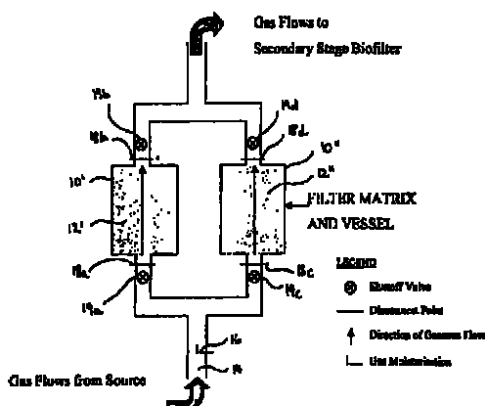
BENNETT JONES

(54) SYSTEME HYBRIDE DE BIOFILTRATION EN DEUX ETAPES

(54) TWO-STAGE HYBRID BIOFILTRATION

(57)

A hybrid filter system for degrading a sulfur-containing compound having a primary stage sacrificial filter and a secondary stage biofilter is disclosed. This hybrid filter system significantly increases the lifetime of the biofilter providing a cost effective and removal effective biofiltration filter system. The process consists of two filtration stages, a primary stage sacrificial filtration and a secondary stage biofiltration. A small percentage of the sulfur-containing compound is oxidized to elemental sulfur which blocks the pore space of the filter matrix. The primary stage sacrificial filter is used to trap and remove elemental sulfur which is produced when the sulfur-containing compound is passed through the filter. To protect the secondary stage biofilter from premature plugging by precipitated elemental sulfur the primary stage sacrificial filter is used to capture the precipitated elemental sulfur. It is then sacrificed on a regular basis to minimize the impact of the elemental sulfur on the secondary stage biofilter.



- Necesidad de eliminar H_2S
- uso de biofiltración para remover los de sulfuro
- Cepas usadas para degradación pertenecientes al género de *thiobacillus*.
- Biofilms estables a $pH < 7$.
- Diferentes tipos de matrices orgánicas e inorgánicas pueden ser usadas.
- Humedeción del compuesto conteniendo el contaminante
- Rinsing para remover el producto de degradación
- Están dispuestos los biofilms en baterías de 2 ó más.

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TWO-STAGE HYBRID BIOFILTRATION

Field of the Invention

- 5 This invention relates to biofiltration processes and more particularly to a process and filter for increasing the biofilter efficiency in removal processes of sulfur-containing compounds.

Background of the Invention

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Environmental regulations are implemented to restrict the emission of pollutants into the atmosphere. Accordingly, it is necessary to reduce the amount of pollutants to their required level. Many chemical processes, such as fossil fuel conversion processes, release sulfur-containing compounds which must be removed from the effluent stream due to their negative environmental impact and high toxicity to most life forms.

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Hydrogen sulfide (H₂S), for example, is one of the most common sulfur-containing compound which needs removal and disposal since this acid gas is extremely toxic and very corrosive in the presence of water. Other toxic sulfur-containing compounds which need to be removed from emitted effluents before entering the atmosphere include:

20

carbon disulfide, sulfur dioxide, carbonyl sulfide, dimethyl sulfide, dimethyl disulfide, methyl mercaptan, and ethyl mercaptan.

25

In recent years, environmental concerns and the introduction of new environmental laws and regulations have brought about an increasing interest in more effective and economical decontamination processes.

30

The majority of the biological world derives energy from the oxidation of organic compounds. However, there exist some groups of microorganisms that derive metabolic energy and reducing equivalents for their biosynthesis from the oxidation of inorganic elements and compounds. Biofiltration processes make use of these types of metabolism (to remove sulfur-containing compounds from effluent gas streams.

A biofilter is usually composed of an organic material, such as compost, peat or wood bark, having microorganisms attached thereto which are capable of decontaminating an effluent gas stream. The component of interest is degraded when the gas stream passes the biofilter through the metabolizing action of the microorganisms within the filter.

A number of microbial processes for the oxidation of hydrogen sulfide have been described in the patent literature. For example, JP Patent 02126917 describes a deodorizing method. The decontamination is carried out in two peat packing layers carrying microorganisms. Similarly U.S. Patent No. 5,747,331 discloses a process and an apparatus for the removal of sulfur-containing compounds from waste gases with the aid of microorganisms. The invention described therein is also a two-stage biodegradation process wherein in the second stage the pre-purified gas is contacted again with the microorganisms to degrade any remaining sulfur-containing compounds. The publication in VDI Berichte 735, Biologische Abgasreinigung, VDI Verlag, Düsseldorf, pp. 129-138, 1989, also discloses the use of *Thiobacillus* spp. microorganisms for the degradation of hydrogen sulfide in waste gases.

Even though the above mentioned processes disclose biofiltration methods for the removal of toxic waste gases, there are still problems associated with the removal strategies, such as short biofilter age or incomplete decontamination.

The design of biofilters depends upon a number of criteria; some of which are the porosity of the filter material, the surface area available for the microorganisms in the organic material to attach to, the loft of the organic material and last but not least, the cost of the media.

It is apparent, that there is a need for effective and lasting biofilters in order to make biofiltration processes more cost effective. The methods disclosed in the prior art attack the problem of biofilter effectiveness by passing the waste gas through two or more biofilters to achieve satisfactory decontamination. Another approach is the post-cleaning

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or chemical "polishing" of the decontaminated gas stream by passing the purified waste gas through activated carbon. However, the biofilters have to be changed quite frequently due to the deposition of solid residues and physical collapse of the biofilter material. These deposits drastically reduce the capability of the biofilter to remove waste gases since the porosity and the surface area of the biofilter are significantly reduced because of pore blockage. Another aspect of this scenario is the economical disadvantage of the methods described above as the production of biofilters is costly and time consuming.

- 10 It is an object of this invention to provide an apparatus and a method for conducting efficient biofiltration processes which are also more cost effective.

It is another object of the invention to provide a method for increasing the lifetime of biofilters.

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It is an object of one embodiment of this invention to provide a method and an apparatus for the effective removal of hydrogen sulfide.

- 20 The invention disclosed herein obviates this difficulty, by providing a method and an apparatus including two filtration stages with two different filters, a primary stage sacrificial filter and a secondary stage biofilter; a hybrid biofilter system.

Summary of the Invention

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In accordance with the invention there is provided a system having two filters serially interconnected, only one of the two filters being a biofilter having microorganisms placed therein for removing an unwanted sulfur-containing compound contained within a gas, a method for removing the sulfur-containing compound contained within the gas

- 30 comprising the ordered steps of:

(a) passing the gas through a first of the two filters, the first filter being a primary stage sacrificial filter for removing elemental sulfur that is formed when the gas passes through the first filter, said first filter being stable at a pH < 7; and subsequently

5 (b) passing the gas through the biofilter for forming a degradation product from the sulfur-containing compound, said biofilter being stable at a pH < 7.

In accordance with the invention there is further provided a filter arrangement for forming a degradation product from a sulfur-containing compound contained within a gas having two sequential filters, only one of the two sequential filters being a biofilter
10 having microorganisms placed therein, the filter arrangement comprising: (a) a first filter for removing elemental sulfur which is formed when the sulfur-containing compound passes through the first filter, said first filter being stable at a pH < 7; and (b) a biofilter disposed in such a manner as to receive a remaining sulfur-containing compound from the first filter, the biofilter for degrading the remaining sulfur-containing compound to
15 form the degradation product, said biofilter being stable at a pH < 7.

Furthermore, in accordance with another embodiment of the invention there is provided a system having two sequential filters, only one of the two sequential filters being a
20 biofilter for removing a sulfur-containing compound from a gas, a method for increasing a filter effectiveness and prolonging a lifetime of the biofilter comprising the steps of:
(a) passing the gas containing the sulfur-containing compound through a first filter for removing elemental sulfur which is formed when the sulfur-containing compound passes through the first filter, the first filter being stable at a pH < 7; (b) passing the gas
25 containing a remaining sulfur-containing compound to the biofilter; and (c) passing the gas containing the remaining gaseous sulfur-containing compound through the biofilter for removing the remaining gaseous sulfur-containing compound from the gas, the
biofilter being stable at pH < 7.

Advantageously, the present invention provides a method and an apparatus for
30 conducting efficient biofiltration processes which are also more cost effective. It is a

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further advantage of the invention to provide a method for increasing the lifetime of biofilters.

5 Brief Description of the Drawings

Exemplary embodiments of the invention will now be described in accordance with the drawings in which:

- 10 Figure 1 shows a schematic presentation of the primary stage sacrificial filter;
- Figure 2 shows a schematic presentation of the secondary stage biofilter; and
- Figure 3 presents a graph showing performance data of the secondary stage biofilter.

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Detailed Description of the Invention

The method and the apparatus in accordance with the invention provides an efficient way
20 of conducting biofiltration processes which are also more cost effective. The process in
accordance with the invention includes two filtration stages: a first filtration stage
including a primary stage sacrificial filter and a second filtration stage including a
secondary stage biofilter.

- 25 Turning to Figure 1 a schematic presentation of the primary stage sacrificial filter is
shown. The primary stage sacrificial filter preferably has at least two cylindrical vessels
10' and 10" arranged in a parallel configuration. The gas containing the unwanted sulfur-
containing compound is directed in an up flow manner through all vessels in a parallel
configuration. The gas is either pressurized before entry or pulled through the system
30 using a fan. The vessels 10' and 10" are typically 1 meter (3.3ft) in height and usually 1-

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3 meters (3.3-9.9ft) in diameter. The appropriate diameter is chosen depending upon the application and how much gas has to be treated.

5 The vessels 10' and 10" are filled with a filter matrix 12' and 12" as indicated by the gray shaded area in Figure 1. In a preferred embodiment in accordance with the instant invention coarse sphagnum peat is used as the filter matrix. Coarse sphagnum peat for this application is peat which is retained on a plastic mesh with a square hole inner dimension of 1cm by 1cm (0.4in by 0.4in). Other dimensions may be used. The plastic mesh is made from polyethylene or polypropylene or a like material. Sphagnum peat is best suited because it has a relatively high surface area and porosity and is stable under acid conditions, i.e. the filter matrix material has to be stable at a pH<7. Alternatively
10 other filter matrices may be used including sphagnum peat or any other type of peat, pre-molded or cut/shredded plastic media, wood chips, or inorganic materials such as crushed rock products and re-manufactured rock products, e.g. Perlite - a generic term for a
15 naturally occurring siliceous rock, or a combination of these materials.

The direction of the gas flow is indicated by the direction of arrows presented in Figure 1. The incoming gases are applied to the entry side 14 of the primary sacrificial stage filter in an up flow manner. After the incoming gases pass the entry side 14, they are passed
20 through a gas moisturisation zone 16. There, the incoming gases are moisturized by fine droplets of water which are injected into the gas stream through the use of a fine spray nozzle. Alternatively, the incoming gases are moisturized by steam injected directly into the gas stream.

TMDA

25 The primary stage sacrificial filter is used to trap and remove elemental sulfur which is produced by the chemical oxidation of hydrogen sulfide in the presence of water and oxygen. The elemental sulfur is precipitated onto the filter matrix 12' and 12", for example onto the peat, and causes premature plugging of the filter matrix and hence reduces the air flow through the filter matrix. The elemental sulfur accumulates until the
30 pore spaces between the filter matrix, e.g. the peat strands, become occluded.

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Claims

What is claimed is:

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1. In a system having two filters serially interconnected, only one of the two filters being a biofilter having microorganisms placed therein for removing an unwanted sulfur-containing compound contained within a gas, a method for removing the sulfur-containing compound contained within the gas comprising the ordered steps of:

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(a) passing the gas through a first of the two filters, the first filter being a primary stage sacrificial filter for removing elemental sulfur that is formed when the gas passes through the first filter, said first filter being stable at a pH < 7.0; and subsequently

(b) passing the gas through the biofilter for forming a degradation product from the sulfur-containing compound, said biofilter being stable at a pH < 7.0.

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2. A method as defined in claim 1 further comprising the step of rinsing at least the biofilter for removing the degradation product from the secondary stage biofilter.

3. A method as defined in claim 2, wherein a matrix material of the two filters is selected from the group consisting of peat, plastic media, wood chips, and crushed rock products.

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4. A method as defined in claim 3, wherein the matrix material of the two filters is comprised of coarse sphagnum peat.

25

5. A method as defined in claim 2 further comprising the step of monitoring a pressure differential of the gas upon passing the first filter, said pressure differential being used as an indicator for determining a level of pore blockage in the first filter.

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6. A method as defined in claim 5 further comprising the step of monitoring a pressure differential of the gas when said gas passes the biofilter, said pressure differential being used as an indicator for determining a level of pore blockage in the biofilter.

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7. A method as defined in claim 2 wherein the sulfur-containing compound is selected from the group consisting of hydrogen sulfide, carbonyl sulfide, dimethyl sulfide, dimethyl disulfide, methyl mercaptan, ethyl mercaptan, carbon disulfide, and sulfur dioxide.

8. A method as defined in claim 2, wherein the microorganisms are selected from the group consisting of *Beggiatoa* spp., *Thiothrix* spp., *Thioploca* spp., *Thiospirillopsis* spp., *Achromatium* spp., *Thiobacterium* spp., *Macromonas* spp., *Thiospira* spp., *Thiovulum* spp., *Bilophococcus* spp., *Thiomicrospira* spp., *Thiodendron* spp., *Thiosphaera* spp., *Paracoccus* spp., *Hyphomicrobium* spp., *Acidophilum* spp., *Thermothrix* spp., *Sulfolobus* spp., *Acidianus* spp., *Hydrogenobacter* spp.

9. A filter arrangement for forming a degradation product from a sulfur-containing compound contained within a gas having two sequential filters, only one of the two sequential filters being a biofilter having microorganisms placed therein, the filter arrangement comprising:

(a) a first filter for removing elemental sulfur which is formed when the sulfur-containing compound passes through the first filter, said first filter being stable at a pH < 7.0; and

(b) a biofilter disposed in such a manner as to receive a remaining sulfur-containing compound from the first filter, the biofilter for degrading the remaining sulfur-containing compound to form the degradation product, said biofilter being stable at a pH < 7.0.

10. A filter arrangement as defined in claim 9 further comprising gas moisturizing means, the gas moisturizing means being disposed in such a manner as to humidify the sulfur-containing compound before said sulfur-containing compound enters the first filter.

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11. A filter arrangement as defined in claim 10 further comprising rinsing means for removing the degradation product.

12. A filter arrangement as defined in claim 11 further comprising pressure sensing means for monitoring a pressure differential when the sulfur-containing compound passes the first filter, the pressure sensing means for indicating available pore space in the first filter.

13. A filter arrangement as defined in claim 12 further comprising pressure sensing means for monitoring a pressure differential when the sulfur-containing compound passes the biofilter, the pressure sensing means for indicating available pore space in the biofilter.

14. A method as defined in claim 11 wherein the sulfur-containing compound is selected from the group consisting of hydrogen sulfide, carbonyl sulfide, dimethyl sulfide, dimethyl disulfide, methyl mercaptan, ethyl mercaptan, carbon disulfide, and sulfur dioxide.

15. A method as defined in claim 14, wherein a matrix material of the two filters is selected from the group consisting of peat, plastic media, wood chips, and crushed rock products.

16. A method as defined in claim 15, wherein the matrix material of the two filters is comprised of coarse sphagnum peat.

17. A method as defined in claim 14, wherein the microorganisms are selected from the group consisting of *Beggiatoa* spp., *Thiothrix* spp., *Thioploca* spp., *Thiospirillopsis* spp., *Achromatium* spp., *Thiobacterium* spp., *Macromonas* spp., *Thiospira* spp., *Thiovulum* spp., *Bilophococcus* spp., *Thiomicrospira* spp., *Thiodendron* spp., *Thiosphaera* spp., *Paracoccus* spp., *Hyphomicrobium* spp., *Acidophilum* spp., *Thermothrix* spp., *Sulfolobus* spp., *Acidiamus* spp., *Hydrogenobacter* spp.

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18. In a system having two sequential filters, only one of the two sequential filters being a biofilter for removing a sulfur-containing compound from a gas, a method for increasing a filter effectiveness and prolonging a lifetime of the biofilter comprising the steps of:

(a) passing the gas containing the sulfur-containing compound through a first filter for removing elemental sulfur which is formed when the sulfur-containing compound passes through the first filter, the first filter being stable at a pH < 7.0;

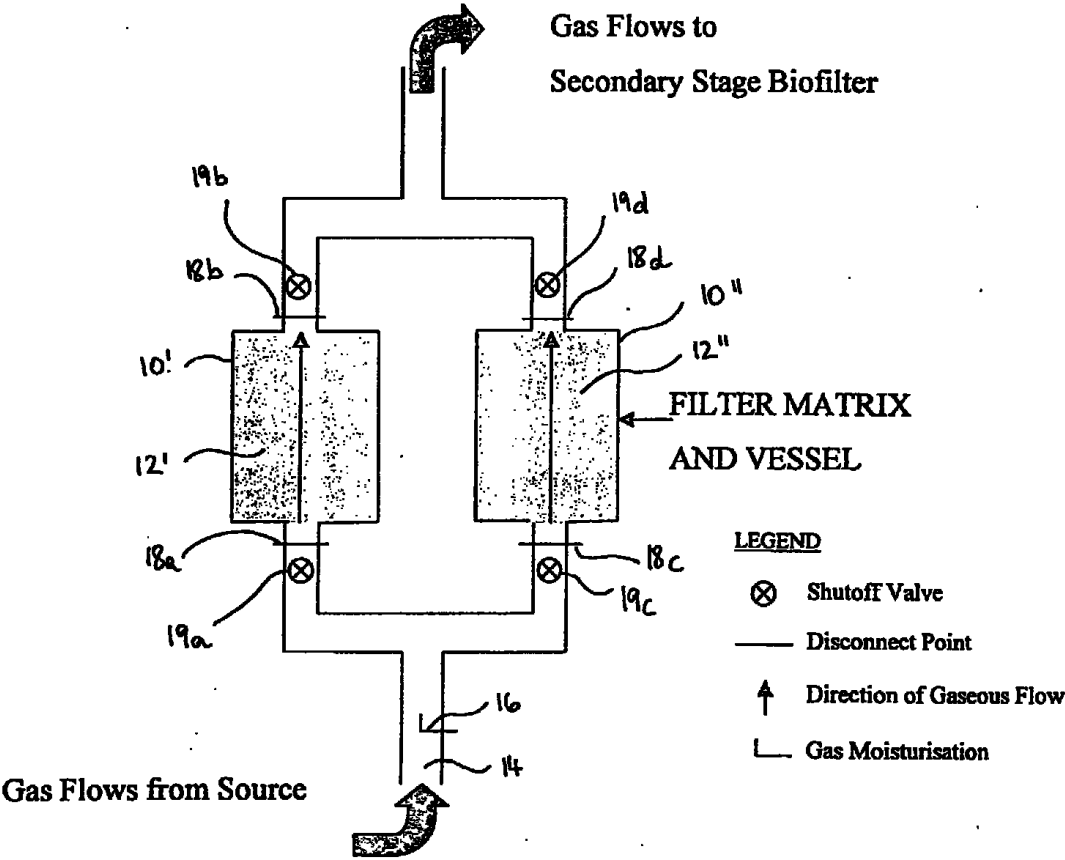
(b) directing the gas containing a remaining sulfur-containing compound to the biofilter; and

(c) passing the gas containing the remaining sulfur-containing compound through the biofilter for removing the remaining sulfur-containing compound from the gas, the biofilter being stable at pH < 7.0.

19. A method as defined in claim 18 further comprising the step of monitoring a pressure differential of the gas upon passing the first filter, said pressure differential being used as an indicator for determining a level of pore blockage in the first filter.

20. A method as defined in claim 19 further comprising the step of replacing the first filter when a pore blockage is indicated for avoiding a premature pore blockage of the biofilter.

Figure 1

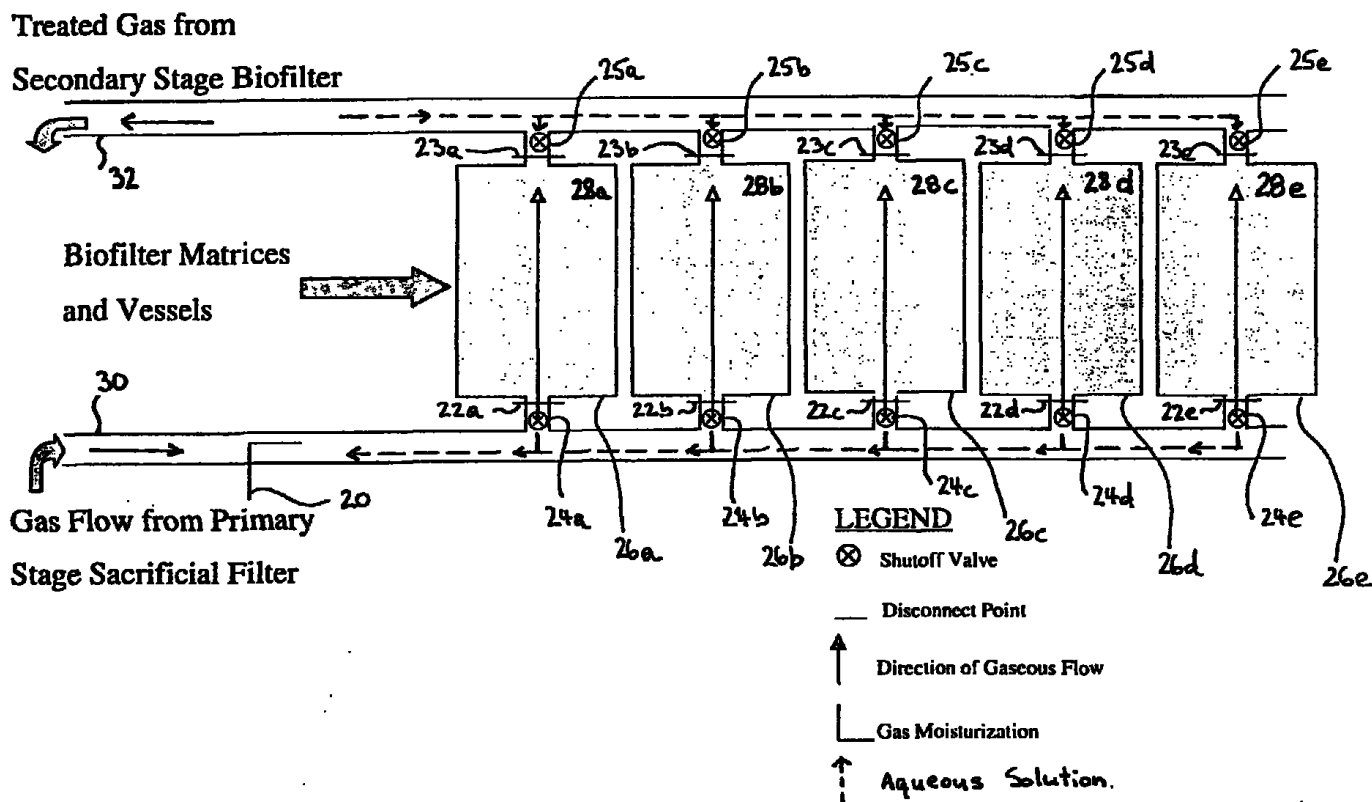


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Figure 2

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(18)



JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

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KOMUNE HIDEAKI

(54) DEODORIZING METHOD

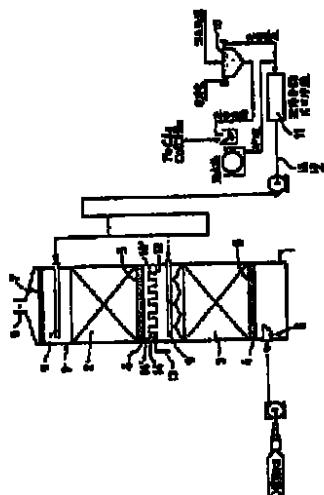
(57) Abstract:

PURPOSE: To reduce the consumption of alkali chemicals by sprinkling the waste liquid of water washing for digestive sludge or the filtrate of dehydrated digestive sludge on the peat packing layers carrying the microbes decomposing malodor components, and washing out and neutralizing sulfuric acid ions produced in the packing layer.

CONSTITUTION: The peat packing layer 2, 3 carrying microbes decomposing malodor component are provided in the treatment tower 1, and malodor gas is upwardly flowed through the peat packing layers 2, 3 to be deodorized. The waste liquid of water washing for digestive sludge or the filtrate of dehydrated digestive sludge is sprinkled through sprinkling pipes 8 on the packing layers 2, 3 and the sulfuric acid ions produced in the packing layers 2, 3 are washed out and neutralized thereby. Namely, as the waste liquid of water washing or the filtrate of dehydrated digestive sludge which has high alkalinity is used as washing water, the sulfuric acid ions are neutralized and the washing waste water is discharged without any treatment. Consequently, when well water is used for the washing

water, the consumption cost of alkali chemicals and the equipment cost of neutralizing unit, etc., are saved.

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- Un biopilho conteniendo microbios que descomponen componentes malolientes de los efluentes de tratamiento de aguas.
- Humectación x aspersión y neutralización lixiviado.



US005747331A

3A

United States Patent [19]

[11] Patent Number: 5,747,331

Hartikainen et al.

[45] Date of Patent: May 5, 1998

[54] PROCESS AND APPARATUS FOR THE
PURIFICATION OF GASES4,968,622 11/1990 Berzaczky et al. 435/266
4,976,751 12/1990 Schippert et al. 55/84
5,236,677 8/1993 Torres-Cardona et al. 423/230[75] Inventors: Tarja Terttu Hartikainen; Pertti
Juhani Martikainen; Arvo Aukusti
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Markku Tapio Källström, Jyväskylä;
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Vaajakoski, all of Finland

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Primary Examiner—Cecilia Tsang

Assistant Examiner—Michael Borin

Attorney, Agent, or Firm—Browdy and Neimark

[57] ABSTRACT

The invention relates to a process and an apparatus for the removal of sparingly-soluble gaseous substances, especially sulfur-containing substances from waste gases with the aid of microorganisms. The waste gas containing the sparingly-soluble gas is directed (24) in the form of small gas bubbles into a suspension (16) of degrading microorganisms. A gas which has been pre-cleaned in this way is preferably led to another bioreactor (10), where microorganisms degrade the contaminant. The invention also relates to a new microorganism which is capable of degrading carbon disulfide and hydrogen sulfide.

27 Claims, 3 Drawing Sheets

[73] Assignee: Vapo Oy, Jyväskylä, Finland

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[22] PCT Filed: Mar. 16, 1995

[86] PCT No.: PCT/Fin95/00140

§ 371 Date: Nov. 18, 1996

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PCT Pub. Date: Sep. 21, 1995

[30] Foreign Application Priority Data

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B01D 53/36; B01D 53/22; C01B 17/16;
C12M 1/04; C12N 1/20[52] U.S. Cl. 435/266; 435/252.5; 423/220;
423/239; 95/149; 296/1[58] Field of Search 435/226, 252.5;
423/220, 230; 95/149

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- Poner en contacto sustancias gaseosas contaminantes con M.O capaces de degradar dichos contaminantes
- Usa biofiltros o biorreactores empacados contienen microorganismos inmovilizados capaces de degradar contaminantes
- El biofiltro contiene una matriz organica
- Dentro de las sustancias a degradar se encuentra el H₂S
- El M.O usado es un M.O aeróbico
- M.O usado pertenece al genero Thiobacillus

growth period. *Thiobacillus* DSM 8985 had all the characteristics of growth:

- the amount of sulfate increased
- the pH sunk
- the microbe density increased
- hydrogen sulfide and carbonyl sulfide (measured in the discharge gas) were generated
- the carbon disulfide content sunk

The above examples illustrate that the biodegradation of sparingly-soluble gases in a microbe suspension surprisingly functions very well with the process according to the invention. Adjusting the conditions in a microbe suspension is very easy and with a microbe suspension it is possible to significantly and quickly reduce the pollutant level of a gas so that a second biodegradation stage placed thereafter can remove the remaining pollutant from the gas. For instance, the problems encountered with peat filters in cases where the carbon disulfide content is high, are eliminated in case the pollutant concentration is lowered by pre-cleaning the gas in a microbe suspension prior to directing it into a peat filter.

In the above description the invention has primarily been illustrated by showing the oxidation of carbon disulfide and hydrogen sulfide with the preferred microorganism of the invention. It is, however, evident to those skilled in the art that for the degradation of carbon disulfide and hydrogen sulfide it is possible to use other known microorganisms or microorganisms especially isolated for the need in question, which microorganisms have the capacity of degrading the sparingly-soluble pollutant in a microbe suspension. In a corresponding way the removal of other sparingly-soluble gases from gases may successfully be performed by pre-cleaning in a microbe suspension with microorganisms isolated from the nature or obtained commercially. In this way the pollutant level in a gas can be reduced in a microbe suspension either in a sufficient degree or to such a level that the pollutant level can be lowered adequately in a subsequent bioreactor.

We claim:

1. A process for the removal of sparingly-soluble gaseous substances from a gas by bringing said gas into contact with microorganisms capable of degrading said sparingly-soluble gaseous substances, characterized in that said gas containing said sparingly-soluble gaseous substance is led into a microbe suspension containing microorganisms capable of degrading said substance such that said gas forms small bubbles in said microbe suspension, on the surface of which bubbles the microorganisms are able to degrade the sparingly-soluble gaseous substance, and, if needed, the gas which has risen to the surface of said suspension is directed to another similar or different biodegradation stage.

2. Process according to claim 1, characterized in that said gas is led into said microbe suspension through a gas bubbling means comprising a multitude of small openings.

3. Process according to claim 1, characterized in that the gas which has been led into said microbe suspension is distributed into small bubbles by mixing, by directing it through a perforated plate or grating, or in some other way.

4. Process according to claim 2, characterized in that the size of said openings is about 10 μm to about 2 mm, preferably about 100–500 μm .

5. Process according to claim 1, characterized in that the gas which has risen to the surface of said microbe suspension is led directly to another microbe suspension or to a bioreactor or a biofilter, the filler or packing of which comprises immobilized microorganisms capable of degrading said gaseous substance.

6. Process according to claim 1, characterized in that said other biodegradation stage comprises a trickling-filter and that the gas which has risen to the surface of said microbe suspension is directed to the bottom of said filter and that microbe suspension is directed to the top of said filter.

7. Process according to claim 1, characterized in that said other biodegradation stage comprises a biofilter having an organic material, preferably peat, as its filler.

8. Process according to claim 1, characterized in that the gas to be purified is moisturized in said microbe suspension to a moisture content of at least 95%, preferably a moisture content of 95–100%.

9. Process according to claim 1, characterized in that said gaseous substance which is to be degraded is carbon disulfide, hydrogen sulfide, dimethyl sulfide, mercaptane, styrene, toluene, or a corresponding sparingly-soluble gas or gas mixture which is microbiologically degradable in said suspension.

10. Process according to claim 1, characterized in that said gaseous substance which is to be degraded is a gas mixture containing hydrogen sulfide, dimethyl sulfide and mercaptane.

11. A process for the removal of sparingly-soluble sulphur-containing gaseous substances from a gas by bringing said gas into contact with microorganisms capable of degrading said sulphur-containing substances, characterized in that said gas containing said sparingly-soluble sulphur-containing substance or substances is led into a microbe suspension containing microorganisms capable of degrading said substance while distributing said gas in the liquid into gas bubbles such that said microorganisms degrade at least a part of said sulphur-containing substance as said bubbles rise towards the surface of said microbe suspension and that, if needed, the gas which has risen to the surface of said suspension is directed to another similar or different biodegradation stage.

12. Process according to claim 11, characterized in that said degrading microorganism is an aerobic microorganism and that said gas which is to be purified is an oxygen-containing gas, such as air.

13. Process according to claim 11, characterized in that said gas which is to be purified is distributed into small bubbles by directing said gas into said suspension through a multitude of small openings the diameter of which is about 10 μm to about 2 mm, preferably 100 μm –500 μm , or by breaking said gas into bubbles by mixing, by using a grating or a perforated plate, or in some other way.

14. Process according to claim 11, characterized in that the gas which has risen to the surface of said microbe suspension is led directly to another microbe suspension or to a bioreactor or a biofilter, the filler or packing of which comprises immobilized microorganisms capable of degrading said gaseous substance.

15. Process according to claim 11, characterized in that the gas which has risen to the surface of said microbe suspension is directed to the bottom of a trickling filter and that microbe suspension is directed to the top of said filter.

16. Process according to claim 11, characterized in that said sparingly-soluble gaseous component which is to be degraded is carbon disulfide, hydrogen sulfide, dimethyl sulfide, mercaptane, and/or a mixture of any of these.

17. Process according to claim 11, characterized in that said microbe suspension contains as said microorganism a microorganism of the genus *Thiobacillus* which uses carbon disulfide and/or hydrogen sulfide as its source of energy.

18. Process according to claim 17, characterized in that said microorganism is *Thiobacillus* sp. TJ330 DSM 8985.

19

19. An apparatus for the removal of sparingly-soluble gaseous substances from gases by the use of microorganisms capable of degrading said sparingly-soluble substances, characterized in that said apparatus comprises a microbe suspension chamber (16) having below its liquid filling level (22) a feed pipe (24) for the gas which is to be purified, as well as at least one bioreactor (10; 10', 10'') placed in direct connection with said chamber (16), the packing or filler of said reactor comprising immobilized therein microorganisms capable of degrading said sparingly-soluble gaseous substance.

20. Apparatus according to claim 19, characterized in that said gas feed pipe (24) ends in perforated tubes or sinter tubes (26) for distributing said gas as small bubbles below said liquid filling level (22) of said suspension chamber (16).

21. Apparatus according to claim 20, characterized in that the pore size of said sinter tube (26) is about 10 to 500 μm .

22. Apparatus according to claim 19, characterized in that said apparatus comprises a mixer, grating or corresponding means for the distribution of said gas into smaller bubbles and/or for increasing the retention time of said gas.

23. Apparatus according to claim 19, characterized in that said apparatus comprises a microbe suspension recirculation

20

arrangement leading from said microbe suspension chamber (16) to the top of at least one bioreactor (10).

24. Apparatus according to claim 19, characterized in that said bioreactor is a trickling filter (10) filled with packing bodies (12), or a biofilter (10', 10'') filled with an organic material, preferably peat.

25. Apparatus according to claim 19, characterized in that the microorganisms which are immobilized in the filler or on the packing bodies are microorganisms belonging to the genus *Thiobacillus* which utilize carbon disulfide and/or hydrogen sulfide as their energy source.

26. Apparatus according to claim 25, characterized in that said microorganism is *Thiobacillus* sp. TJ330 DSM 8985.

27. An isolated and purified microorganism culture which is capable of degrading sparingly-soluble gases in a microbe suspension, characterized in that said microorganism is *Thiobacillus* sp. TJ330 DSM 8985, which is capable of degrading carbon disulfide and hydrogen sulfide from a gas flow bubbling through a microbe suspension.

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