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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



DELEGATURA PROPIEDAD INDUSTRIAL

División de Nuevas Creaciones

PCT
SOLICITUD
PATENTE DE INVENCION

ENTRADA EN FASE NACIONAL

21. EXPEDIENTE No.

06-17140

54 **TITULO** SEPARACION EN SECO DE CONTAMINANTES DE MATERIALES DE POLIESTER

51 **CLASIFICACION INTERNACIONAL** _____

71 **SOLICITANTE** UNITED RESOURCE RECOVERY CORPORATION

DOMICILIO SPARTANBURG, SC 29303, ESTADOS UNIDOS DE AMERICA

74 **APODERADO** HECTOR GOMEZ MEJIA

22 **SANTAFE DE BOGOTA, D.C.** _____

PETITORIO

AS 100 474



SUPERINDUSTRIA Y COMERCIO
Radicación 86817148 80000000 Folios 88
Fecha (MM): 2006-02-21 16:14 58
Trámite 011 PCT-PATENT 378 FASE NACI 411 PRESENTAC
Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

FORMULARIO UNICO DE SOLICITUD DE PATENTE PCT ENTRADA EN FASE NACIONAL

1

SOLICITUD DE



Patente de Invención



Patente de Modelo de Utilidad



Capítulo I



Capítulo II

2

SOLICITANTE
(71)

Nombre UNITED RESOURCE RECOVERY CORPORATION

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Teléfono Fax
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IDENTIFICACION

CC ☐ NIT ☐
CE ☐ Otro ☐
Cual _____
Número _____

3

REPRESENTANTE
O APODERADO

Nombre HECTOR GOMEZ MEJIA

Dirección Cra 7 No 16-56 Piso 9

Teléfono 380-2200 Fax. 380-2700
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IDENTIFICACION

CC ☒ NIT ☐
CE ☐ Otro ☐
Cual _____
Número 22720 TP 19436

4

INVENTOR (ES)
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Dirección 170 Knighton Road, Spartanburg, SC 29302, US, 249 Cumberland Drive,
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Nacionalidad o Domicilio Estados Unidos de América (Respectivamente)

5 PCT (86)

Solicitud Internacional No PCT/US2004/028695 Fecha 03-09-2004
Publicación Internacional No WO 2005/023895 A3 Fecha 17-03-2005

Título (54) SEPARACIÓN EN SECO DE CONTAMINANTES DE MATERIALES DE POLIÉSTER

7 Clasificación Internacional (51) B01B9/00, B02C13/02

8 Prioridad

SI ☒

NO ☐

(33) Pais de
Origen

US

(32) Fecha

03-09-2003

(31) Numero de Solicitud

60/499,862

9 Comprobante de pago No. 06-4,824

Fecha 16-02-2006

Instrucciones para el diligenciamiento del presente formulario, ver reverso de esta página

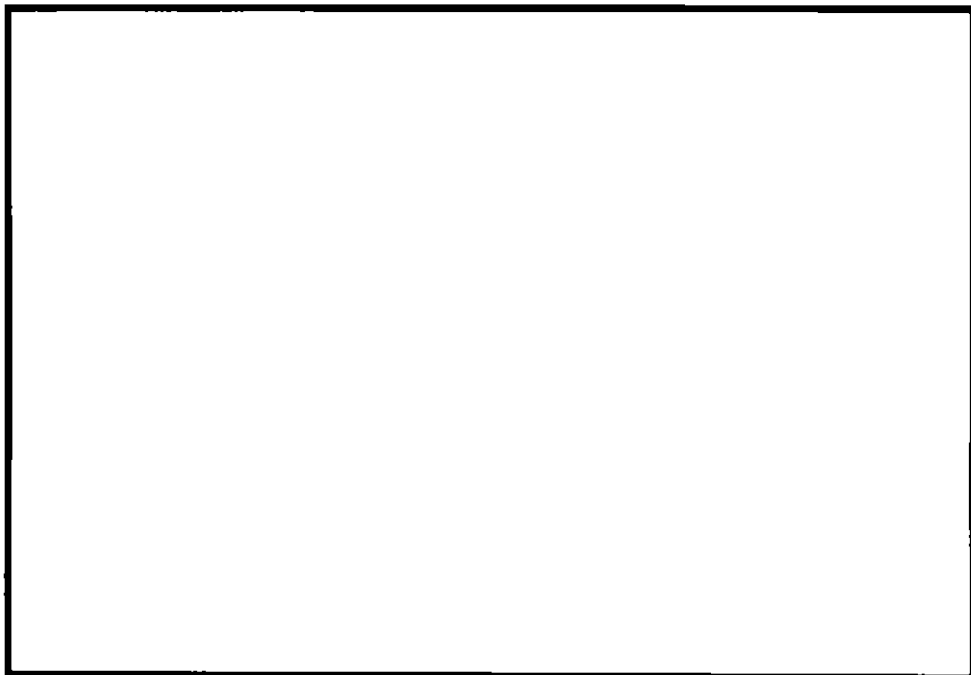
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ANEXOS

2

- ☒ Comprobante de pago de la tasa de presentación de la solicitud. \$463.000
- ☒ Documento que acredita la existencia y representación legal cuando el solicitante sea persona jurídica.
- ☒ Poderes, si fuere el caso. Fotocopia Autenticada
- ☐ Documento de cesión del inventor al solicitante o a su causante.
- ☐ Declaraciones
- ☒ Copia de la solicitud internacional. (Resumen, descripción, reivindicaciones, dibujos)
- ☒ Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicaciones, dibujos)
- ☐ Copia del examen preliminar efectuado por la IPEA.
- ☐ Traducción del examen preliminar efectuado por la IPEA
- ☐ De ser el caso, copia del contrato de acceso.
- ☐ De ser el caso, documento que acredite la licencia o autorización de uso de conocimientos tradicionales de las comunidades indígenas.
- ☐ De ser el caso, certificado de depósito del material biológico.
- ☐ Arte final 12x12.
- ☐ De ser el caso, información sobre otras solicitudes de patente o títulos obtenidos en el extranjero por el mismo titular o su causante, relacionadas parcial o totalmente con la invención de esta solicitud.
- ☒ Otros: Tarjeta de propietarios

11 FIGURA CARACTERÍSTICA:



12 Solicito la concesión de la patente,

NOMBRE: HECTOR GOMEZ MEJÍA

FIRMA: *Hector Gomez Mejia*
C.C. 22720 de Bogotá T.P. 19436 del C.S.J.

Instrucciones para la presentación de los anexos, ver reverso de esta página.

3

SUPERINDUSTRIA Y COMERCIO
Radacion : 86017148 00000000
Fecha (AMD): 2006-02-21 16:14:58
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Folios: 08

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 06 - 4,824
FECHA : ENERO 23 DE 2006

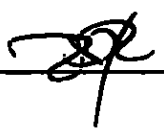
CONSIGNACION

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PAGO	Vr. PAGO
BRIGARD & CASTRO LTDA	CONSIGNACION	BANCO POPULAR	050-00110-8	45022890	23/01/2006	27,920,000.00

CONCEPTO

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-01 SOLICITUDES	1 TRANITES DE SOL. DE PATENTE DE IN	463,000.00
		TOTAL :	\$ 463,000.00

SON: CUATROCIENTOS SESENTA Y TRES MIL PESOS

RESPONSABLE : 

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

4

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISION DE NUEVAS CREACIONES

PATENTE: ☒ PCT/US2004/028695 ☐ MODELO DE UTILIDAD ☐ DISEÑO INDUSTRIAL ☐

SOLICITANTES. RAZON SOCIAL O APELLIDOS Y NOMBRES UNITED RESOURCE RECOVERY CORPORATION

DOMICILIO SPARTANBURG SC 29303 ESTADOS UNIDOS DE AMERICA

APODERADO HECTOR GOMEZ MEJIA

TITULO SEPARACION EN SECO DE CONTAMINANTES DE MATERIALES DE POLIESTER

CLASIFICACION _____

EXPEDIENTE No. _____ FECHA DE SOLICITUD _____ ROLLO MICROFILM _____

CERTIFICADO No. _____ FECHA DE CONCESION _____ VIGENCIA DESDE _____ HASTA _____

PRORROGA _____ CAMBIO DE NOMBRE _____

TRASPASO A _____

INVENTOR (ES) CARLOS D. GUTIERREZ, ALVIS FAIL

OTROS _____

OFICINA DE COMUNICACIONES

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING
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P.O. Box 1449
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Date of mailing (day/month/year)
06 October 2005 (06.10.2005)

Applicant's or agent's file reference
URC-20-PCT

IMPORTANT NOTICE

International application No.
PCT/US2004/028695

International filing date (day/month/year)
03 September 2004 (03.09.2004)

Priority date (day/month/year)
03 September 2003 (03.09.2003)

Applicant

UNITED RESOURCE RECOVERY CORPORATION et al

The International Bureau transmits herewith the following documents:

- ☐ copy of the international application as published by the International Bureau on under No. WO
- ☒ copy of international application as republished by the International Bureau on 06 October 2005 (06.10.2005) under No. WO 2005/023895
For an explanation as to the reason for this republication of the international application, reference is made to INID codes (15), (48) or (88) (as the case may be) on the front page of the attached document.

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OCT 14 2005

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1211 Geneva 20, Switzerland

Authorized officer

Philippe Becamel

Facsimile No.+41 22 740 14 35

Facsimile No.+41 22 338 70 90

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
17 March 2005 (17.03.2005)

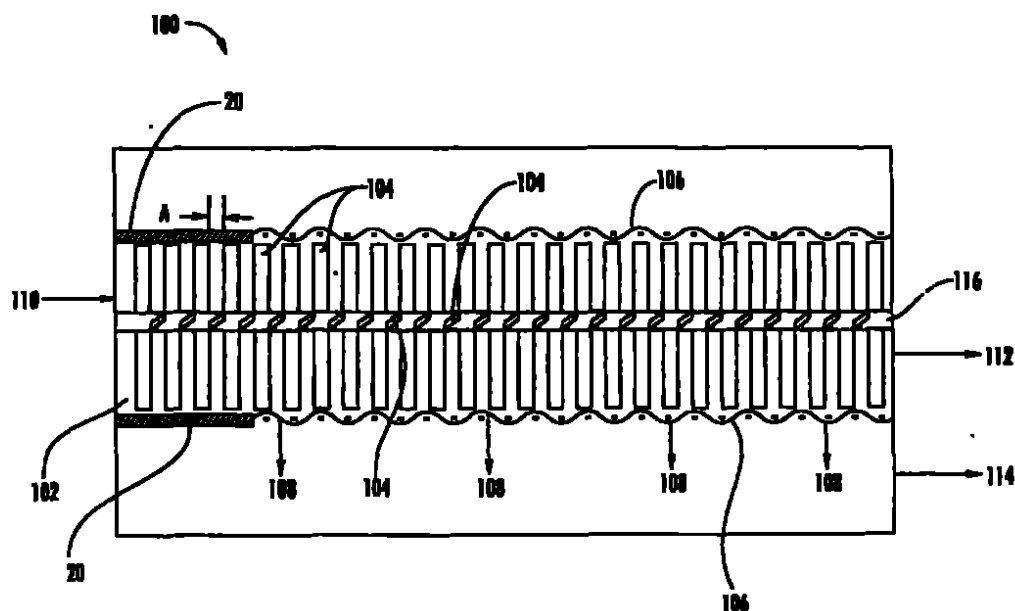
PCT

(10) International Publication Number
WO 2005/023895 A3

- (51) International Patent Classification⁷: B07B 9/00, B02C 17/02 (74) Agent: DORITY & MANNING; P.O. Box 1449, Greenville, SC 29602 (US).
- (21) International Application Number: PCT/US2004/028695 (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (22) International Filing Date: 3 September 2004 (03.09.2004) (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BI, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- (25) Filing Language: English
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- (30) Priority Data: 60/499,862 3 September 2003 (03.09.2003) US (71) Applicant (for all designated States except US): UNITED RESOURCE RECOVERY CORPORATION [US/US]; 5396 North Blackstock Road, Spartanburg, SC 29303 (US).
- (72) Inventors; and (75) Inventors/Applicants (for US only): GUTIERREZ, Carlos, D. [US/US]; 170 Knighton Road, Spartanburg, SC 29302 (US). FAILL, Alvin [US/US]; 249 Cumberland Drive, Moore, SC 29369 (US).
- Published:
— with international search report

[Continued on next page]

(54) Title: DRY SEPARATION OF CONTAMINANTS FROM POLYESTER MATERIALS



(57) Abstract: A method for separating polyester materials from contaminants is disclosed suitable for, for example, a polyester recycling system. The method is a dry separation method and includes rapidly spinning a mixture of polyester and contaminants within a cleaning chamber. During the spinning of the mixture, the contaminants can be degraded and pass through a screen at the chamber wall while the polyester materials are not substantially degraded and can remain in the cleaning chamber. Polyester fines can also remain in the cleaning chamber. A cleaning device suitable for use in the process is also disclosed. The device can include a screen of a hardened material that can help degrade the contaminants and a plurality of rotating blades that can spin the mixture within the device and can also help to degrade the contaminant materials.



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(88) Date of publication of the international search report:
6 October 2005

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/28695

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B07B 9/00; B02C 17/02

US CL : 209/305, 306; 241/24.28, 24.3

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 209/21-23, 44.3, 262, 305, 306, 714; 55/471, 473, 428; 241/24.1, 24.8, 24.18, 24.28, 24.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST (Search terms: drum polyester glass separate sort screen mesh rotate rotor)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,389,020 A (CLIN et al) 21 June 1983 (21.06.1983), Fig. 1-5; col. 1, 7-col. 4, ln. 39.	1, 2, 7-11
Y	US 2002/0079250 A1 (FAHRBACH et al) 27 June 2002 (27.06.2002), Fig. 1, 2, para. 3-19.	3-6
Y, P	US 6,629,653 B2 (FAHRBACH et al) 7 October 2003 (07.10.2003), Fig. 1, 2 and col. 2, ln. 15-col. 3, ln. 49.	
A, T	US 2003/0183705 A1 (CHRISTIANI et al) 02 October 2003 (10.02.2003).	

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"A" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 22 July 2005 (22.07.2005)	Date of mailing of the international search report 17 AUG 2005
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1490 Alexandria, Virginia 22313-1490 Facsimile No. (703) 305-3230	Authorized officer Donald Walsh Telephone No. 571-272-6584

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/28695

Box No. II Observations where certain claims were found unsearchable (Continuation of Item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of Item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-11

Remark on Protest

☐
☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/28695

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-11

Group II, claims 12-19

Group III, claims 20-27

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features as the unifying feature comprises spinning a mixture in a cleaning chamber and contacting a mesh wall to separate contaminants. The prior art, however, teaches that this feature is well known and is not "special". Therefore, the claim groupings lack a special technical feature and thus lack unity of invention.

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copy of the international application as published by the International Bureau on 17 March 2005 (17.03.2005) under
No. WO 2005/023895copy of international application as republished by the International Bureau on under
No. WOFor an explanation as to the reason for this republication of the international application, reference is made to INID codes (15), (48)
or (88) (as the case may be) on the front page of the attached document.**RECEIVED**

MAR 28 2005

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Philippe Becamel

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- (21) International Application Number:
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- (25) Filing Language: English
- (26) Publication Language: English
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60/499,862 3 September 2003 (03.09.2003) US
- (71) Applicant (for all designated States except US): UNITED
RESOURCE RECOVERY CORPORATION [US/US];
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- (72) Inventors; and
- (75) Inventors/Applicants (for US only): GUTIERREZ,
Carlos, D. [US/US]; 170 Knighton Road, Spartanburg,
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- (74) Agent: DORITY & MANNING; P.O. Box 1449,
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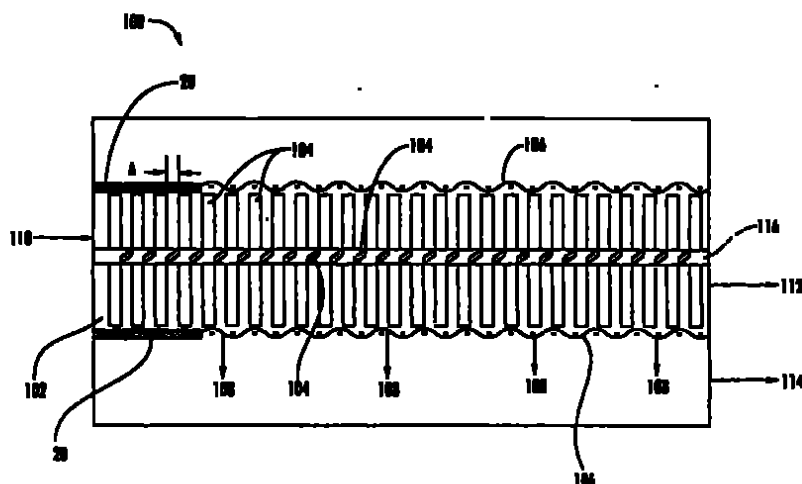
(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,
ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,
FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,
SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

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— without international search report and to be republished
upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: DRY SEPARATION OF CONTAMINANTS FROM POLYESTER MATERIALS



(57) Abstract: A method for separating polyester materials from contaminants is disclosed suitable for, for example, a polyester recycling system. The method is a dry separation method and includes rapidly spinning a mixture of polyester and contaminants within a cleaning chamber. During the spinning of the mixture, the contaminants can be degraded and pass through a screen at the chamber wall while the polyester materials are not substantially degraded and can remain in the cleaning chamber. Polyester fines can also remain in the cleaning chamber. A cleaning device suitable for use in the process is also disclosed. The device can include a screen of a hardened material that can help degrade the contaminants and a plurality of rotating blades that can spin the mixture within the device and can also help to degrade the contaminant materials.

PATENT
ATTORNEY DOCKET NO: URC-20

**DRY SEPARATION OF
CONTAMINANTS FROM POLYESTER MATERIALS**

Cross Reference to Related Application

[001] This application claims benefit to United States Provisional Application having serial number 60/499,862 filed September 3, 2003.

Background of the Invention

10 [002] Polyesters are polymeric materials made from the esterification of polybasic organic acids with polyhydric acids. Perhaps the most commonly made and used polyester is polyethylene terephthalate (PET), which can be manufactured by reacting terephthalic acid with ethylene glycol.

15 [003] Polyesters are currently being used in increasing amounts in various applications. For instance, polyesters are commonly used to make many types of beverage and food containers, photographic films, X-ray films, magnetic recording tapes, electrical insulation, surgical aids such as synthetic arteries, fabrics and other textile products.

20 [004] Because polyesters can be remelted and reformed, ongoing efforts are underway to efficiently recycle as much polyester as possible after use. Before polyester can be recycled, however, it is necessary to separate the post-consumer polyester from contaminants, i.e., materials that may be found mixed with or attached to the polyester. Many recycle processes include a separation step wherein the polyester is washed with an aqueous solution in order to separate the polyester from

25 contaminants. While aqueous washing can remove many contaminants, it does utilize a great deal of water as well as require the further step of post treatment of the wash solution to remove contaminants from the wastewater. Unfortunately, aqueous washing can also prove ineffective for removing relatively hard contaminants, such as glass, sand, and the like, which may become embedded in the polyester materials.

30 [005] In an attempt to remove embedded materials from polyester substrates, melt filtration processes have been used in which the contaminated polyester is melted and then filtered in order to remove the solid contaminants. These are not terribly cost effective methods, however, and often prove economically unfeasible.

[006] What is needed in the art is a novel method for removing contaminants from polyester materials, and in particular, from post-consumer polyester materials. In addition, what is needed in the art is a polyester recycling process in which contamination levels of treatment water are reduced as compared to previously known recycling processes.

Summary

[007] In one embodiment, the present invention is directed to a process for separating polyester from contaminants. For example, the process can include providing a dry mixture of polyester mixed with contaminant materials to a cleaning chamber and spinning the mixture about the axis of the cleaning chamber so as to fluidize the mixture. As the mixture spins, it can contact the wall of the cleaning chamber. In particular, the contaminants within the mixture can contact the wall. In addition, at least a portion of the wall can be a mesh material, for example a metal screen. As such, when the small contaminant materials contact the wall, they can pass through the mesh material openings, leaving the clean polyester materials within the cleaning chamber.

[008] The cleaning chamber can also include an axle along the central axis that rotates while the mixture spins about the axis. For instance the axle can rotate at a speed of at least about 2000 rpm. In addition, the cleaning chamber can include a plurality of blades emanating from the axle that can rotate with the axle with a tip speed of, for example, greater than about 20 meters per second. In one embodiment, the blades can rotate with a tip speed of greater than 40 meters per second. In another embodiment, the blades can rotate with a tip speed of greater than about 60 meters per second.

[009] The contaminant materials mixed in with the polyester can include loose contaminants as well as materials physically attached to the polyester. For example, contaminants can be adhered to the surface of the polyester materials or embedded within the polyester. The process as herein described can also separate such physically attached contaminant materials from the polyester. Moreover, this can be done without substantially degrading the polyester materials themselves.

[0010] The contaminants can also include brittle materials, such as glass, dirt, concrete, and the like. According to this embodiment, the method can also include degrading the brittle contaminants within the cleaning chamber, for example as the contaminants contact the chamber wall and/or the blades.

5 [0011] In one particular embodiment, the contaminants can include glass. For example, glass mixed with and/or embedded in the polyester. According to this embodiment, the process can remove most of the glass from the mixture. For example, the process can remove more than about 97% of the glass from the mixture. In one embodiment, the process can remove more than about 98% of the glass from
10 the mixture.

[0012] In one embodiment, the invention is directed to a cleaning vessel suitable for the disclosed process. For example, the cleaning vessel can include a cleaning chamber surrounded by a wall, at least a portion of which can be a hardened mesh material having a hardness about equivalent to or greater than the hardness of
15 grade 316 stainless steel. The cleaning chamber can also include an inlet that can deliver the dry mixture of polyester and contaminants to the chamber.

[0013] The cleaning vessel can also include an axle along the central axis and a plurality of blades emanating from the axle. Optionally, the blades can also be formed from a hardened material, for example a material having a hardness about
20 equivalent to or greater than the hardness of grade 400 stainless steel. Moreover, the blades can be oriented on the axle and/or have a cross-sectional shape so as to facilitate airflow through the cleaning chamber when the axle is spinning.

[0014] If desired, a portion of the wall of the cleaning chamber can be solid, rather than a mesh. For example, the portion of the wall surrounding the cleaning
25 chamber inlet can be formed of a solid material, for instance a solid hardened steel.

Brief Description of the Figures

[0015] A full and enabling disclosure of the present invention, including the best mode thereof, to one of ordinary skill in the art, is set forth more particularly in the remainder of the specification, including reference to the accompanying figures, in
30 which:

[0016] Figure 1 is a side view of one embodiment of a cleaning vessel of the present invention;

[0017] Figure 2 is a cut-away front view of the cleaning vessel of Figure 1;

5 [0018] Figure 3 is another embodiment of a cleaning vessel of the present invention;

[0019] Figure 4 shows the particle size distribution of US polyester flakes dry cleaned according to the present invention as compared to similar flakes cleaned according to a traditional aqueous wash process; and

10 [0020] Figure 5 shows the particle size distribution of Mexican polyester flakes cleaned according to the present invention as compared to similar flakes cleaned according to a traditional aqueous wash process.

[0021] Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present invention.

15 **Detailed Description of Preferred Embodiments**

[0022] Reference will now be made in detail to various embodiments of the invention, one or more examples of which are illustrated in the accompanying drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that
20 various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment, can be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention cover such modifications and variations as come within the scope of the appended claims and
25 their equivalents.

[0023] The present invention is generally directed to a cleaning process for separating and recovering post-consumer polyester from various contaminant materials. The invention is also directed to a cleaning vessel suitable for the disclosed process. The invention can be utilized to separate post-consumer polyester
30 from various contaminants including glass, dirt, paper, metal, and the like.

Beneficially, the disclosed process is a dry separation process and can significantly reduce the total production of wastewater as well as the level of contamination of wastewater in a polyester recycling process.

[0024] The presently disclosed process includes feeding dry contaminated polyester to a cleaning vessel. The cleaning vessel includes a chamber to which the dry mixture is charged. The chamber is at least partially surrounded by a mesh with a predetermined opening size. Within the chamber can be a series of blades spaced along the axial length of the chamber. During the separation process, the blades can spin at a high rate of speed, fluidizing the dry mixture, and the spinning mixture can contact the chamber wall, which can lead to the degradation of contaminants as well as separation of embedded or otherwise attached contaminants from the polyester. The contaminants can pass through the surrounding mesh, while the polyester can remain in the chamber. Surprisingly, the process can be utilized to separate and degrade contaminants, even embedded contaminants, from the polyester without substantial degradation of the polyester. In addition, while contaminants can be separated from the polyester and pass through the surrounding mesh, the polyester can remain within the cleaning chamber. Even in those embodiments wherein the polyester includes polyester flakes of a size smaller than the mesh openings, the bulk of the small polyester fines can remain in the cleaning chamber and not be lost with the contaminants during the separation process.

[0025] As used herein, a polyester is defined as an esterification or reaction product between a polybasic organic acid and a polyol. It is believed that any known polyester or copolyester may be used in the process of the present invention. However, in one particular embodiment, the process of the present invention is directed to a class of polyesters referred to herein as polyol polyterephthalates, in which terephthalic acid serves as the polybasic organic acid.

[0026] As used herein, a polybasic organic acid refers to any organic acid having two or more carboxyl groups (-COOH). Most polyesters are derived from dibasic acids, also referred to as dicarboxylic acids. Polybasic acids can have a linear or a cyclic conformation. Examples of linear polybasic acids that can be used to

make polyesters include the aliphatic dicarboxylic acids. In particular, the aliphatic dicarboxylic acids having up to ten carbon atoms in their chains can be used. These acids include adipic acid, glutaric acid, succinic acid, malonic acid, oxalic acid, pimelic acid, suberic acid, azelaic acid, sebacic acid, maleic acid, and fumaric acid.

5 [0027] Cyclic polybasic organic acids, on the other hand, include the carbocyclic dicarboxylic acids. These acids include phthalic acid, isophthalic acid, and terephthalic acid. In particular, terephthalic acid is used to make polyethylene terephthalate, which is perhaps the most common commercially available polyester.

[0028] As described above, a polybasic organic acid can be reacted with a
10 polyol to produce a polyester. Polyols are compounds that contain at least two hydroxyl groups. Many polyesters are synthesized with a diol. Diols are normally prepared from an alkene by the net addition of two hydroxy groups to the double carbon bond in a method known as hydroxylation. Polyols are commonly referred to as glycols and polyhydric alcohols. Examples of polyols used to make polyesters
15 include ethylene glycol, propylene glycol, butylene glycol, and cyclohexane dimethanol.

[0029] For exemplary purposes, Table 1 contains a nonexhaustive list of commercially available polyesters that may be recovered and recycled according to the present invention. For each polyester, the corresponding polybasic organic acid
20 and polyol are provided.

Table 1

POLYESTER	POLYBASIC ORGANIC ACID	DIOL
Polyethylene Terephthalate	Terephthalic Acid	Ethylene Glycol
Polybutylene Terephthalate	Terephthalic Acid	Butylene Glycol
PETG Co-polyester	Terephthalic Acid	Cyclohexane-dimethanol And Ethylene Glycol
PBTG Co-polyester	Terephthalic Acid	Cyclohexane-dimethanol And Butylene Glycol
Polycyclohexane-dimethanol Terephthalate	Terephthalic Acid	Cyclohexane- dimethanol
PEN Polyester	Naphthalene Dicarboxylic Acid	Ethylene Glycol

[0030] In one embodiment, the present invention is directed to a cleaning process for separating and recovering post-consumer polyester from various contaminant materials. For example, the process can be utilized for removing loose contaminants that may be merely mixed in with the polyester, such as loose dirt, paper, glass or sand particles for instance, from a mixture of materials charged to the cleaning vessel. In addition, the disclosed process can remove coatings adhered to polyester. For example, labels attached to a polyester substrate can be physically separated from the polyester according to the present invention. In addition, the process can be advantageously utilized for separating contaminants from the polyester that are embedded in the softer polyester substrate, such as glass, dirt, and metal contaminants, for example. Once these attached materials have been physically separated from the polyester, they can be removed from the mixture according to the process, leaving the clean polyester without the contaminants.

[0031] Prior to being charged to the cleaning vessel, the contaminated polyester materials can be, if desired, chopped or ground into flake form. For purposes of this disclosure, the term polyester flake refers to polyester materials that have been chopped or ground into small pieces. Flaking of the materials can be done for the purpose of facilitating handling. It should be understood that all different sizes and shapes of material may be used in the process of the present invention and no one size or shape is required. In general, however, the majority of the individual polyester pieces charged to the cleaning vessel can be larger than the openings of the mesh material in the cleaning vessel, to facilitate handling of the mixture. Sizing of the materials prior to charging the materials to the cleaning vessel can also help to insure that the contaminants are of a size to pass through the mesh, although many contaminants can be degraded within the cleaning vessel during the process prior to passing through the mesh.

[0032] According to the present invention, a mixture of materials including polyester can be charged to a cleaning vessel. In particular, the mixture of materials charged to the cleaning vessel will contain at least some post-consumer polyester and the mixture will be dry. That is, the mixture will not be in a slurry form. The dry

mixture of materials need not be excessively dry, however. For example, the mixture need not be pre-treated to remove all moisture from the mixture, and the mixture can be charged to the vessel at an atmospheric level of humidity.

[0033] Figure 1 illustrates one embodiment of a cleaning vessel 100 suitable for the process of the present invention. A dry mixture including polyester materials and contaminant materials can be charged to vessel 100 at Inlet 110. For instance, the mixture of materials can be charged to vessel 100 via a gravity feed, a screw feeder, or any other suitable feed method. The mixture of materials can include contaminants that are physically attached to polyester materials as well as contaminants that are merely mixed with the polyester, and not necessarily physically attached to the polyester. For example, the mixture charged to the vessel 100 can include some combination of polyester materials attached to various coatings, such as paper or other labels; polyester materials embedded with contaminants, such as dirt and glass; polyester materials that do not have contaminants physically attached; as well as loose contaminants, such as dirt, metals and loose paper, which are merely mixed in with the polyester materials.

[0034] Referring to Figure 1, the mixture of materials can be charged to one end of chamber 102 within vessel 100 via inlet 110. In this particular embodiment, chamber 102 can have a circular cross-section, as can be more clearly seen in Figure 2. In addition, chamber 102 can generally have a length to diameter ratio L/D of at least about 2, though this is not a requirement of the invention. For example, the diameter of chamber 102 can generally be between about 0.5 and about 3 meters.

[0035] Chamber 102 can include a series of blades 104 radially extending from an axle 116 that runs along the axis of chamber 102. In one embodiment, individual blades 104 can be oriented and/or shaped so as to control airflow over the blades. For example, each individual blade 104 can be set at a slight angle to axle 116 and/or have a specifically designed cross-sectional shape so as to facilitate air flow through the chamber as shown by the directional arrows at 110 and 112 when the axle is spinning.

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[0036] According to this embodiment, and as can be seen in Figures 1 and 2, multiple blades 104 can be aligned along axle 116 to form one or more rows of blades extending along the axial length of the chamber 102. Adjacent individual blades 104 within a row can be separated from one another by a distance A. In this embodiment, 5 the distance A can be roughly equivalent to the width of a blade on the axle. In another embodiment, the blades need not be axially aligned with one another to form rows, and can be more randomly located around axle 116 than is illustrated in the Figures.

[0037] The blades 104 can also extend from axle 116 so as to be offset from 10 each other around the circumference of the axle 116. For example, and as shown in Figure 2, rows of blades 104 can extend from axle 116 with a 90° angle between adjacent rows. This particular arrangement of the rows of blades 104 is not a requirement of the present invention, however. For instance, in another embodiment, rows of blades 104 can extend from axle 116 with an angle between rows of more or 15 less than that shown in Figure 2. For example, in one embodiment, two or three rows of blades could be equidistantly spaced around axle 116. In another embodiment, more than four rows of blades could be spaced around axle 116, for instance, five, six, or even more rows could be spaced around the central axle 116.

[0038] In one embodiment, the individual blades 104 can be formed of a 20 relatively hard material in order to prevent uneconomically fast degradation of the blades 104 during the process. For example, in one embodiment, the individual blades can be formed of a hardened steel such as a hardened stainless or carbon steel. For instance, the blades can be formed of a 400 or higher-grade stainless steel. The blades can optionally be formed of other hard materials as well, having a 25 roughly equivalent or greater hardness. For example, in other embodiments, the blades can be formed of abrasion resistant steel or the like.

[0039] After being charged to the vessel 100, the materials can be induced to rotate or spin about axle 116, for instance, by the rotation of blades 104. As previously mentioned, in one embodiment, the rotation of blades 104 can also

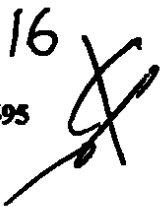
facilitate airflow through the chamber and the movement of the materials from one end of the chamber 102 to the other.

[0040] The blades 104 can rotate at a high rate of speed and promote fluidization of the mixture, i.e., the suspension as well as the rotation of the materials within the chamber 102. For example, blades 104 can rotate at a speed greater than about 20 m/sec. In one embodiment, the blades can rotate at greater than about 2000 rpm. In one embodiment, the tip speed of blades 104 can be between about 40 m/sec and about 100 m/sec such as about 50 m/sec. In another embodiment, the tip speed of blades 104 can be between about 60 m/sec and about 80 m/sec.

[0041] In one embodiment, axle 116 can be rotating as the materials are fed to chamber 102. According to this embodiment, the initial motion of the materials upon entrance to chamber 102 can be radial, rather than rotational. As such, it may be preferred in some embodiments of the invention that the wall 20 surrounding chamber 102 near the inlet 110 of the chamber 102 be a solid material, to prevent degradation of the wall of chamber 102 by the initial radial motion of the materials. For example, in one embodiment, between about 5% and about 20% of the initial length of chamber 102 can be surrounded by a solid wall 20, as shown in Figure 1. In addition, in one embodiment of the invention, the solid wall 20 of chamber 102 can be formed of a relatively hard material, so as to further prevent degradation of the wall by the initial radial motion of the materials.

[0042] After being charged to chamber 102 and while under the influence of the spinning blades 104, the dry mixture containing polyester and contaminants can begin to rotate about axle 116. Moreover, due to the high rotational speed of the blades, the materials can become suspended in the chamber as they rotate about axle 116. In addition, the materials can be continually abraded by the spinning blades as well as by collision with each other and the wall 20, 106 of chamber 102 as they rotate about axle 116.

[0043] As the materials are abraded within chamber 102, contaminants that are attached to the polyester substrate can become separated from the substrate. In addition, materials that are embedded in the polyester substrate can be stripped from

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the materials. Surprisingly, while the present process can promote separation of contaminants from polyester, including embedded materials, as well as degradation of many contaminants, the polyester itself is not substantially degraded by the process. For example, while coating materials, such as paper label materials or vapor barrier coatings, and embedded materials, such as embedded glass and dirt, can become detached from the polyester substrate through the disclosed process, the polyester flakes themselves will remain essentially the same size and shape as originally charged to the vessel 100.

[0044] The lack of degradation of the polyester flakes during the cleaning process appears to be independent of blade speed as well as independent of the mesh size of wall 106 that at least partially surrounds chamber 102. For instance, there appears to be little or no degradation of the polyester in the process no matter whether the blade speed is relatively slow, or somewhat higher.

[0045] In contrast to the polyester materials, brittle and fibrous contaminant materials mixed in with the mixture, whether charged to the vessel 100 already physically separated from the polyester or physically separated from the polyester within chamber 102, can be degraded by the process. For example, glass, dirt, concrete, brittle polymer or metal materials, and the like, can be degraded by the process. In addition, fibrous materials, such as paper, can also be degraded by the process.

[0046] At least a portion of the wall 106 of chamber 102 can be a mesh material. For purposes of this disclosure, a mesh is herein defined as a material defining multiple open spaces in a network. For example, a mesh can include any openwork fabric or net structure and can include a net, a screen, a sieve, and the like.

[0047] For example, in the embodiment illustrated in Figure 1, the entire chamber 102 beyond the initial section surrounded by wall 20 can be surrounded by wall 106 that is formed of a mesh material. In order to promote degradation of the contaminants contained in the mixture, as well as to prevent excessively fast deterioration of wall 106, wall 106 can be formed of a hardened material. For example, wall 106 can be formed of a hardened stainless or carbon steel screen. In

one embodiment, wall 106 can be formed of a grade 316 or higher stainless steel screen or a material of similar or greater hardness.

[0048] Wall 106 can generally have a predetermined mesh size. In particular, the mesh size of wall 106 can be of a size such that the majority of the polyester substrate pieces in the mixture are larger than the openings in the mesh wall 106. For example, in one embodiment, wall 106 can be a metal screen and can have a market grade mesh size of between about 8 and about 12.

[0049] As the contaminants are degraded within the chamber 102, they can become smaller than the openings in wall 106 and can pass out of chamber 102 as represented by arrows 108 in Figure 1, leaving the cleaner polyester substrate in the chamber 102.

[0050] The presently disclosed process can be particularly effective at removing glass from a mixture including both glass and polyester. Glass can be one of the most difficult materials to separate from post-consumer polyester during a polyester recycling process and can be detrimental to the process if not completely removed. Glass that is not removed during the recycling process can not only cause serious damage to processing equipment during the recycling process, but it can also destroy the materials to be formed from the recycled polyester. For example, glass that is not removed during the recycling process can become incorporated with the polyester during a subsequent material formation process (e.g., a beverage container formation process) and can destroy the materials to be formed from the polyester through, for instance, the formation of holes in the polyester products.

[0051] According to one embodiment of the present process, more than about 97% of the glass in a mixture containing both glass and polyester can be removed from the mixture. In one embodiment, more than about 98% of the glass in a mixture can be removed. In another embodiment, more than about 99% of the glass can be removed.

[0052] Surprisingly, while brittle contaminant materials such as glass can be degraded and pass through the mesh of 106, the polyester materials themselves can remain in the chamber 102. This is partly due to the fact that the polyester is not

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degraded within the chamber 102 during the process, as discussed above. However, it has been discovered that even polyester flakes of a smaller size than the mesh openings can remain in chamber 102 during the cleaning process of the present invention. In particular, it has been discovered that polyester fines can remain in the chamber during the process. While not wishing to be bound by any particular theory, it is believed that due to the high rotational speed of the mixture in chamber 102, the materials within the chamber can become fluidized and suspended as they rotate about axle 116. Moreover, it is believed that the centrifugal forces acting on the suspension can cause the materials within the mixture to separate, with the denser materials, and in particular, contaminants such as glass, metal, paper, and the like, moving to the outside of the mass and passing through the wall 106 (following any degradation due to abrasion), while the lighter polyester materials, and particularly the small polyester fines, can remain suspended closer to the center of the chamber. In particular, glass-like materials and fibrous materials can pass through the screen, while elastomeric materials, such as PET will remain behind. Even PET particles smaller than the screen orifice will remain with the main body of the PET. As the polyester fines remain in the center of the suspended, rotating mass of material, very few polyester fines will pass through the screen in the process, and high yield of polyester can be attained in the cleaning process of the present invention.

[0053] Following the separation process, the clean polyester materials can be removed from chamber 102. For example, the residence time of the materials in the chamber can be, in one embodiment, between about 0.5 and about 3 seconds. For example, Figure 1 illustrates a continuous process in which the polyester materials can be removed from chamber 102 at access 112, while the separated contaminants can be removed from vessel 100 at a separate access, such as at 114 following the disclosed separation process.

[0054] In an alternative embodiment, for example in a batch process, the chamber can include only a single access for both introducing and removing the polyester materials. In addition, when considering a batch process, it may be preferable to have the base of the chamber include a solid wall across the entire

length of the chamber. For instance, in one embodiment illustrated in Figure 3, the chamber 102 can include a solid wall 20 along the base of the entire length of chamber 102 and a mesh wall 106 above the solid wall 20 along the entire length of the chamber. Such an embodiment may be preferred, for example, in a batch
5 process that includes charging the dry mixture of materials to the chamber prior to the initiation of rotation of the mixture, in order to prevent polyester substrate from falling through the screen when the mixture is not spinning.

[0055] Beneficially, the presently disclosed cleaning process is a dry process. As such, contaminants can be separated from the polyester during the process
10 without the utilization of wash water, which can reduce the overall costs of the cleaning process.

[0056] Moreover, even if aqueous processing of the polyester occurs following the disclosed dry cleaning process, there can be much lower contamination levels and hence less wastewater treatment processing required by the process. For example,
15 following the above described dry cleaning process, the polyester substrate may be subjected to an aqueous rinse, if desired, to remove any remaining impurities. For example, the polyester flakes can be subjected to a subsequent water rinse under agitation. As many contaminant materials and impurities can be removed by the above described dry cleaning process, problems encountered in the past with
20 aqueous separation techniques, such as congealing of separated coating materials, or expensive water treatment requirements, for example, can be less of a problem in the polyester recovery process of the present invention. For example, following the dry cleaning process of the present invention, wash water can generally show a decrease in chemical oxygen demand of at least about 15% that can vary (depending
25 on the tip speed of the blades used), as compared to wash water used directly on the contaminated polyester materials. Similarly, through use of the process of the present invention prior to an aqueous wash, the total dissolved solids level of the wash water can decrease by about 30%, total suspended solids can decrease by at least about 50%, and oil and grease can decrease by about 15%, in various embodiments.



[0057] The disclosed process may optionally be utilized in conjunction with other polyester recycling treatment processes, as are generally known in the art. For example, the disclosed dry cleaning process can be utilized in conjunction with polyester treatment processes such as those disclosed in U.S. Patent No. 5,958,987 to Schwartz, Jr., et al., U.S. Patent No. 6,197,838 to Schwartz, Jr., et al., U.S. Patent No. 6,147,129, to Schwartz, Jr., or U.S. Patent Application Publication No. 2003/0010680 to Holmes, et al., all of which are incorporated herein by reference.

[0058] The present invention may be better understood with reference to the following examples.

Example 1

[0059] US polyester flakes were cleaned in a dry cleaning vessel according to the present invention. As a control, 620.5 g of the US flake polyester was cleaned according to a standard aqueous wash process without being subjected to the dry cleaning process of the present invention. Roughly equivalent amounts of the U.S. flake were cleaned according to the present invention and then washed in a like manner as the control following the dry cleaning process. Two samples of US flake were dry cleaned according to the present invention with the tip speed of the cleaning vessel blades at either 40 m/s (620.2 g sample) or 60 m/s (620.7 g sample).

Comparison results for the wash water were as follows:

Chemical Oxygen Demand:

	COD (ppm)	COD/g flake	% reduction
CONTROL	634	1.02	
40 M/S	520	0.84	17.9
60 M/S	422	0.68	33.5

Total Dissolved Solids:

	TDS (ppm)	TDS/g flake	% reduction
CONTROL	312	0.50	
40 M/S	197	0.32	36.8
60 M/S	151	0.24	51.6

Total Suspended Solids:

	TSS ppm	TSS/g flake	% reduction
CONTROL	756	1.22	
40 M/S	343	0.55	54.6
60 M/S	140	0.23	81.5

Oil and Grease:

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	O&G ppm	O&G/g flake	% reduction
CONTROL	53	0.09	
40 M/S	32	0.05	39.6
60 M/S	19	0.03	64.2

Nitrates:

	TOTAL ppm
CONTROL	2
40 M/S	2
60 M/S	2

Nitrogen:

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	TOTAL ppm
CONTROL	9.2
40 M/S	8.3
60 M/S	7

Phosphorous:

	TOTAL ppm
CONTROL	7.1
40 M/S	5.8
60 M/S	4.3

- 15 [0060] Figure 4 shows the particle size distribution of the materials cleaned as described above. As can be seen, the particle size distribution of the materials cleaned according to the present invention did not change appreciably from that cleaned only according to the wash process. That is, the particle size distribution of all of the cleaned materials remained about the same irrespective of the different

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cleaning processes, indicating that the polyester flakes are not appreciably degraded in the disclosed process.

[0061] Tabular results showing the percentage of the clean polyester materials of a size above the given mesh size for the control and the samples cleaned according to the disclosed process are given in Table 2, below:

Table 2

Mesh Size	12	16
Control	4.93%	2.98%
40 M/S	5.20%	2.82%
80 M/S	10.75%	6.64%

[0062] As can be seen, the polyester fines were not lost with the removal of the contaminants during the disclosed process.

[0063] In addition, it was determined that approximately 4.66% by weight of the total material charged to the dry cleaning apparatus was removed as contaminants during the process when the process was operated at a blade speed of 80 m/s, and approximately 2.65% by weight of the total material charged to the dry cleaning apparatus was removed as contaminants by the cleaning process when the process was operated at a blade speed of 40 m/s.

Example 2

[0064] Mexican polyester flakes were cleaned in a dry cleaning vessel according to the present invention. As a control, 621.2 g of the Mexican flake polyester was cleaned according to a standard aqueous wash process without being subjected to the dry cleaning process of the present invention. Samples of roughly equivalent amounts of the Mexican flake were cleaned according to the present invention and then washed in a like manner as the control following the dry cleaning process. Two samples of the Mexican flake were dry cleaned according to the present invention with the tip speed of the cleaning vessel blades at either 40 m/s (620.4 g sample) or 60 m/s (620.4 g sample). Comparison results for the wash water was as follows:

Chemical Oxygen Demand:

	COD ppm	COD/g flake	% reduction
CONTROL	663	1.07	
40 M/S	238	0.38	64.1
60 M/S	159	0.26	78.0

Total Dissolved Solids:

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	TDS ppm	TDS/g flake	% reduction
CONTROL	354	0.57	
40 M/S	169	0.27	52.2
60 M/S	481	0.78	-36.1

- a. Note: The sample utilized to obtain the TDS figure for the 60 m/s sample was believed to have been contaminated, as the results are nonsensical.

10 Total Suspended Solids:

	TSS ppm	TSS/g flake	% reduction
CONTROL	829	1.33	
40 M/S	269	0.43	67.5
60 M/S	93	0.15	88.8

Oil and Grease:

	O&G ppm	O&G/g flake	% reduction
CONTROL	22	0.04	
40 M/S	18	0.03	18.1
60 M/S	6	0.01	72.7

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Nitrates:

	TOTAL ppm
CONTROL	2
40 M/S	2
60 M/S	2

Nitrogen:

	TOTAL ppm
CONTROL	22.5
40 M/S	13.8
60 M/S	9

Phosphorous:

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	TOTAL ppm
CONTROL	3.8
40 M/S	3.7
60 M/S	1.9

[0065] Figure 5 shows the particle size distribution of the materials cleaned as described above. As can be seen, the particle size distribution of the materials cleaned according to the present invention did not change appreciably from that cleaned only according to the wash process. That is, the particle size distribution of all of the cleaned materials remained about the same irrespective of the different cleaning processes, indicating that the polyester flakes are not appreciably degraded in the disclosed process.

[0066] Tabular results showing the percentage of the clean polyester materials of a size above the given mesh size for the control and the samples cleaned according to the disclosed process are given in Table 3 below:

Table 3

Mesh Size	12	16
Control	5.74%	3.44%
40 M/S	3.54%	1.71%
60 M/S	3.54%	1.65%

[0067] In addition, it was estimated that approximately 7.8% by weight of the total material charged to the dry cleaning apparatus was removed as contaminants by the cleaning process when the process was operated at a blade speed of 60 m/s, and approximately 5.12% by weight of the total material charged to the dry cleaning apparatus was removed as contaminants by the cleaning process when the process was operated at a blade speed of 40 m/s.

Example 3

[0068] Mixtures of glass and polyester were treated according to the present invention. Three mixtures were dry cleaned as described above at different blade speeds: 55 m/sec, 61 m/sec, and 67 m/sec. Initial mixture glass composition and separation process results are tabulated in Table 4, below:

Table 4

Blade Speed	Initial Glass Amt (g)	Final Glass Amt (g)	Removal %
55 m/sec	897.10	19.368	97.8%
61 m/sec	836.96	15.536	98.1%
67 m/sec	895.88	9.128	99.0%

[0069] These and other modifications and variations to the present invention may be practiced by those of ordinary skill in the art, without departing from the spirit and scope of the present invention. In addition, it should be understood that aspects of the various embodiments may be interchanged both in whole or in part. Furthermore, those of ordinary skill in the art will appreciate that the foregoing description is by way of example only, and is not intended to limit the invention.

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What is claimed is:

1. A process for separating polyester from contaminants comprising:
providing a dry mixture comprising polyester and contaminant materials
to a cleaning chamber, the cleaning chamber defining an axis;
5 spinning the mixture about the axis of the cleaning chamber;
contacting a wall of the cleaning chamber with the contaminants as the
mixture spins about the axis of the cleaning chamber, wherein at least a portion of the
wall comprises a mesh material; and
passing at least a portion of the contaminants through the mesh material
10 openings.
2. The process according to claim 1, wherein the mesh material is a metal
screen.
3. The process according to claim 1, wherein the cleaning chamber
comprises an axle along the axis that rotates while the mixture spins about the axis,
15 the axle rotating at a speed of at least about 2000 rpm.
4. The process according to claim 3, wherein the cleaning chamber further
comprises a plurality of blades emanating from the axle, wherein the blades rotate
with a tip speed of greater than about 20 meters per second while the mixture spins.
5. The process according to claim 4, wherein the blades rotate with a tip
20 speed greater than about 40 meters per second.
6. The process according to claim 4, wherein the blades rotate with a tip
speed greater than about 60 meters per second.
7. The method according to claim 1, wherein the contaminants include
materials physically attached to the polyester.
- 25 8. The method according to claim 7, wherein the contaminants include
materials embedded within the polyester.
9. The method according to claim 7, the method further comprising
separating the physically attached materials from the polyester to which they are
attached.

10. The method according to claim 1, wherein the contaminants comprise brittle materials, the method further comprising degrading the brittle contaminants within the cleaning chamber.

5 11. The method according to claim 1, wherein the method is a continuous process.

12. A method of separating a mixture comprising:
providing a dry mixture comprising polyester and glass to a cleaning chamber, the cleaning chamber defining an axis;
spinning the mixture about the axis of the cleaning chamber;
10 contacting a wall of the cleaning chamber with the glass as the mixture spins about the axis of the cleaning chamber, wherein at least a portion of the wall comprises a screen; and
passing at least a portion of the glass through the screen openings.

13. The process according to claim 12, wherein the cleaning chamber
15 comprises an axle along the axis that rotates while the mixture spins about the axis, the axle rotating at a speed of at least about 2000 rpm.

14. The process according to claim 13, wherein the cleaning chamber further comprises multiple blades emanating from the axle, wherein the blades rotate with a tip speed of greater than about 20 meters per second while the mixture spins.

20 15. The method according to claim 12, wherein a portion of the glass in the mixture is embedded within the polyester.

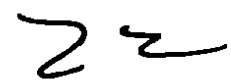
16. The method according to claim 15, the method further comprising releasing the embedded glass from the polyester.

25 17. The method according to claim 12, the method further comprising degrading the glass within the cleaning chamber.

18. The method according to claim 12, wherein more than about 97% of the glass in the mixture passes through the metal screen.

19. The method according to claim 12, wherein more than about 98% of the glass in the mixture passes through the metal screen.

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20. A cleaning vessel comprising:

a cleaning chamber surrounded by a wall, wherein at least a portion of the cleaning chamber wall comprises a hardened mesh material, the mesh material having a hardness about equivalent to or greater than the hardness of grade 316

5 stainless steel, the cleaning chamber defining a central axis;

an axle along the central axis;

a plurality of blades emanating from the axle; and

an inlet for delivering a dry mixture comprising polyester materials and contaminant materials to the cleaning chamber.

10 21. The cleaning vessel of claim 20, wherein a portion of the wall comprises a solid material.

22. The cleaning vessel of claim 21, wherein the solid wall material surrounds the cleaning chamber near the inlet.

15 23. The cleaning vessel of claim 21, wherein the solid wall portion is formed of a hardened steel.

24. The cleaning vessel of claim 20, wherein the blades are formed of a hardened material having a hardness about equivalent to or greater than the hardness of grade 400 stainless steel.

20 25. The cleaning vessel of claim 20, wherein the blades can rotate about the central axis, the rotating blades facilitating air flow through the cleaning chamber.

26. The cleaning vessel of claim 20, further comprising a first outlet exterior to the cleaning chamber for removing dry contaminants from the cleaning vessel.

25 27. The cleaning vessel of claim 20, further comprising a second outlet at the wall of the cleaning chamber for removing clean polyester materials from the cleaning vessel.

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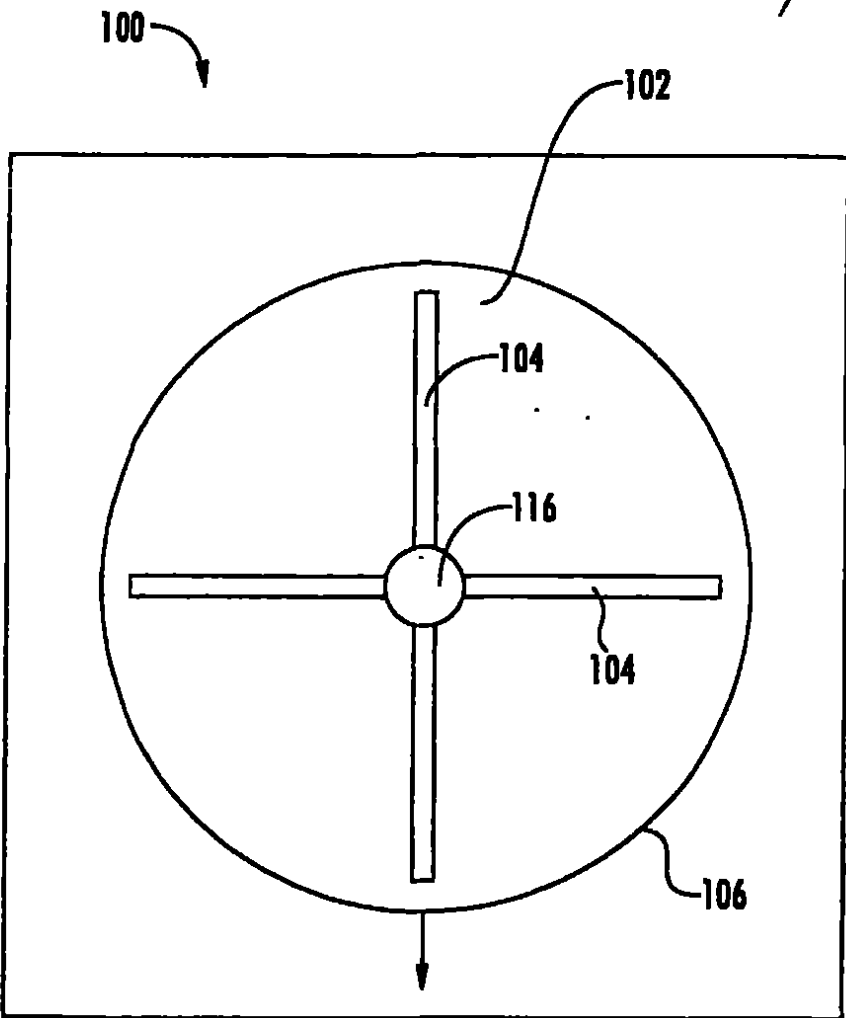


FIG. 2

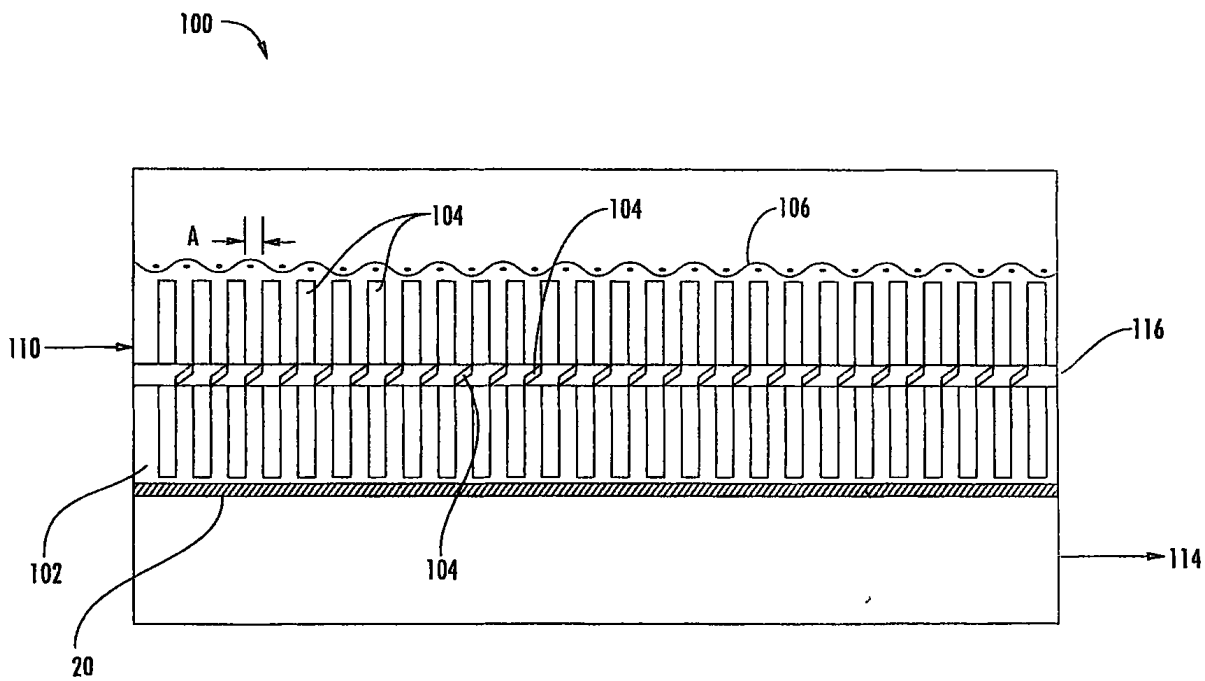


FIG 3

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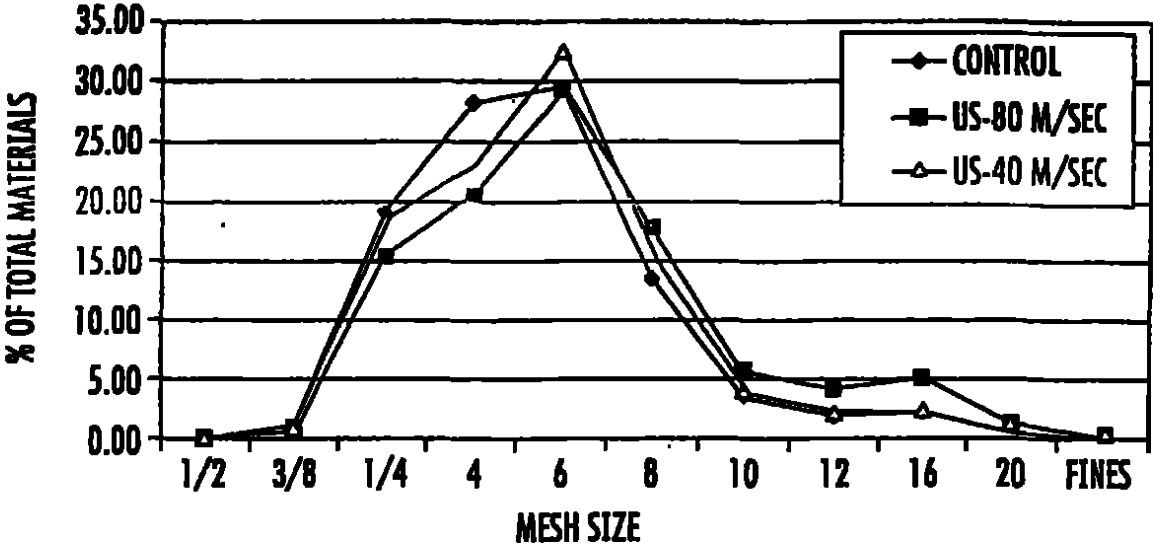


FIG. 4

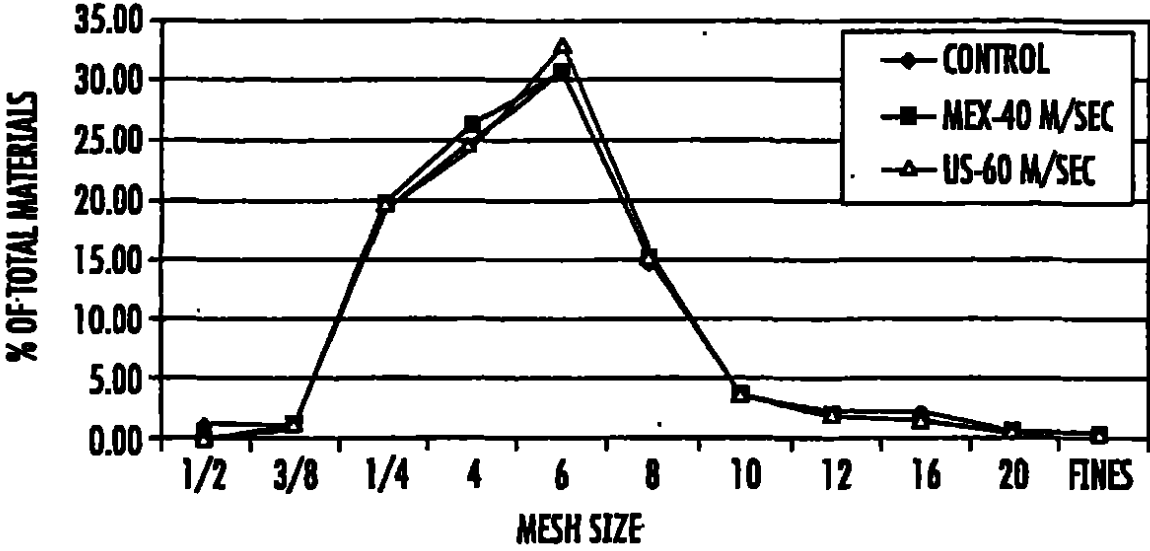


FIG. 5

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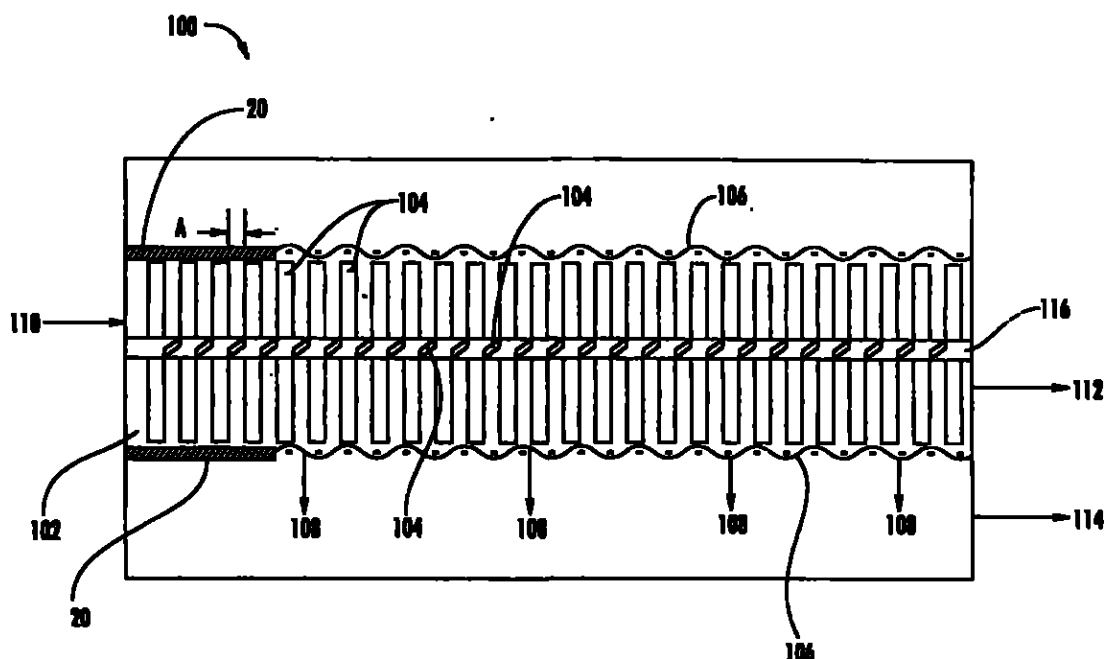
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(54) Título: SEPARACIÓN EN SECO DE CONTAMINANTES DE MATERIALES DE POLIÉSTER



(57) Extracto: Se divulga un método para separar materiales de poliéster de contaminantes, por ejemplo, apropiado para un sistema de reciclaje de poliéster. El método es un método de separación en seco e incluye agitar rápidamente una mezcla de poliéster y contaminantes en una cámara de limpieza. Durante la agitación de la mezcla, los contaminantes pueden degradarse y atravesar un tamiz en la pared de la cámara, mientras los materiales de poliéster no se degradan sustancialmente y permanecen en la cámara de limpieza. En la misma forma los finos de poliéster pueden permanecer en la cámara de limpieza. Se divulga igualmente un dispositivo de limpieza apropiado para uso en el proceso. El dispositivo puede incluir un tamiz de material endurecido, que puede ayudar a degradar los contaminantes, y una pluralidad de cuchillas rotatorias que pueden agitar la mezcla en el dispositivo y contribuir asimismo a degradar los materiales contaminantes.



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— antes del vencimiento del tiempo límite para modificar las reivindicaciones y para volverse a publicar en el caso de recibo de modificaciones

Para códigos de dos letras y otras abreviaturas, remítase a las "Notas Guía sobre Códigos y Abreviaturas" que aparece al comienzo de cada edición regular del Boletín Oficial PCT.

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**PATENTE****EXPEDIENTE NO. URC-20**

SEPARACIÓN EN SECO DE CONTAMINANTES DE MATERIALES DE POLIÉSTER

Referencia Cruzada a una Solicitud Relacionada

[001] La presente solicitud reivindica el beneficio a la Solicitud Provisional de los Estados Unidos con número consecutivo 60/499,862 presentada el 3 de septiembre de 2003.

Antecedentes de la Invención

[002] Los poliésteres son materiales poliméricos elaborados a partir de la esterificación de ácidos orgánicos polibásicos con ácidos polihídricos. Tal vez el poliéster más comúnmente fabricado y usado es el tereftalato de polietileno (PET), que puede manufacturarse haciendo reaccionar ácido tereftálico con etilen glicol.

[003] En la actualidad los poliésteres se están empleando en cantidades crecientes en diferentes aplicaciones. Por ejemplo, habitualmente los poliésteres se utilizan para elaborar muchos tipos de envases para bebidas y alimentos, películas fotográficas, películas de rayos X, cintas de grabación magnética, aislamiento eléctrico, auxiliares quirúrgicos tales como arterias sintéticas, telas y demás productos textiles.

[004] Debido a que los poliésteres pueden volverse a fundir y moldearse, se acometen esfuerzos continuos para reciclar eficientemente tanto poliéster como sea posible luego de su empleo. No obstante, antes de poder reciclar el poliéster, es necesario separar el poliéster usado de los contaminantes, es decir, materiales que puedan hallarse mezclados con el poliéster, o adheridos a él. Muchos procesos de reciclaje incluyen un paso de separación en donde el poliéster se lava con una solución acuosa, con el fin de separar el poliéster de



los contaminantes. Aunque el lavado acuoso puede eliminar muchos contaminantes, éste utiliza una gran cantidad de agua, a la vez que requiere el paso adicional de pos-tratamiento de la solución de lavado para retirar los contaminantes de las aguas residuales. Desafortunadamente, se ha demostrado que el lavado acuoso es además ineficaz para eliminar contaminantes relativamente duros, tales como vidrio, arena y similares, los cuales pueden incrustarse en los materiales de poliéster.

[005] En un intento por eliminar materiales incrustados de sustratos de poliéster, se han empleado procesos de filtración de fundido ("*melt filtration processes*"), en los cuales el poliéster contaminado se funde y luego se filtra, con el fin de retirar los contaminantes sólidos. Sin embargo, estos procesos no son muy productivos en relación con los costos y, a menudo, demuestran ser económicamente irrealizables.

[006] Lo que se necesita en el arte es un método novedoso para eliminar contaminantes de materiales de poliéster y, en particular, de materiales de poliéster usado. Además, lo que se requiere en el arte es un proceso de reciclaje del poliéster en el cual se reduzcan los niveles de contaminación del agua de tratamiento, comparados con los procesos de reciclaje previamente conocidos.

Sumario

[007] En una incorporación, la presente invención se dirige a un proceso para separar el poliéster de los contaminantes. Por ejemplo, el proceso puede incluir el paso de alimentar a una cámara de limpieza una mezcla seca de poliéster, mezclado con materiales contaminantes, y hacer rota la mezcla alrededor del eje de la cámara de limpieza, con el fin de fluidizar la mezcla. A medida que la mezcla rota, ésta puede contactar la pared de la cámara de limpieza. En particular, los contaminantes dentro de mezcla pueden contactar la pared. Adicionalmente, por lo menos una porción de la pared puede ser un material de malla, por ejemplo un tamiz metálico. Como tal, cuando los materiales contaminantes pequeños contactan la pared, éstos pueden atravesar

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las aberturas del material de malla, dejando los materiales de poliéster limpios en la cámara de limpieza.

[008] La cámara de limpieza puede incluir igualmente un árbol a lo largo del eje central que rote mientras la mezcla da vueltas alrededor del eje. Por ejemplo, el árbol puede rotar a una velocidad de por lo menos alrededor de 2.000 rpm. Adicionalmente, la cámara de limpieza puede incluir una pluralidad de cuchillas que emerjan del árbol, las cuales pueden rotar con el árbol con una velocidad de tope ("*a tip speed*") de, por ejemplo, más de alrededor de 20 metros por segundo. En una incorporación, las cuchillas pueden rotar con una velocidad de tope de más de 40 metros por segundo. En otra incorporación, las cuchillas pueden rotar con una velocidad de tope de más de alrededor de 60 metros por segundo.

[009] Los materiales contaminantes mezclados con el poliéster pueden incluir contaminantes sueltos, así como materiales físicamente adheridos al poliéster. Por ejemplo, los contaminantes pueden estar adheridos a la superficie de los materiales de poliéster o estar incrustados en el poliéster. Tal como se describe aquí, el proceso puede separar también del poliéster tales materiales contaminantes físicamente adheridos. Más aún, esto puede hacerse sin degradar sustancialmente los materiales de poliéster propiamente dichos.

[0010] Los contaminantes pueden incluir también materiales quebradizos, tales como vidrio, basura, concreto y similares. De acuerdo con esta incorporación, el método puede incluir además degradar los contaminantes quebradizos en la cámara de limpieza, por ejemplo a medida que los contaminantes contactan la pared y/o las cuchillas de la cámara.

[0011] En una incorporación particular, los contaminantes pueden incluir vidrio. Por ejemplo, vidrio mezclado con el poliéster y/o incrustado en él. De acuerdo con esta incorporación, el proceso puede retirar la mayor parte del vidrio de la mezcla. Por ejemplo, el proceso puede eliminar más de alrededor de 97% del vidrio de la mezcla. En una incorporación, el proceso puede retirar más de alrededor de 98% del vidrio de la mezcla.

[0012] En una incorporación, la invención se dirige a un tanque de limpieza apropiado para el proceso divulgado. Por ejemplo, el tanque de

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limpieza puede incluir una cámara de limpieza rodeada por una pared, de la cual por lo menos una porción puede ser un material de malla endurecido con una dureza aproximadamente equivalente a, o mayor que la dureza de acero inoxidable grado 316. La cámara de limpieza puede incluir además una entrada que pueda alimentar la mezcla seca de poliéster y contaminantes a la cámara.

[0013] El tanque de limpieza puede incluir igualmente un árbol a lo largo del eje central y una pluralidad de cuchillas que se proyecten del árbol. De manera opcional, las cuchillas pueden formarse igualmente de un material endurecido, por ejemplo un material con una dureza aproximadamente equivalente a, o mayor que la dureza del acero inoxidable grado 400. Más aún, las cuchillas pueden orientarse sobre el árbol y/o tener una configuración de sección transversal, de manera que faciliten el flujo de aire a través de la cámara de limpieza cuando el árbol dando vueltas.

[0014] Si se desea, una porción de la pared de la cámara de limpieza puede ser sólida, en lugar de una malla. Por ejemplo, la porción de la pared que rodea la entrada de la cámara de limpieza puede formarse de un material sólido, por ejemplo un acero endurecido sólido.

Breve Descripción de las Figuras

[0015] Una divulgación completa y que posibilite la presente invención, incluido su mejor modo de realización, a una persona de habilidad ordinaria en el arte, se expone más particularmente en el resto de la especificación, incluida la referencia a las figuras acompañantes, en las cuales:

[0016] Figura 1 es una vista lateral de una incorporación de un tanque de limpieza de la presente invención;

[0017] Figura 2 es una vista frontal en corte del tanque de limpieza de Figura 1;

[0018] Figura 3 es otra incorporación de un tanque de limpieza de la presente invención;

[0019] Figura 4 muestra la distribución del tamaño de partícula de

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hojuelas de poliéster de Estados Unidos, limpiadas en seco de acuerdo con la presente invención, comparadas con hojuelas similares limpiadas de acuerdo con un proceso de lavado acuoso tradicional; y

[0020] Figura 5 muestra la distribución del tamaño de partícula de hojuelas de poliéster de México, limpiadas de acuerdo con la presente invención, comparadas con hojuelas similares limpiadas de acuerdo con un proceso de lavado acuoso tradicional.

[0021] El empleo repetido de caracteres de referencia en la presente especificación y dibujos tiene como finalidad representar características idénticas o análogas, o elementos de la presente invención.

Descripción Detallada de Incorporaciones Preferidas

[0022] Se hará ahora referencia en detalle a varias incorporaciones de la invención, de la cual se ilustran uno o más ejemplos en los dibujos acompañantes. Cada ejemplo se da a modo de explicación de la invención, no a modo de limitación de la invención. De hecho, será evidente a aquellas personas expertas en el arte la posibilidad de introducir diferentes modificaciones y variaciones en la presente invención sin desviarse del ámbito o espíritu de la invención. Por ejemplo, características ilustradas o descritas como parte de una incorporación pueden utilizarse en otra incorporación para producir una incorporación más. Por consiguiente, se pretende que la presente invención cubra tales modificaciones y variaciones en la medida en que caigan dentro del ámbito de las reivindicaciones adjuntas y sus equivalentes.

[0023] La presente invención se dirige generalmente a un proceso de limpieza para separar y recuperar poliéster usado de diferentes materiales contaminantes. La invención se dirige asimismo a un tanque de limpieza apto para el proceso divulgado. La invención puede utilizarse para separar poliéster usado de diferentes contaminantes, incluidos vidrio, basura, papel, metal y similares. Ventajosamente, el proceso divulgado es un proceso de separación en seco y puede reducir significativamente la producción total de aguas residuales, así como el nivel de contaminación de las aguas residuales en un proceso de reciclaje de poliéster.

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[0024] El proceso divulgado en la actualidad incluye alimentar poliéster contaminado seco a un tanque de limpieza. El tanque de limpieza incluye una cámara a la cual se carga la mezcla seca. La cámara está por lo menos parcialmente rodeada por una malla con un tamaño de abertura predeterminado. Dentro de la cámara puede haber una serie de cuchillas distanciadas en la dirección de la longitud axial de la cámara. Durante el proceso de separación, las cuchillas pueden girar con un elevado régimen de velocidad, fluidizando la mezcla seca, y la mezcla en rotación puede contactar la pared de la cámara, lo cual puede llevar a la degradación de contaminantes, así como a la separación de contaminantes del poliéster, incrustados o adheridos a él en otra forma. Los contaminantes pueden atravesar la malla circundante, mientras que el poliéster puede permanecer en la cámara. Sorprendentemente, el proceso puede utilizarse para separar y degradar contaminantes, incluso contaminantes incrustados, del poliéster sin degradación sustancial del poliéster. Adicionalmente, aunque los contaminantes pueden separarse del poliéster y atravesar la malla circundante, el poliéster puede permanecer dentro de la cámara de limpieza. Incluso en aquellas incorporaciones en donde el poliéster incluye hojuelas de poliéster de un tamaño menor que las aberturas de la malla, el grueso de los pequeños finos de poliéster puede permanecer en la cámara de limpieza sin perderse con los contaminantes durante el proceso de separación.

[0025] Tal como se emplea aquí, un poliéster se define como un producto de esterificación o reacción entre un ácido orgánico polibásico y un poliol. Se cree que en el proceso de la presente invención puede usarse cualquier poliéster o copoliéster. No obstante, en una incorporación particular, el proceso de la presente invención se dirige a una clase de poliésteres designados aquí como poliol politereftalatos, en los cuales el ácido tereftálico hace las veces del ácido orgánico polibásico.

[0026] Tal como se emplea aquí, un ácido orgánico polibásico se refiere a cualquier ácido orgánico que tenga dos o más grupos carboxilo ($-\text{COOH}$). La mayoría de los poliésteres se derivan de ácidos di-básicos, también conocidos como ácidos dicarboxílicos. Los ácidos polibásicos pueden tener

una conformación lineal o cíclica. Ejemplos de ácidos polibásicos lineales, que pueden usarse para elaborar poliésteres, incluyen los ácidos dicarboxílicos alifáticos. En particular, pueden usarse los ácidos dicarboxílicos alifáticos que tienen en sus cadenas hasta diez átomos de carbono. Estos ácidos incluyen ácido adípico, ácido glutárico, ácido succínico, ácido malónico, ácido oxálico, ácido pimélico, ácido subérico, ácido azelaico, ácido sebácico, ácido maleico y ácido fumárico.

[0027] Ácidos orgánicos polibásicos cíclicos, por otro lado, incluyen los ácidos dicarboxílicos carbocíclicos. Estos ácidos incluyen ácido de ftalato, ácido isoftálico y ácido tereftálico. En particular, el ácido tereftálico se usa para elaborar tereftalato de polietileno, el cual es tal vez el poliéster más común disponible en el comercio.

[0028] Como se describe más arriba, un ácido orgánico polibásico puede hacerse reaccionar con un poliol para producir un poliéster. Los polioles son compuestos que contienen por lo menos dos grupos hidroxilo. Muchos poliésteres se sintetizan con un diol. Los dioles se preparan normalmente de un alqueno por la adición neta de dos grupos hidroxilo al doble enlace carbono, en un método conocido como hidroxilación. Los polioles se designan comúnmente como glicoles y alcoholes polihídricos. Ejemplos de polioles empleados para elaborar poliésteres incluyen etilen glicol, propilen glicol, butilen glicol y ciclohexano dimetanol.

[0029] Para efectos ejemplares, la Tabla 1 contiene un listado no exhaustivo de poliésteres disponibles en el comercio, que pueden recuperarse y reciclarse de acuerdo con la presente invención. Para cada poliéster se indican el correspondiente ácido orgánico polibásico y el poliol.

Tabla 1

POLIÉSTER	ÁCIDO ORGÁNICO POLIBÁSICO	DIOL
Tereftalato de Polietileno	Ácido Tereftálico	Etilen Glicol
Tereftalato de Polibutileno	Ácido Tereftálico	Butilen Glicol

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PETG Co-poliéster	Ácido Tereftálico	Ciclohexano-dimetanol y Etilen Glicol
PBTG Co-poliéster	Ácido Tereftálico	Ciclohexano-dimetanol y Butilen Glicol
Políciclohexano-dimetanol Tereftalato	Ácido Tereftálico	Ciclohexano-dimetanol
PEN Poliéster	Ácido Naftaleno Dicarboxílico	Etilen Glicol

[0030] En una incorporación, la presente invención se dirige a un proceso de limpieza para separar y recuperar poliéster usado de diferentes materiales contaminantes. Por ejemplo, el proceso puede utilizarse para retirar contaminantes sueltos, los cuales pueden estar simplemente mezclados con el poliéster, tales como basura suelta, papel, vidrio o partículas de arena, por ejemplo, de una mezcla de materiales cargados al tanque de limpieza. Además, el proceso divulgado puede eliminar recubrimientos adheridos al poliéster. Por ejemplo, etiquetas pegadas a un sustrato de poliéster pueden separarse físicamente del poliéster de acuerdo con la presente invención. Además, el proceso puede utilizarse ventajosamente para separar contaminantes del poliéster que se encuentren incrustados en el sustrato más suave del poliéster, tal como vidrio, basura y contaminantes metálicos, por ejemplo. Una vez se han separado físicamente del poliéster estos materiales adheridos, pueden eliminarse de la mezcla de acuerdo con el proceso, dejando el poliéster limpio sin los contaminantes.

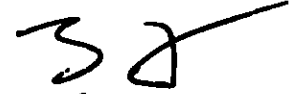
[0031] Si se desea, antes de cargarse al tanque de limpieza, los materiales de poliéster contaminados pueden cortarse en pequeños trozos o molerse en forma de hojuelas. Para efectos de esta divulgación, el término hojuela de poliéster se refiere a materiales de poliéster que se han cortado en trozos o se han molido en pedazos pequeños. El deslaminado ("*flaking*") de los materiales puede hacerse para efectos de facilitar el manejo. Debe entenderse que en el proceso de la presente invención es posible usar todos los diferentes tamaños y formas de material y que no se requiere un tamaño o forma. En general, sin embargo, la mayoría de los pedazos de poliéster individuales

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cargados al tanque de limpieza pueden ser mayores que las aberturas del material de la malla en el tanque de limpieza, con el fin de facilitar el manejo de la mezcla. La clasificación por tamaño de los materiales, antes de cargar los materiales al tanque de limpieza, puede contribuir además a garantizar que los contaminantes sean de un tamaño que atravesase la malla, aunque muchos contaminantes pueden degradarse dentro del tanque de limpieza durante el proceso, antes de atravesar la malla.

[0032] De acuerdo con la presente invención, una mezcla de materiales que incluyan poliéster puede cargarse a un tanque de limpieza. En particular, la mezcla de materiales cargados al tanque de limpieza contendrá por lo menos algún poliéster usado, y la mezcla estará seca. Es decir, la mezcla no estará en una forma de pasta aguada ("*a slurry form*"). No obstante, la mezcla seca de materiales no necesita estar excesivamente seca. Por ejemplo, la mezcla no necesita tratarse previamente para eliminar toda la humedad de la mezcla, y la mezcla puede cargarse al tanque con un nivel atmosférico de humedad.

[0033] Figura 1 ilustra una incorporación de un tanque de limpieza 100, apto para el proceso de la presente invención. Una mezcla seca, que incluye materiales de poliéster y materiales contaminantes, puede cargarse al tanque 100 en la entrada 110. Por ejemplo, la mezcla de materiales puede cargarse al tanque 100 mediante alimentación por gravedad, un alimentador de tornillo, o cualquier otro método adecuado de alimentación. La mezcla de materiales puede incluir contaminantes que estén físicamente pegados a los materiales de poliéster, así como contaminantes que simplemente estén mezclados con el poliéster, y no necesariamente adheridos físicamente al poliéster. Por ejemplo, la mezcla cargada al tanque 100 puede incluir alguna combinación de materiales de poliéster pegados a diferentes recubrimientos, tales como papel u otras etiquetas; materiales de poliéster incrustados con contaminantes, tales como basura y vidrio; materiales de poliéster que no tengan contaminantes físicamente pegados; al igual que contaminantes sueltos, tales como basura, metales y papel suelto, los cuales están simplemente mezclados con los materiales de poliéster.



[0034] Con referencia a Figura 1, la mezcla de materiales puede cargarse en un extremo de la cámara 102 en el tanque 100 por la entrada 110. En esta incorporación particular, la cámara 102 puede tener una sección transversal circular, tal como puede observarse más claramente en Figura 2. Además, la cámara 102 puede tener generalmente una relación de longitud a diámetro L/D de por lo menos alrededor de 2, aunque éste no es un requerimiento de la invención. Por ejemplo, el diámetro de la cámara 102 puede estar por lo general entre alrededor de 0.5 y alrededor de 3 metros.

[0035] La cámara 102 puede incluir una serie de cuchillas 104 que se proyectan radialmente de un árbol 116, el cual corre en la dirección del eje de la cámara 102. En una incorporación, cuchillas individuales 104 pueden estar orientadas y/o configuradas de tal manera que controlen el flujo de aire sobre las cuchillas. Por ejemplo, cada cuchilla individual 104 puede fijarse en un ligero ángulo con respecto al árbol 116 y/o tener una forma de sección transversal específicamente diseñada para facilitar el flujo de aire a través de la cámara, como se indica por las flechas direccionales en 110 y 112 cuando el árbol está girando.

[0036] De acuerdo con esta incorporación, y como puede observarse en Figuras 1 y 2, es posible alinear múltiples cuchillas 104 a lo largo del árbol 116 para formar una o más filas de cuchillas que se proyecten en la dirección de la longitud axial de la cámara 102. Cuchillas individuales adyacentes 104 en una hilera pueden separarse una de otra en una distancia A. En esta incorporación, la distancia A puede ser aproximadamente equivalente al ancho de una cuchilla sobre el árbol. En otra incorporación, las cuchillas no necesitan alinearse axialmente una con otra para formar hileras, y pueden localizarse de manera más aleatoria alrededor del árbol 116 que como se ilustra en las Figuras.

[0037] Las cuchillas 104 pueden proyectarse también del árbol 116 de modo que estén corridas ("*so as to be offset*") una de otra alrededor de la circunferencia del árbol 116. Por ejemplo, y como se muestra en Figura 2, hileras de cuchillas 104 pueden proyectarse del árbol 116 con un ángulo de 90° entre hileras adyacentes. No obstante, este arreglo particular de las hileras

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de cuchillas 104 no es un requerimiento de la presente invención. Por ejemplo, en otra incorporación, hileras de cuchillas 104 pueden proyectarse del árbol 116 con un ángulo entre hileras mayor o menor que el mostrado en Figura 2. Por ejemplo, en una incorporación, dos o tres hileras de cuchillas podrían hallarse espaciadas equidistantemente alrededor del árbol 116. En otra incorporación, más de cuatro hileras de cuchillas podrían estar espaciadas alrededor del árbol 116, por ejemplo, cinco, seis, o incluso más hileras podrían encontrarse espaciadas alrededor del eje central 116.

[0038] En una incorporación, las cuchillas individuales 104 pueden formarse de un material relativamente duro con el fin de prevenir la degradación antieconómicamente rápida de las cuchillas 104 durante el proceso. Por ejemplo, en una incorporación, las cuchillas individuales pueden formarse de un acero endurecido, tal como acero inoxidable endurecido o acero al carbono. Por ejemplo, las cuchillas pueden formarse de un acero inoxidable grado 400 ó mayor. En forma opcional, las cuchillas pueden formarse también de otros materiales duros, que tengan una dureza aproximadamente equivalente o mayor. Por ejemplo, en otras incorporaciones, las cuchillas pueden formarse de acero resistente a la abrasión, o similar.

[0039] Luego de cargarse al tanque 100, los materiales pueden hacerse rotar o girar alrededor del árbol 116, por ejemplo mediante la rotación de las cuchillas 104. Como se mencionó previamente, en una incorporación, la rotación de cuchillas 104 puede facilitar además el flujo de aire a través de la cámara y el movimiento de los materiales de un extremo de la cámara 102 al otro.

[0040] Las cuchillas 104 pueden rotar a un régimen elevado de velocidad y favorecer la fluidización de la mezcla, es decir, la suspensión así como la rotación de los materiales dentro de la cámara 102. Por ejemplo, las cuchillas 104 pueden rotar a una velocidad mayor que alrededor de 20 m/s. En una incorporación, las cuchillas a una velocidad mayor que alrededor de 2.000 rpm. En una incorporación, la velocidad de tope de las cuchillas 104 puede estar entre alrededor de 40 m/s y alrededor de 100 m/s, tal como alrededor de

50 m/s. En otra incorporación, la velocidad de tope de las cuchillas 104 puede estar entre alrededor de 60 m/s y alrededor de 80 m/s.

[0041] En una incorporación, el árbol 116 puede estar en rotación a medida que los materiales se alimentan a la cámara 102. De acuerdo con esta incorporación, el movimiento inicial de los materiales a la entrada a la cámara 102 puede ser radial, en lugar de rotacional. Como tal, puede preferirse en algunas incorporaciones de la invención que la pared 20, que rodea la cámara 102 cerca de la entrada 110 de la cámara 102 sea un material sólido, con el fin de evitar la degradación de la pared de la cámara 102 por el movimiento radial inicial de los materiales. Por ejemplo, en una incorporación, entre alrededor de 5% y alrededor de 20% de la longitud inicial de la cámara 102 puede estar rodeado por una pared sólida 20, como se muestra en Figura 1. Adicionalmente, en una incorporación de la invención, la pared sólida 20 de la cámara 102 puede formarse de un material relativamente duro, con el fin de evitar aún más la degradación de la pared por el movimiento radial inicial de los materiales.

[0042] Luego de cargarse a la cámara 102 y todavía bajo la influencia de las cuchillas en rotación 104, la mezcla seca que contiene poliéster y contaminantes puede empezar a rotar alrededor del árbol 116. Más aún, debido a la alta velocidad rotacional de las cuchillas, los materiales pueden llegar a suspenderse en la cámara a medida que rotan alrededor del árbol 116. Adicionalmente, los materiales pueden ser continuamente erosionados por las cuchillas en rotación, así como por la colisión entre ellos y la pared 20, 106 de la cámara 102 a medida que rotan alrededor del árbol 116.

[0043] A medida que los materiales se erosionan dentro de la cámara 102, los contaminantes que están adheridos al sustrato de poliéster pueden separarse del sustrato. Adicionalmente, los materiales que están incrustados en el sustrato de poliéster pueden ser arrancados de los materiales. Sorprendentemente, aunque el presente proceso puede promover la separación de contaminantes del poliéster, incluidos los materiales incrustados, así como una degradación de muchos contaminantes, el poliéster en sí no se degrada sustancialmente por el proceso. Por ejemplo, aunque los materiales de

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recubrimiento, tales como materiales de etiquetas de papel o recubrimientos de barrera de vapor y los materiales incrustados, tales como basura y vidrio incrustado, pueden desprenderse del sustrato de poliéster mediante el proceso divulgado, las hojuelas mismas de poliéster permanecerán esencialmente de la misma forma y tamaño en que se cargaron originalmente en el tanque 100.

[0044] La falta de degradación de las hojuelas de poliéster durante el proceso de limpieza parece ser independiente de la velocidad de las cuchillas, así como independiente del tamaño de la malla de la pared 106, que rodea por lo menos parcialmente la cámara 102. Por ejemplo, parece haber poca o ninguna degradación del poliéster en el proceso, sin importar si la velocidad de las cuchillas es relativamente lenta, o algo más elevada.

[0045] En contraste con los materiales de poliéster, los materiales contaminantes quebradizos y fibrosos incorporados en la mezcla, ya separados físicamente del poliéster o separados físicamente del poliéster dentro de la cámara 102 al cargarlos al tanque 100, pueden degradarse por el proceso. Por ejemplo, vidrio, basura, concreto, materiales poliméricos o metálicos quebradizos y similares pueden degradarse por el proceso. Adicionalmente, pueden degradarse también por el proceso materiales fibrosos, tales como papel.

[0046] Por lo menos una porción de la pared 106 de la cámara 102 puede ser un material de malla. Para efectos de esta divulgación, una malla se define aquí como un material que presenta múltiples espacios abiertos en una red. Por ejemplo, una malla puede incluir cualquier tela de tejido abierto o estructura de red y puede incluir una red, un tamiz, un cedazo y similares.

[0047] Por ejemplo, en la incorporación ilustrada en Figura 1, toda la cámara 102, más allá de la sección inicial rodeada por la pared 20, puede estar circundada por la pared 106 que está formada de un material de malla. Con el fin de promover la degradación de los contaminantes contenidos en la mezcla, así como para evitar el deterioro excesivamente rápido de la pared 106, la pared 106 puede formarse de un material endurecido. Por ejemplo, la pared 106 puede formarse de un tamiz de acero inoxidable endurecido o acero al carbono. En una incorporación, la pared 106 puede formarse de un tamiz de

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acero inoxidable grado 316 ó mayor, o un material de dureza similar o superior.

[0048] La pared 106 puede tener generalmente un tamaño de malla predeterminado. En particular, el tamaño de malla de la pared 106 puede ser de un tamaño tal que la mayoría de los pedazos del sustrato de poliéster en la mezcla sean más grandes que las aberturas en la pared de la malla 106. Por ejemplo, en una incorporación, la pared 106 puede ser un tamiz de metal y puede tener un tamaño de malla de grado corriente en el mercado ("*a market grade mesh size*") de entre alrededor de 8 y alrededor de 12.

[0049] A medida que los contaminantes se degradan en la cámara 102, pueden volverse más pequeños que las aberturas en la pared 106 y pueden salir de la cámara 102, como se representa por las flechas 108 en Figura 1, dejando el sustrato de poliéster más limpio en la cámara 102.

[0050] El proceso divulgado actualmente puede ser particularmente efectivo en la eliminación de vidrio de una mezcla, que incluya vidrio y poliéster. Durante un proceso de reciclaje de poliéster el vidrio puede ser uno de los materiales más difíciles de separar del poliéster usado y puede ser perjudicial al proceso, si no se elimina completamente. El vidrio que no se retira durante el proceso de reciclaje no sólo puede causar un daño serio al equipo de procesamiento durante el proceso de reciclaje, sino que puede destruir asimismo los materiales que se vayan a moldear a partir del poliéster reciclado. Por ejemplo, el vidrio que no se retira durante el proceso de reciclaje puede incorporarse con el poliéster durante un proceso subsiguiente de moldeo del material (por ejemplo, un proceso de moldeo de envases para bebidas) y puede destruir los materiales a moldearse a partir del poliéster mediante, por ejemplo, la formación de huecos en los productos de poliéster.

[0051] De acuerdo con una incorporación del presente proceso, más de alrededor del 97% de los vidrios en una mezcla, que contiene vidrio y poliéster, puede retirarse de la mezcla. En una incorporación, puede eliminarse más de alrededor del 98% del vidrio en una mezcla. En otra incorporación, puede retirarse más de alrededor del 99% del vidrio.

[0052] Sorprendentemente, aunque los materiales contaminantes

quebradizos tales como vidrio pueden degradarse y atravesar la malla de la pared 106, los materiales mismos de poliéster pueden permanecer en la cámara 102. Esto se debe parcialmente al hecho de que el poliéster no se degrada en la cámara 102 durante el proceso, como se discute anteriormente. No obstante, se ha descubierto que incluso hojuelas de poliéster de un tamaño menor que las aberturas de la malla pueden permanecer en la cámara 102 durante el proceso de limpieza de la presente invención. En particular, se ha descubierto que los finos de poliéster pueden permanecer en la cámara durante el proceso. Sin querer entrar en limitaciones teóricas particulares, se cree que debido a la elevada velocidad rotacional de la mezcla en la cámara 102, los materiales en el interior de la cámara pueden fluidizarse y suspenderse a medida que rotan alrededor del árbol 116. Más aún, se cree que las fuerzas centrífugas que actúan sobre la suspensión puede hacer que los materiales dentro de la mezcla se separen, desplazándose los materiales más densos y, en particular, los contaminantes tales como vidrio, metal, papel y similares, al exterior de la masa y atravesando la pared 106 (luego de cualquier degradación debida a la abrasión), mientras que los materiales de poliéster más livianos y, particularmente, los finos de poliéster pequeños pueden permanecer suspendidos más cerca del centro de la cámara. En particular, materiales similares al vidrio y materiales fibrosos pueden atravesar el tamiz, mientras que los materiales elastoméricos, tales como PET permanecerán detrás. Incluso partículas de PET, más pequeñas que el orificio del tamiz quedarán con el grueso principal ("*the main body*") del PET. Como los finos de poliéster permanecen en el centro de la masa en rotación, suspendida, de material, muy pocos finos de poliéster atravesarán el tamiz en el proceso, y puede obtenerse un alto rendimiento de poliéster en el proceso de limpieza de la presente invención.

[0053] Luego del proceso de separación, los materiales de poliéster limpios pueden retirarse de la cámara 102. Por ejemplo, en una incorporación, el tiempo de residencia de los materiales en la cámara puede estar entre alrededor de 0.5 y alrededor de 3 segundos. Por ejemplo, Figura 1 ilustra un proceso continuo en el cual los materiales de poliéster pueden retirarse de la

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cámara 102 en el acceso 112, mientras que los contaminantes separados pueden eliminarse del tanque 100 en un acceso separado, tal como en 114, siguiendo el proceso de separación divulgado.

[0054] En una incorporación alternativa, por ejemplo en un proceso por lotes, la cámara puede incluir únicamente un solo acceso para introducir y retirar los materiales de poliéster. Adicionalmente, cuando se considera un proceso por lotes, puede ser preferible hacer que la base de la cámara incluya una pared sólida en toda la longitud de la cámara. Por ejemplo, en una incorporación ilustrada en Figura 3, la cámara 102 puede incluir una pared sólida 20 a lo largo de la base de toda la longitud de la cámara 102 y una pared de malla 106 encima de la pared sólida 20 en la dirección de toda la longitud de la cámara. Tal incorporación puede preferirse, por ejemplo, en un proceso por lotes que incluye cargar la mezcla seca de materiales a la cámara antes de la iniciación de la rotación de la mezcla, con el fin de evitar que el sustrato de poliéster caiga a través del tamiz cuando la mezcla no está girando.

[0055] Ventajosamente, el proceso de limpieza divulgado en la actualidad es un proceso en seco. Como tal, los contaminantes pueden separarse del poliéster durante el proceso sin la utilización de agua de lavado, lo cual puede reducir los costos totales del proceso de limpieza.

[0056] Más aún, incluso si ocurre un procesamiento acuoso del poliéster luego del proceso divulgado de limpieza en seco, puede haber niveles de contaminación mucho más bajos y, por consiguiente, el proceso requerirá menos tratamiento de las aguas residuales. Por ejemplo, si se desea, luego del proceso de limpieza en seco descrito más arriba, el sustrato de poliéster puede someterse a un enjuague acuoso para retirar cualquier tipo de impurezas restantes. Por ejemplo, las hojuelas de poliéster pueden someterse a un enjuague subsiguiente con agua bajo agitación. Como muchos materiales contaminantes e impurezas pueden eliminarse por el proceso de limpieza en seco ya descrito, los problemas afrontados en el pasado con técnicas de separación acuosa, tales como la coagulación de materiales de recubrimiento separados, o costosos requerimientos de tratamiento de agua, por ejemplo, pueden ser menos en el proceso de recuperación de poliéster de la presente

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invención. Por ejemplo, luego del proceso de limpieza en seco de la presente invención, el agua de lavado puede mostrar generalmente una disminución en la demanda química de oxígeno de por lo menos alrededor de 15%, la cual puede variar (dependiendo de la velocidad de tope de las cuchillas usadas), comparada con el agua de lavado utilizada directamente en los materiales de poliéster contaminados. Análogamente, gracias al uso del proceso de la presente invención antes de un lavado acuoso, el nivel de sólidos disueltos totales del agua de lavado puede disminuir en alrededor del 30%, los sólidos suspendidos totales pueden disminuir en por lo menos alrededor del 50%, y el aceite y la grasa pueden disminuir en alrededor del 15%, en diferentes incorporaciones.

[0057] De manera opcional, el proceso divulgado puede utilizarse en conjunción con otros procesos de tratamiento para el reciclaje de poliéster, como se conocen generalmente en el arte. Por ejemplo, el proceso de limpieza en seco divulgado puede utilizarse en conjunción con procesos de tratamiento de poliéster, tales como los divulgados en la Patente de los Estados Unidos No. 5,958,987 a Schwartz, Jr., y colaboradores, la Patente de los Estados Unidos No. 6,197,838 a Schwartz, Jr., y colaboradores, la Patente de los Estados Unidos No. 6,147,129, a Schwartz, Jr., o la Publicación de la Solicitud de Patente de los Estados Unidos No. 2003/0010680 a Holmes, y colaboradores, todas las cuales se incorporan aquí por referencia.

[0058] La presente invención puede entenderse mejor con referencia a los siguientes ejemplos.

Ejemplo 1

[0059] Hojuelas de poliéster de Estados Unidos se limpiaron en un tanque de limpieza en seco de acuerdo con la presente invención. Como control, se limpiaron 620.5 g del poliéster en hojuelas de Estados Unidos de acuerdo con un proceso de lavado acuoso estándar, sin someterse al proceso de limpieza en seco de la presente invención. Cantidades aproximadamente equivalentes de las hojuelas de los Estados Unidos se limpiaron de acuerdo con la presente invención y luego se lavaron en una manera similar al control,

luego del proceso de limpieza en seco. Dos muestras de las hojuelas de Estados Unidos se limpiaron en seco de acuerdo con la presente invención, con la velocidad del tope de las cuchillas del tanque de limpieza en 40 m/s (muestra de 620.2 g) ó 60 m/s (muestra de 620.7 g). Los resultados de la comparación para el agua de lavado fueron los siguientes:

Demanda Química de Oxígeno (COD):

	COD (ppm)	COD/g hojuelas	% reducción
CONTROL	634	1.02	
40 M/S	520	0.84	17.9
60 M/S	422	0.68	33.5

Sólidos Disueltos Totales (TDS):

	TDS (ppm)	TDS/g hojuelas	% reducción
CONTROL	312	0.50	
40 M/S	197	0.32	36.8
60 M/S	151	0.24	51.6

Sólidos Suspendidos Totales (TSS):

	TSS ppm	TSS/g hojuelas	% reducción
CONTROL	756	1.22	
40M/S	343	0.55	54.6
60M/S	140	0.23	81.5

Aceite y Grasa (O&G):

	O&G ppm	O&G/g hojuelas	% reducción
CONTROL	53	0.09	
40M/S	32	0.05	39.6
60 M/S	19	0.03	64.2

Nitratos:

	TOTAL ppm
CONTROL	2
40 M/S	2
60 M/S	2

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Nitrógeno:

	TOTAL ppm
CONTROL	9.2
40 M/S	8.3
60 M/S	7

Fósforo:

	TOTAL ppm
CONTROL	7.1
40 M/S	5.8
60 M/S	4.3

[0060] Figura 4 muestra la distribución de tamaño de partícula de los materiales limpiados según se describió ya. Como puede observarse, la distribución de tamaño de partícula de los materiales limpiados de acuerdo con la presente invención no cambió apreciablemente de los limpiados únicamente de acuerdo con el proceso de lavado. Es decir, la distribución de tamaño de partícula de la totalidad de los materiales limpiados permaneció casi la misma, independientemente de los diferentes procesos de limpieza, indicando que las hojuelas de poliéster no se degradan apreciablemente en el proceso divulgado.

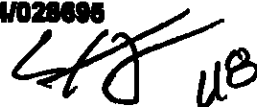
[0061] Los resultados tabulados, que muestran el porcentaje de los materiales de poliéster limpios de un tamaño superior al tamaño de malla dado para el control y las muestras limpiadas de acuerdo con el proceso divulgado, se indican en la siguiente Tabla 2:

Tabla 2

Tamaño de Malla	12	16
Control	4.93%	2.98%
40 M/S	5.20%	2.82%
80M/S	10.75%	6.64%

[0062] Como puede observarse, los finos de poliéster no se perdieron con el retiro de los contaminantes durante el proceso divulgado.

[0063] Adicionalmente, se determinó que aproximadamente 4.66% en peso del material total cargado al aparato de limpieza en seco se eliminó como



contaminantes durante el proceso, cuando el proceso se operó a una velocidad de la cuchilla de 80 m/s, y aproximadamente 2.65% en peso del material total cargado al aparato de limpieza en seco se eliminó como contaminantes por el proceso de limpieza, cuando el proceso se operó a una velocidad de la cuchilla de 40 m/s.

Ejemplo 2

[0064] Hojuelas de poliéster de Méjico se limpiaron en un tanque de limpieza en seco de acuerdo con la presente invención. Como control, se limpiaron 621.2 g del poliéster en hojuelas de Méjico de acuerdo con un proceso de lavado acuoso estándar, sin someterlas al proceso de limpieza en seco de la presente invención. Muestras de cantidades aproximadamente equivalentes de las hojuelas de Méjico se limpiaron de acuerdo con la presente invención y luego se lavaron en una manera similar al control luego del proceso de limpieza en seco. Dos muestras de las hojuelas de Méjico se limpiaron en seco de acuerdo con la presente invención con la velocidad de tope de las cuchillas del tanque de limpieza a 40 m/s (muestra de 620.4 g) ó 60 m/s (muestra de 620.4 g). Los resultados de la comparación para el agua de lavado fueron los siguientes:

Demanda Química de Oxígeno (COD):

	COD ppm	COD/g hojuelas	% reducción
CONTROL	663	1.07	
40 M/S	238	0.38	64.1
60 M/S	159	0.26	76.0

Sólidos Disueltos Totales (TDS):

	TDS ppm	TDS/g hojuelas	% reducción
CONTROL	354	0.57	
40 M/S	169	0.27	52.2
60 M/S	481	0.78	-36.1

a. Nota: Se cree que la muestra utilizada para obtener las cifras de

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TDS para la muestra 60 m/s había estado contaminada, puesto que los resultados son absurdos.

Sólidos Suspendidos Totales (TSS):

	TSS ppm	TSS/g hojuelas	% reducción
CONTROL	829	1.33	
40 M/S	269	0.43	67.5
60 M/S	93	0.15	88.8

Aceite y Grasa (O&G):

	O&G ppm	O&G/g hojuelas	% reducción
CONTROL	22	0.04	
40 M/S	18	0.03	18.1
60 M/S	6	0.01	72.7

Nitratos:

	TOTAL ppm
CONTROL	2
40 M/S	2
60 M/S	2

Nitrógeno:

	TOTAL ppm
CONTROL	22.5
40M/S	13.8
60M/S	9

Fósforo:

	TOTAL ppm
CONTROL	3.8
40M/S	3.7
60M/S	1.9

[0065] Figura 5 muestra la distribución de tamaño de partícula de los

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materiales limpiados, como se describe anteriormente. Como puede observarse, la distribución de tamaño de partícula de los materiales limpiados de acuerdo con la presente invención no cambió apreciablemente de los limpiados sólo de acuerdo con el proceso de lavado. Es decir, la distribución de tamaño de partícula de todos los materiales limpiados permaneció casi la misma, independientemente de los diferentes procesos de limpieza, indicando que las hojuelas de poliéster no se degradan apreciablemente en el proceso divulgado.

[0066] Los resultados tabulados, que muestran el porcentaje de los materiales de poliéster limpios de un tamaño superior al tamaño de malla dado para el control y las muestras limpiadas de acuerdo con el proceso divulgado, se indican en la siguiente Tabla 3:

Tabla 3

Tamaño de Malla	12	16
Control	5.74%	3.44%
40 M/S	3.54%	1.71%
60 M/S	3.54%	1.65%

[0067] Adicionalmente, se calculó que aproximadamente 7.8% en peso del material total cargado al aparato de limpieza en seco se retiró como contaminantes por el proceso de limpieza, cuando el proceso se operó a una velocidad de la cuchillas de 60 m/s, y aproximadamente 5.12% en peso del material total cargado al aparato de limpieza en seco se eliminó como contaminantes por el proceso de limpieza cuando el proceso se operó a una velocidad de las cuchillas de 40 m/s.

Ejemplo 3

[0068] Mezclas de vidrio y poliéster se trataron de acuerdo con la presente invención. Tres mezclas se limpiaron en seco como se describe anteriormente a diferentes velocidades de las cuchillas: 55 m/s, 61 m/s y 67 m/s. La composición de vidrio de la mezcla inicial y los resultados del proceso de separación se tabulan en la siguiente Tabla 4:

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Tabla 4

Velocidad de las Cuchillas	Cantidad (g) de Vidrio Inicial	Cantidad (g) de Vidrio Final	Eliminación %
55 m/s	897.10	19.366	97.8%
61 m/s	836.96	15.536	98.1%
67 m/s	895.88	9.128	99.0%

[0069] Estas y otras modificaciones y variaciones a la presente invención pueden ponerse en práctica por aquellas personas de habilidad ordinaria en el arte, sin desviarse del espíritu y el ámbito de la presente invención. Además, debe entenderse que aspectos de las diferentes incorporaciones pueden intercambiarse en todo o en parte. Más aún, aquellas personas de habilidad ordinaria en el arte observarán que la anterior descripción es sólo a manera de ejemplo, y no pretende limitar la invención.

Lo que se reivindica es:

1. Un proceso para separar poliéster de contaminantes, que comprende:

alimentar una mezcla seca, que comprende poliéster y materiales contaminantes, a una cámara de limpieza, cámara de limpieza que define un eje;

agitar la mezcla alrededor del eje de la cámara de limpieza;

contactar una pared de la cámara de limpieza con los contaminantes, a medida que la mezcla rota alrededor del eje de la cámara de limpieza, en donde por lo menos una porción de la pared comprende un material de malla; y

pasar por lo menos una porción de los contaminantes a través de las aberturas del material de malla.

2. El proceso de acuerdo con la reivindicación 1, en donde el material de malla es un tamiz metálico.

3. El proceso de acuerdo con la reivindicación 1, en donde la cámara de limpieza comprende un árbol a lo largo del eje que rota mientras la mezcla gira alrededor del eje, y el árbol rota a una velocidad de por lo menos alrededor de 2.000 rpm.

4. El proceso de acuerdo con la reivindicación 3, en donde la cámara de limpieza comprende además una pluralidad de cuchillas que se proyectan del árbol, en donde las cuchillas rotan con una velocidad de tope superior a alrededor de 20 metros por segundo mientras la mezcla gira.

5. El proceso de acuerdo con la reivindicación 4, en donde las cuchillas rotan con una velocidad de tope superior a alrededor de 40 metros por segundo.

6. El proceso de acuerdo con la reivindicación 4, en donde las

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\$B

cuchillas rotan con una velocidad de tope superior a alrededor de 60 metros por segundo.

7. El método de acuerdo con la reivindicación 1, en donde los contaminantes incluyen materiales físicamente adheridos al poliéster.

8. El método de acuerdo con la reivindicación 7, en donde los contaminantes incluyen materiales incrustados en el poliéster.

9. El método de acuerdo con la reivindicación 7, método que comprende además separar los materiales físicamente adheridos del poliéster, al cual se pegan.

10. El método de acuerdo con la reivindicación 1, en donde los contaminantes comprenden materiales quebradizos, método que comprende además degradar los contaminantes quebradizos en la cámara de limpieza.

11. El método de acuerdo con la reivindicación 1, en donde el método es un proceso continuo.

12. Un método de separar una mezcla que comprende:
alimentar una mezcla seca, que comprende poliéster y vidrio, a una cámara de limpieza, cámara de limpieza que define un eje;
agitar la mezcla alrededor del eje de la cámara de limpieza;
contactar una pared de la cámara de limpieza con el vidrio, a medida que la mezcla gira alrededor del eje de la cámara de limpieza, en donde por lo menos una porción de la pared comprende un tamiz; y
pasar por lo menos una porción del vidrio a través de las aberturas del tamiz.

13. El proceso de acuerdo con la reivindicación 12, en donde la cámara de limpieza comprende un árbol a lo largo del eje que rota mientras la mezcla

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X

gira alrededor del eje, y el árbol rota a una velocidad de por lo menos alrededor de 2.000 rpm.

14. El proceso de acuerdo con la reivindicación 13, en donde la cámara de limpieza comprende además múltiples cuchillas que se proyectan del árbol, en donde las cuchillas rotan con una velocidad de tope superior a alrededor de 20 metros por segundo, mientras la mezcla gira.

15. El método de acuerdo con la reivindicación 12, en donde una porción del vidrio en la mezcla está incrustada en el poliéster.

16. El método de acuerdo con la reivindicación 15, método que comprende además desprender el vidrio incrustado del poliéster.

17. El método de acuerdo con la reivindicación 12, método que comprende además degradar el vidrio en la cámara de limpieza.

18. El método de acuerdo con la reivindicación 12, en donde más de alrededor del 97% del vidrio en la mezcla atraviesa el tamiz metálico.

19. El método de acuerdo con la reivindicación 12, en donde más de alrededor del 98% del vidrio en la mezcla atraviesa el tamiz metálico.

20. Un tanque de limpieza que comprende:

una cámara de limpieza rodeada por una pared, en donde por lo menos una porción de la pared de la cámara de limpieza comprende un material de malla endurecido, material de malla que tiene una dureza aproximadamente equivalente a, o mayor que la dureza de acero inoxidable grado 316, cámara de limpieza que define un eje central;

un árbol a lo largo del eje central;

una pluralidad de cuchillas que se proyectan del árbol; y

una entrada para alimentar a la cámara de limpieza una mezcla



seca, que comprende materiales de poliéster y materiales contaminantes.

21. El tanque de limpieza de la reivindicación 20, en donde una porción de la pared comprende un material sólido.

22. El tanque de limpieza de la reivindicación 21, en donde el material de la pared sólida rodea la cámara de limpieza cerca de la entrada.

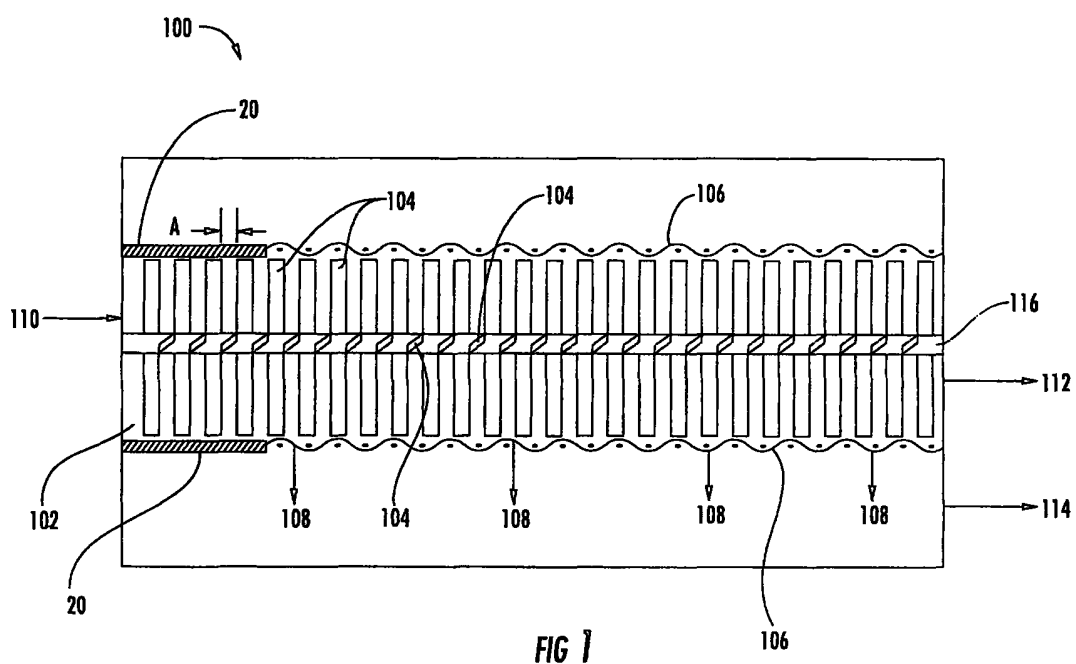
23. El tanque de limpieza de la reivindicación 21, en donde la porción de la pared sólida se forma de acero endurecido.

24. El tanque de limpieza de la reivindicación 20, en donde las cuchillas se forman de un material endurecido con una dureza aproximadamente equivalente a, o mayor que la dureza de acero inoxidable grado 400.

25. El tanque de limpieza de la reivindicación 20, en donde las cuchillas pueden rotar alrededor del eje central, cuchillas rotatorias que facilitan el flujo de aire a través de la cámara de limpieza.

26. El tanque de limpieza de la reivindicación 20, que comprende además una primera salida exterior a la cámara de limpieza para retirar los contaminantes secos del tanque de limpieza.

27. El tanque de limpieza de la reivindicación 20, que comprende además una segunda salida en la pared de la cámara de limpieza para retirar los materiales de poliéster limpios del tanque de limpieza.



ST

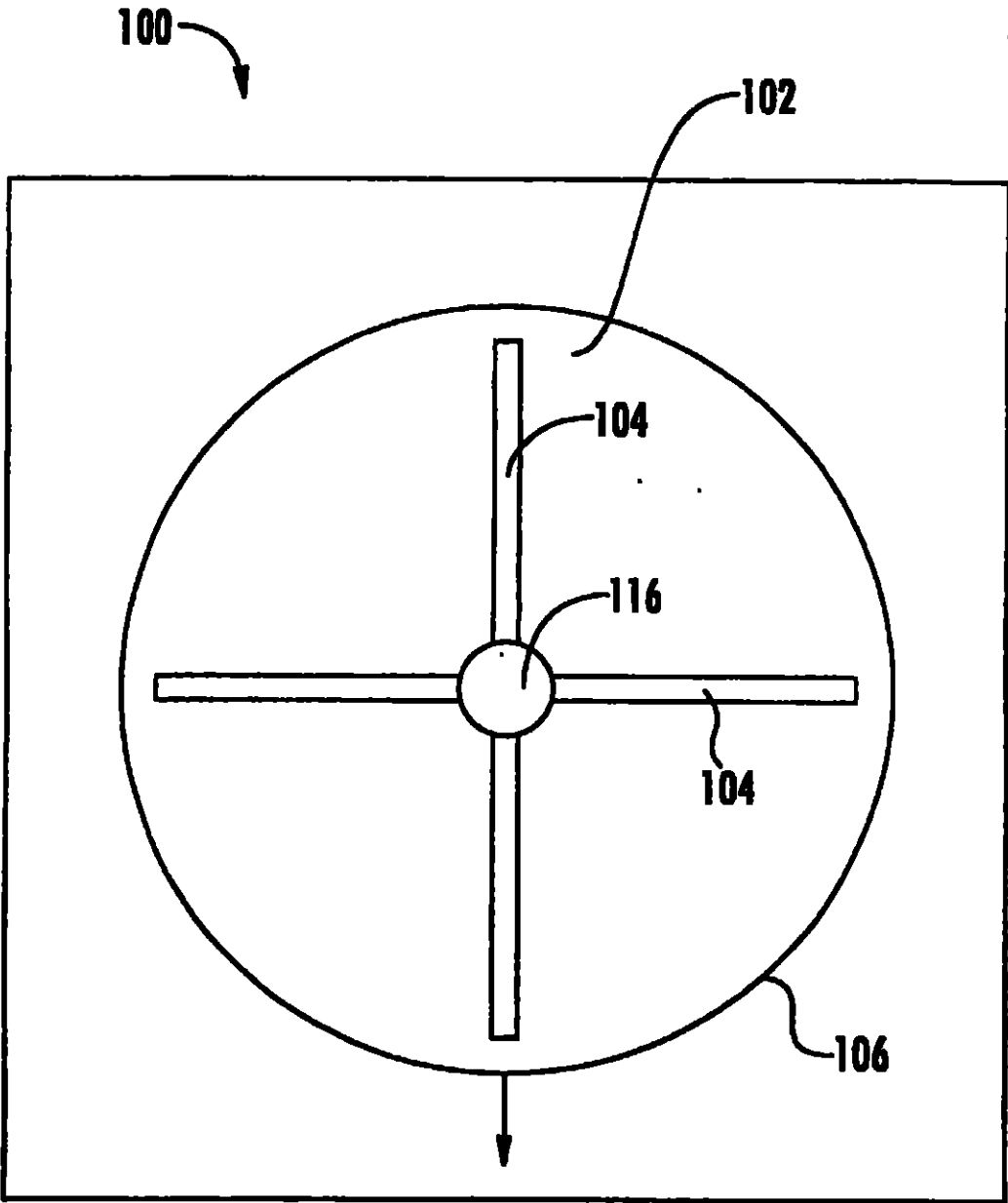


FIG. 2

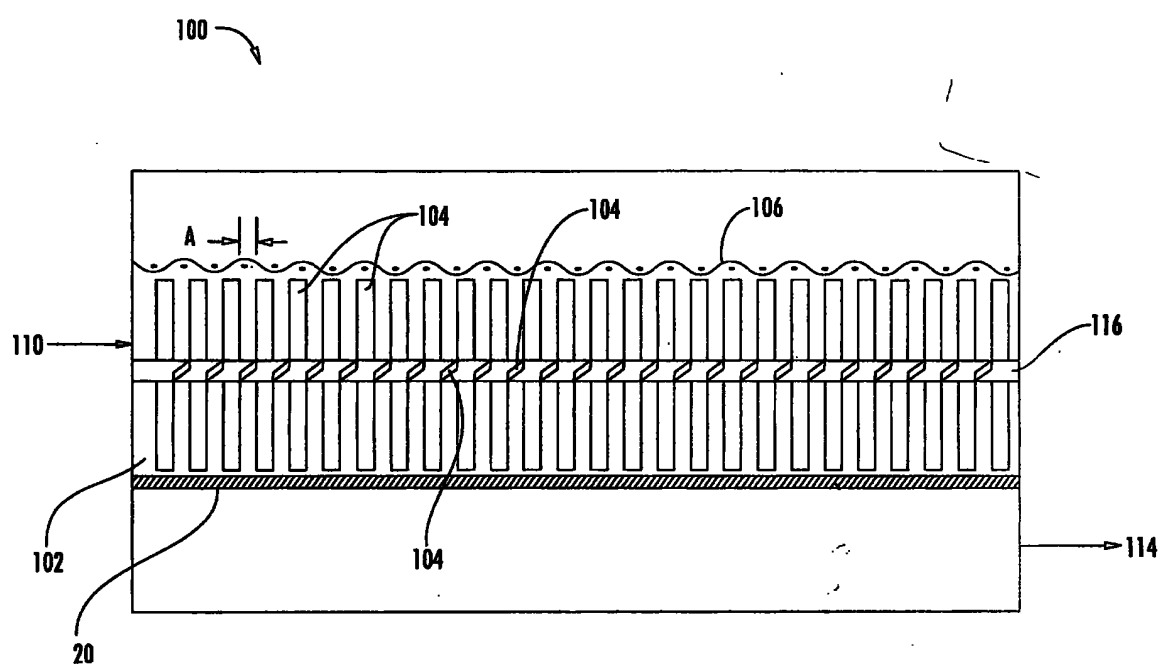


FIG. 3

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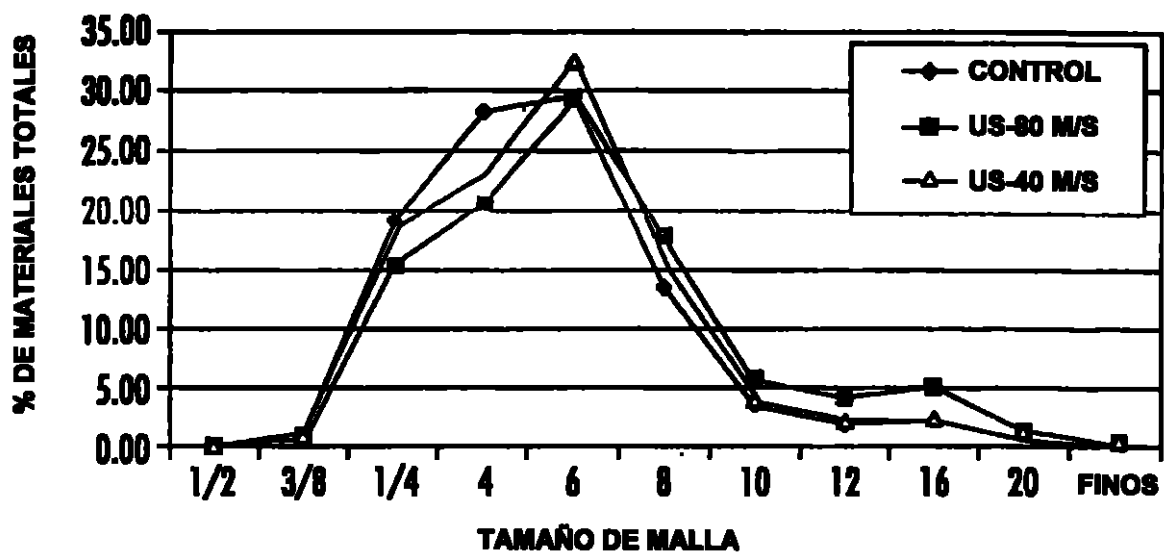


FIG. 4

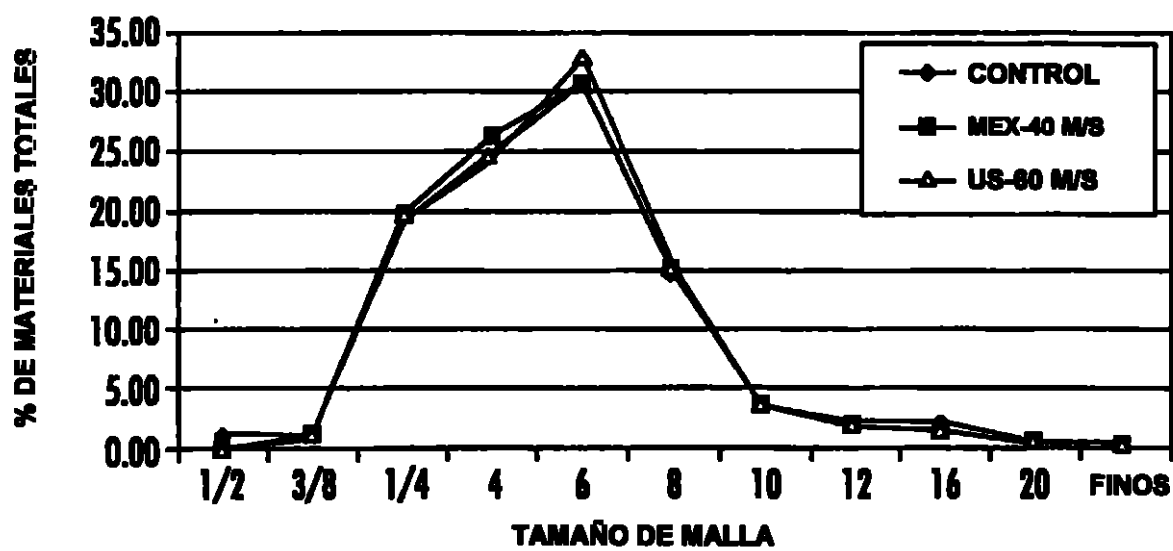


FIG. 5

PATENT COOPERATION TREATY

60
RECEIVED

From the INTERNATIONAL SEARCHING AUTHORITY

AUG 19 2005

To:
DORITY & MANNING
P.O. BOX 1449
GREENVILLE, SC 29602

PCT

DORITY AND MANNING
NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION *CLM*

(PCT Rule 44.1)

D & M DOCKETING

Applicant's or agent's file reference URC-20-PCT		Date of mailing (day/month/year) 17 AUG 2005
International application No. 10/17/05 PCT/US04/28695		FOR FURTHER ACTION See paragraphs 1 and 4 below
Applicant UNITED RESOURCE RECOVERY CORPORATION		International filing date (day/month/year) 03 September 2004 (03.09.2004)

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46).

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: +41 22 740 14 35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the decision under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

Shortly after the expiration of 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise, the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No. (703) 303-3230

Authorized officer

Donald Walsh
Donald Walsh

Telephone No. 571-272-6584

Form PCT/ISA/220 (January 2004)

(See notes on accompanying sheet)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference URC-20-PCT	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US04/28695	International filing date (day/month/year) 03 September 2004 (03.09.2004)	(Earliest) Priority Date (day/month/year) 03 September 2003 (03.09.2003)
Applicant UNITED RESOURCE RECOVERY CORPORATION		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).



With regard to any nucleotide and/or amino acid sequence disclosed in the international application, see Box No. I.

2. ☐ Certain claims were found unsearchable (See Box No. II)

3. ☒ Unity of invention is lacking (See Box No. III)

4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

- a. the figure of the drawings to be published with the abstract is Figure No. 1



as suggested by the applicant.



as selected by this Authority, because the applicant failed to suggest a figure.



as selected by this Authority, because this figure better characterizes the invention.



none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/28695

Box No. II Observations where certain claims were found unsearchable (Continuation of Item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of Item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-11

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/28695

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B07B 9/00; B02C 17/02

US CL : 209/305, 306; 241/24.28, 24.3

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 209/21-23, 44.3, 262, 305, 306, 714; 55/471, 473, 428; 241/24.1, 24.8, 24.18, 24.28, 24.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST (Search terms: drum polyester glass separate sort screen mesh rotate rotor)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,389,020 A (CLIN et al) 21 June 1983 (21.06.1983), Fig. 1-5; col. 1, 7-col. 4, ln. 39.	1, 2, 7-11
Y	US 2002/0079250 A1 (FAHRBACH et al) 27 June 2002 (27.06.2002), Fig. 1, 2, para. 3-19.	3-6
Y, P	US 6,629,653 B2 (FAHRBACH et al) 7 October 2003 (07.10.2003), Fig. 1, 2 and col. 2, ln. 15-col. 3, ln. 49.	
A, T	US 2003/0183705 A1 (CHRISTIANI et al) 02 October 2003 (10.02.2003).	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

22 July 2005 (22.07.2005)

Date of mailing of the international search report

17 AUG 2005

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US

Commissioner for Patents

P.O. Box 1450

Alexandria, Virginia 22313-1450

Facsimile No. (703) 305-3230

Authorized officer

Donald Walsh

Telephone No. 571-272-6584

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/28495

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-11

Group II, claims 12-19

Group III, claims 20-27

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features as the unifying feature comprises spinning a mixture in a cleaning chamber and contacting a mesh wall to separate contaminants. The prior art, however, teaches that this feature is well known and is not "special". Therefore, the claim groupings lack a special technical feature and thus lack unity of invention.

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
DORITY & MANNING
P.O. BOX 1449
GREENVILLE, SC 29602

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Applicant's or agent's file reference URC-20-PCT		Date of mailing (day/month/year) 17 AUG 2005 FOR FURTHER ACTION See paragraph 2 below
International application No. PCT/US04/28695	International filing date (day/month/year) 03 September 2004 (03.09.2004)	Priority date (day/month/year) 03 September 2003 (03.09.2003)
International Patent Classification (IPC) or both national classification and IPC IPC(7): B07B 9/00; B02C 17/02 and US Cl.: 209/305, 306; 241/24.28, 24.3		
Applicant UNITED RESOURCE RECOVERY CORPORATION		

1. This opinion contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|--|
| ☒ | Box No. I | Basis of the opinion |
| ☐ | Box No. II | Priority |
| ☐ | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| ☒ | Box No. IV | Lack of unity of invention |
| ☒ | Box No. V | Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| ☐ | Box No. VI | Certain documents cited |
| ☐ | Box No. VII | Certain defects in the international application |
| ☐ | Box No. VIII | Certain observations on the international application |

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Donald Walsh Telephone No. 571-272-6584
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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US04/28695

Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US04/28695

Box No. IV Lack of unity of invention

1. ☒ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has:
- ☐ paid additional fees
- ☐ paid additional fees under protest
- ☒ not paid additional fees
2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is
- ☐ complied with
- ☒ not complied with for the following reasons:
- See the lack of unity section of the International Search Report (Form PCT/ISA/210)

4. Consequently, this opinion has been established in respect of the following parts of the international application:

- ☐ all parts.
- ☒ the parts relating to claims Nos. 1-11

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/28695

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims <u>3-6</u>	YES
	Claims <u>1-2, 7-11</u>	NO
Inventive step (IS)	Claims <u>NONE</u>	YES
	Claims <u>1-11</u>	NO
Industrial applicability (IA)	Claims <u>1-11</u>	YES
	Claims <u>NONE</u>	NO

2. Citations and explanations:

Claims 1, 2 and 7-11 lack novelty under PCT Article 33(2) as being anticipated by Clin et al. ("Clin") (US 4,389,020). Clin (Fig. 1-5) teaches a process for separating polyester from contaminants comprising: providing a dry mixture comprising polyester and contaminant materials (col. 4, ln. 12-39; col. 1, ln. 60-col. 2, ln. 24 teaching a variety of material and contaminants and that the device crushes the material and contaminants *together* prior to liberating contaminants via friction) to a cleaning chamber, the cleaning chamber defining an axis (Fig. 1, from left to right); spinning the mixture about the axis of the cleaning chamber (Fig. 2-5), contacting a wall (3; col. 3, ln. 35 et seq. describing perforations) of the cleaning chamber with the contaminants as the mixture spins about the axis of the cleaning chamber, wherein at least a portion of the wall comprises a mesh material; and passing at least a portion of the contaminants through the mesh material openings (Fig. 1, near 12). Here, the screen is regarded as inherently metal as a first portion is taught as metal (col. 3, ln. 25) and the process can be regarded as continuous.

Claims 3-6 lack an inventive step under PCT Article 33(3) as being obvious over Clin in view of Fahrbach et al. ("Fahrbach") (2002/0079250 with citations to US 6,629,653).

Clin as set forth above teaches all that is claimed except for expressly teaching an axle along the axis that rotates while the mixture spins about the axis the axle rotating at a speed of at least about 2000 rpm, wherein blade tips emanating from the axle rotate at speed greater than 60 meters per second. Clin, however, already teaches that some form of impeller (i.e., axle and blade structure) is used, that this structure is well known, and that the speed of operation for the device can be varied based on the materials to be separated (col. 1, ln. 34-42; col. 3, ln. 20-col. 4, ln. 39). Further, Fahrbach teaches an impeller structure that is specifically designed to increase the mechanical stress within a drum screen during the dry separation of plastics (Fig. 1, 2; col. 2, ln. 14-36). Moreover, Fahrbach recommends that the blades travel at "about" 2000 rpm for optimum performance (col. 3, ln. 35-47). Thus, since Clin expressly teaches that the speed can be varied and Fahrbach teaches the range claimed by Applicant, it is implicit that the claimed tip speed is also taught. Therefore, the claimed invention lacks an inventive step as it would have been obvious to modify the invention of Clin as taught above to obtain optimum separation of the plastic material and contaminants via impact and friction forces.

Claims 1-11 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry (e.g., waste recycling).

CHAPTER I
PCT TELEPHONE MEMORANDUM
FOR
LACK OF UNITY OF INVENTION



PCT No.: PCT/US04/28695

Examiner: Joseph C. Rodriguez

Attorney spoken to: Christina Mangelson

Date of call: 18 July 2005

- ☐ Amount of payment approved:
- ☐ Deposit account number to be charged:
- ☐ Attorney elected to pay for ALL additional inventions
- ☐ Attorney elected to pay only for the additional inventions covered by
- ☐ Group(s):
- encompassing --
- ☐ Claim(s):
- ☒ Attorney elected NOT to pay for any additional inventions, therefore, only the first claimed invention (Group I) covered by Claim(s) 1-11 has been searched.
- ☐ Attorney was orally advised that there is no right to protest for any group not paid for.
- ☐ Attorney was orally advised that any protest must be filed no later than 15 days from the mailing of the Search Report (PCT/ISA/210).

Time Limit For Filing A Protest

Applicant is hereby given 15 days from the mailing date of this Search Report in which to file a protest of the holding of lack of unity of invention. In accordance with PCT Rule 40.2, applicant may protest the holding of lack of unity only with respect to the group(s) paid for.

Detailed Reasons For Holding Lack of Unity of Invention:
See Continuation Sheet in PCT-ISA-210

Note: A copy of this form must be attached to the Search Report.

USPTO/299 (August 1997) B

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NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under Article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)".

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments and any accompanying statement, under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the time of filing, the amendments (and any statement) with the International Bureau, also file with the International Preliminary Examining Authority a copy of such amendments (and of any statement) and, where required, a translation of such amendments for the procedure before that Authority (see Rules 55.3(a) and 62.2, first sentence). For further information, see the Notes to the demand form (PCT/IPEA/401).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see the *PCT Applicant's Guide*, Volume II.

PATENT COOPERATION TREATY

From the RECEIVING OFFICE

PCT

To:
DORITY & MANNING
P.O. BOX 1449
GREENVILLE, SOUTH CAROLINA 29602

NOTIFICATION OF THE INTERNATIONAL APPLICATION NUMBER AND OF THE INTERNATIONAL FILING DATE

(PCT Rule 20.5(c))

Date of mailing <i>(day month year)</i>		01 Oct 2004
Applicant's or agent's file reference URC-20-PCT		IMPORTANT NOTIFICATION
International application No. PCT/US2004/028695	International filing date <i>(day month year)</i> 03 Sep 2004	Priority date <i>(day month year)</i> 03 Sep 2003
Applicant UNITED RESOURCE RECOVERY CORPORATION		
Title of the invention DRY SEPARATION OF CONTAMINANTS FROM POLYESTER MATERIALS		

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application:

- ☒ was transmitted to the International Bureau on 01 Oct 2004
- ☐ has not yet been transmitted to the International Bureau for the reason indicated below and a copy of this notification has been sent to the International Bureau*:
- ☐ because the necessary national security clearance has not yet been obtained.
- ☐ because *(reason to be specified)*:

* The International Bureau monitors the transmittal of the record copy by the receiving Office and will notify the applicant (with Form PCT/IB 301) of its receipt. Should the record copy not have been received by the expiration of 14 months from the priority date, the International Bureau will notify the applicant (Rule 22.1(c)).

3. FOREIGN TRANSMITTAL LICENSE INFORMATION

Completed by: NT

- ☐ Additional license for foreign transmittal not required. This subject matter is covered by a license already granted or the equivalent U.S. national application. Refer to that license for information concerning its scope.
- ☐ License for foreign transmittal not required. 37 CFR 5.11(e)(1) or 37 CFR 5.11(e)(2). However, a license may be required for additional subject matter. See 37 CFR 5.15(h).
- ☒ Foreign transmittal license granted. 35 U.S.C. 184; 37 CFR 5.11 on 20 Sep 2004 ;
- ☐ 37 CFR 5.15(a) ☒ 37 CFR 5.15(b)

Name and mailing address of the receiving Office Mail Stop PCT, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 703-305-3230	Authorized officer Nhu Thuy Tran Telephone No. 703-605-1537
---	---

PCT REQUEST

Original (for SUBMISSION)

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form PCT/RO/101 PCT Request	
0-4-1	Prepared Using	PCT-SAFE [EASY mode] Version 3.50 (Build 0002.162)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	United States Patent and Trademark Office (USPTO) (RO/US)
0-7	Applicant's or agent's file reference	URC-20-PCT
I	Title of invention	DRY SEPARATION OF CONTAMINANTS FROM POLYESTER MATERIALS
II	Applicant	
II-1	This person is	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	UNITED RESOURCE RECOVERY CORPORATION
II-5	Address	5396 North Blackstock Road Spartanburg, South Carolina 29303 United States of America
II-6	State of nationality	US
II-7	State of residence	US
II-8	Telephone No.	864.574.0904
II-9	Facsimile No.	864.574.0710
III-1	Applicant and/or inventor	
III-1-1	This person is	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	GUTIERREZ, Carlos, D.
III-1-5	Address	170 Knighton Road Spartanburg, South Carolina 29302 United States of America
III-1-6	State of nationality	US
III-1-7	State of residence	US

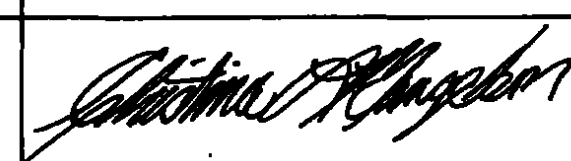
PCT REQUEST

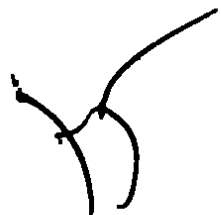
Original (for SUBMISSION)

III-2	Applicant and/or inventor	
III-2-1	This person is	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	FAIL, Alvis
III-2-5	Address	249 Cumberland Drive Moore, South Carolina 29369 United States of America
III-2-6	State of nationality	US
III-2-7	State of residence	US
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/ has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	DORITY & MANNING
IV-1-2	Address	P.O. Box 1449 Greenville, South Carolina 29602 United States of America
IV-1-3	Telephone No.	864.271.1592
IV-1-4	Facsimile No.	864.233.7342
V	DESIGNATIONS	
V-1	The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the International filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.	
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	03 September 2003 (03.09.2003)
VI-1-2	Number	60/499,862
VI-1-3	Country	US
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	International Searching Authority Chosen	United States Patent and Trademark Office (USPTO) (ISA/US)

PCT REQUEST

Original (for SUBMISSION)

VIII	Declarations	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	Check list	number of sheets	electronic file(s) attached
IX-1	Request (including declaration sheets)	4	✓
IX-2	Description	20	-
IX-3	Claims	3	-
IX-4	Abstract	1	✓
IX-5	Drawings	4	-
IX-7	TOTAL	32	
	Accompanying items	paper document(s) attached	electronic file(s) attached
IX-8	Fee calculation sheet	✓	-
IX-11	Copy of general power of attorney	reference no. URC-20-PCT	-
IX-17	PCT-SAFE physical media	-	✓
IX-18	other	PCT Transmittal	
IX-18	other	Return Receipt Postcard	
IX-18	other	Check	
IX-19	Figure of the drawings which should accompany the abstract	Figure 1	
IX-20	Language of filing of the international application	English	
X-1	Signature of applicant, agent or common representative		
X-1-1	Name	DORITY & MANNING	
X-1-2	Name of signatory	Christina L. Mangelsen	
X-1-3	Capacity	Agent	



FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/US
10-6	Transmittal of search copy delayed until search fee is paid	

FOR INTERNATIONAL BUREAU USE ONLY

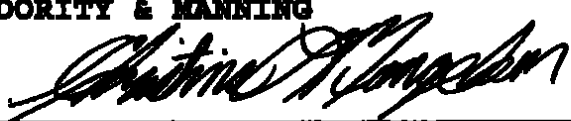
11-1	Date of receipt of the record copy by the International Bureau	
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PCT REQUEST (ANNEX - FEE CALCULATION SHEET)

Original (for SUBMISSION)

(This sheet is not part of and does not count as a sheet of the international application)

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0	For receiving Office use only	
0-1	International Application No.	
0-2	Date stamp of the receiving Office	
0-4	Form PCT/RO/101 (Annex) PCT Fee Calculation Sheet	
0-4-1	Prepared Using	PCT-SAFE [EASY mode] Version 3.50 (Build 0002.162)
0-8	Applicant's or agent's file reference	URC-20-PCT
2	Applicant	UNITED RESOURCE RECOVERY CORPORATION
12	Calculation of prescribed fees	fee amount/multiplier Total amounts (USD)
12-1	Transmittal fee T	⇒ 300
12-2-1	Search fee S	⇒ 1000
12-2-2	International search to be carried out by	US
12-3	International filing fee (first 30 sheets) I1	1134
12-4	Remaining sheets 2	
12-5	Additional amount 00	12
12-6	Total additional amount I2	24
12-7	I1 + I2 = I	1158
12-12	EASY Filing reduction R	- 81
12-13	Total international filing fee (I-R) I	⇒ 1077
12-14	Fee for priority document Number of priority documents requested 1	
12-15	Fee per document 00	20
12-16	Total priority document fee: P	⇒ 20
12-17	TOTAL FEES PAYABLE (T+S+I+P)	⇒ 2397
12-19	Mode of payment	cheque
12-20	Deposit account instructions The receiving Office	United States Patent and Trademark Office (USPTO) (RO/US)
12-20-2	Authorization to charge any deficiency or credit any overpayment in the total fees indicated above	✓
12-21	Deposit account No.	04-1403
12-22	Date	03 September 2004 (03.09.2004)
12-23	Name and signature	DORITY & MANNING 

A method for separating polyester materials from contaminants is disclosed. Suitable for, for example, a polyester recycling system. The method is a dry separation method and includes rapidly spinning a mixture of polyester and contaminants within a cleaning chamber. During the spinning of the mixture, the contaminants can be degraded and pass through a screen at the chamber wall while the polyester materials are not substantially degraded and can remain in the cleaning chamber. Polyester fines can also remain in the cleaning chamber. A cleaning device suitable for use in the process is also disclosed. The device can include a screen of a hardened material that can help degrade the contaminants and a plurality of rotating blades that can spin the mixture within the device and also help to degrade the contaminant materials.

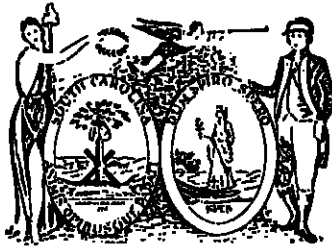
77

State of South Carolina
Office of the Secretary of State
The Honorable Mark Hammond

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1205 PENDLETON STREET, SUITE 506
COLUMBIA, SC 29201

Spencer Hewitt, Director
(803) 734-2119



P.O. BOX 11350
COLUMBIA, SC 29211

Patricia Hamby, Co-Director
(803) 734-2512
PatHamby@infoave.net

Apostille

(Convention de La Haye du 5 octobre 1961)

Country: United States of America

This public document has been signed by PATRICIA M. STROUD, NOTARY PUBLIC
FOR THE STATE OF SOUTH CAROLINA, bears the seal / stamp of PATRICIA M.
STROUD, NOTARY PUBLIC FOR THE STATE OF SOUTH CAROLINA

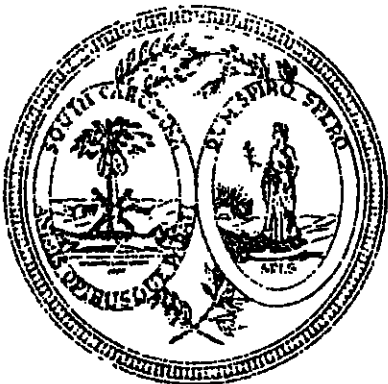
Certified

At Columbia, South Carolina

Wednesday, March 31, 2004

by the Secretary of the State of South Carolina

N ° 13847



Mark Hammond

www.scsos.com

Mark Hammond, Secretary of State

Brigard & Castro

BOGOTA - COLOMBIA

[Handwritten signature]

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PODER

POWER OF ATTORNEY

Yo (nosotros)

I (We) United Resource Recovery Corporation

domiciliado(s) en

domiciled in
5396 North Blackstock Road

Nombro(amos) a: **RAMIRO CASTRO DUQUE y/o HECTOR GOMEZ MEJIA**, de Bogotá, Colombia, apoderados verdaderos y legales con poder especial, amplio y suficiente, para recabar de las oficinas y autoridades colombianas administrativas, judiciales y de policía, en cualquier instancia o recurso, la obtención de patentes de invención, registros de marcas, diseños industriales, modelos de utilidad, depósitos de nombres comerciales y enseññas, registros de derechos de autor y contratos sobre los mismos, obtención de certificados de obtentor de variedades vegetales, así como sus prórrogas, renovaciones, anotaciones de traspaso, cambios de nombre y/o domicilio; elaborar, tramitar y registrar contratos de licencia y licencias de cualesquiera clases; intervenir como demandante o como demandado en cualquier instancia y recurso ante cualquier juez, corporación, funcionario público o autoridad en acciones judiciales, administrativas y de policía tales como: oposiciones al registro de marcas; acciones de caducidad, cancelación y nulidad; acciones reivindicatorias, acciones derivadas de la obtención o explotación de licencias; acciones de competencia desleal; demandas penales; acciones de indemnización de perjuicios, reclamos y observaciones a solicitudes de patentes, diseños industriales, modelos de utilidad, en el ejercicio de medidas cautelares y en otras acciones o medidas similares.

Spartanburg, SC 29303
Hereby appoint **RAMIRO CASTRO DUQUE and/or HECTOR GOMEZ MEJIA**, of Bogotá, Colombia, my (our) true and lawful attorneys with special, ample and sufficient power to obtain from the Colombian administrative, judicial and police offices and authorities, in any instance, privileges of patents of invention, registration of trademarks, industrial designs and utility models; registration of commercial names and emblems, registration of copyright and contracts related thereto, certificates of obtainers of vegetables varieties, as well as extensions, renewals and recordal of assignments and changes of name and domicile related to the above; to prepare, prosecute and register licenses of any kind; to act as plaintiff or defendant in any instance or recourse, and before any judge, corporation, public official or authority in judicial, administrative and police actions, such as: oppositions to the registration of trademarks; caducity, cancellation and nullity actions; claim actions derived from the obtaining or exploitation of licenses, action of unfair competition; penal demands, actions of indemnities for damages; claims or observations on patent applications, models, industrial designs and utility models; in the exercise of preventive measures; and in other actions or similar proceedings.

A este efecto, lo(s) faculto(amos) para elevar solicitudes, formular descripciones, enmiendas, protestas, declaraciones, oposiciones, cancelaciones, nulidades, apelaciones y reclamos; pagar impuestos, cuotas y gravámenes prescritos por la ley; renunciar o desistir a derechos concedidos o en curso de concesión; recibir toda clase de documentos y valores, dando el descargo respectivo, y, en general, para dar ante dichas autoridades todos los pasos necesarios al efecto indicado y tomar todas las medidas que creyeren conducentes al resguardo de mis (nuestros intereses), con todas las demás facultades legales necesarias.

To that effect they hereby empowered to file applications, formulate descriptions, amendments, protests, declarations, oppositions, cancellations, nullities, appeals and claims; to pay taxes, quotas and assessments prescribed by law, renounce or waive the rights granted or in the process of granting; to receive all kinds of documents and valuables, giving the respective release of receipt, and, in general, to take before said authorities the necessary steps to such effect, and any measures that they may deem pertinent to the safeguard of my (our) interest(s) with all the other necessary legal powers.

Este poder comprende la facultad de ratificar o confirmar en mi (nuestro) nombre lo actuado así como la facultad de desistir, transigir, comprometer, y a de sustituirlo en todo o en parte y revocar sustituciones. Asimismo nombro(amos) a: **RAMIRO CASTRO DUQUE y/o HECTOR GOMEZ MEJIA**, domiciliado(s) en la Carrera 7 No. 16-56 Piso 9, mis (nuestros) apoderados en Colombia, con facultades para recibir notificaciones y designar apoderados judiciales o extrajudiciales.

This power includes the faculty to ratify or confirm desist, settle and compromise on my (our) behalf, and to substitute this power in whole or in part and to revoke substitutions. At the same time I (We) hereby appoint **RAMIRO CASTRO DUQUE and/or HECTOR GOMEZ MEJIA**, domiciled in Carrera 7 No. 16-56, Piso 9, my (our) attorney(s) in fact, with powers to receive notifications and to designate judicial and extrajudicial attorneys.

Otorgado y firmado en

Granted and signed in

hoy de de 200_

this 25th day of March 2004

Firma *[Handwritten signature]*
Nombre
Cargo

Signature *[Handwritten signature]*
Name
Title President

NOTARIAL CERTIFICATE (CORPORATION)

CERTIFICADO NOTARIAL (SOCIEDAD)

On this 25th day of March 2004
of
personally appeared before me

Carlos Gutierrez
to me known, and known to me to be the
person who signed the foregoing instrument
who being by me duly sworn did depose and
say that he (she) is the
President

of

United Resource Recovery Corporation

Which is legally constituted for a term not yet
expired, that deponent is authorized by said
Company to confer this Assignment document:
that the seal affixed hereunto by the deponent
in the name and on behalf of said Corporation
is the corporate seal thereof; and that the
purpose for which this instrument is granted is
included within the corporate purpose of
company.

The undersigned Notary Public attests that he
has seen the documents that prove the
existence of the company.

State of South Carolina
under date of June 15, 1992

and that he (she) who grants the present
Assignment document is its Representative.

Notary Public (Seal)

NOTARIAL CERTIFICATE
NATURAL PERSON

On this 25th day of March 2004
of
personally appeared before me

Carlos Gutierrez

who is(are) known to me and who I attest
executed the foregoing document and he
(they) declared he (they) grant(s) the document
for the uses and purposes therein expressed.

Patricia M. Stroud
Notary Public (Seal)

LEGALIZATION BY APOSTILLE IS REQUIRED.

Hoy de de
personalmente compareció ante mí

a quien conozco, y de quien me consta que
firmó el anterior documento, debidamente
juramentado declaró y dijo que él es

de

Sociedad legalmente constituida para un
período de duración que aún no ha terminado;
que el declarante está autorizado por dicha
compañía para conferir este documento de
Cesión; que el sello estampado por él al pie de
tal cesión, en nombre y representación de la
expresada compañía, es el sello oficial de ella;
y que el objeto para el cual se confiere este
Instrumento está comprendido dentro del de la
sociedad.

El suscrito Notario hace constar que tuvo a la
vista las pruebas de la existencia de la
sociedad.

Estado de
con fecha

y que quien confiere el presente documento de
Cesión es su representante.

Notario Público (sello)

CERTIFICADO NOTARIAL
PERSONA NATURAL

Hoy de de
compareció(eron) ante mí

a quien (es) conozco y me consta que es(son)
la(s) persona(s) firmante(s) del documento que
precade y quien(es) declara(n) que otorgan el
mismo para los fines y propósitos que en él se
expresan.

Patricia M. Stroud
Notario Público (sello)

LEGALIZACION POR APOSTILLA ES REQUERIDA.



Industria y Comercio

SUPERINTENDENCIA

Delegatura de Propiedad Industrial División de Nuevas Creaciones

REQUISITOS NECESARIOS PARA PRESENTACIÓN Y AGILIZACIÓN DEL TRAMITE

PATENTE DE INVENCION ☒	MODELO DE UTILIDAD ☐	USUARIO ()	RADICADOR ()
-Indicación de que se solicita la concesión de una patente ☒		()	(X)
-Datos de identificación del solicitante o de la persona que se presenta la solicitud. ☒		()	(X)
-Descripción de la invención. ☒		()	(X)
-Dibujos de ser estos pertinentes ☒		()	(X)
-Comprobante de Pago de las tasas establecidas. ☒		()	(X)
COMPLETA ()	INCOMPLETA ()	()	()

DISEÑO INDUSTRIAL ☐			
-Indicación de que se solicita el registro de Diseño Industrial.	()	()	()
-Datos de identificación del solicitante o de la persona que se presenta la solicitud.	()	()	()
-Representación gráfica y fotográfica del Diseño Industrial o muestra del Material que incorpora el diseño.	()	()	()
-Comprobante de Pago de las tasas establecidas.	()	()	()
COMPLETA ()	INCOMPLETA ()	()	()

ESQUEMA DE TRAZADO ☐			
-Indicación de que se solicita el registro de Diseño Industrial.	()	()	()
-Datos de identificación del solicitante o de la persona que se presenta la solicitud.	()	()	()
-Representación gráfica del Esquema Trazado.	()	()	()
-Comprobante de Pago de las tasas establecidas.	()	()	()
COMPLETA ()	INCOMPLETA ()	()	()

Firma Responsable:

Fecha:

Febrero 20 de 2006.

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REPUBLICA DE COLOMBIA
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

Bogotá,
2020

Doctor(a)
GOMEZ MEJIA HECTOR
Apoderado(a) y/o Representante de
UNITED RESOURCE RECOVERY CORPORATION

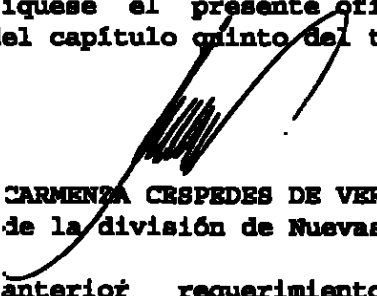
REFERENCIA	Radicación No.	6 17140
	Solicitud internacional	US2004/028695
	Fecha inicio fase nacional	03/04/2006
	Trámite	11
	Evento	378
	Actuación	430
	Oficio No.	4607

Como resultado del examen de forma, realizado con fundamento en el artículo 38 de la Decisión 486 de la Comisión de la Comunidad Andina, artículo 27 del Tratado de Cooperación en Materia de Patentes (PCT), regla 51 bis del Reglamento y Circular Única de la Superintendencia de Industria y Comercio, se le comunica que:

1. La solicitud no contiene la copia del documento en que consta la cesión del derecho a la patente del inventor al solicitante o a su causante. (Art. 26-k) Decisión 486.

En cumplimiento de lo dispuesto por el artículo 39 de la Decisión 486, se le requiere para que dentro del término de dos meses siguientes a la fecha de notificación del presente oficio, complete los requisitos anteriormente enunciados. En caso de no dar cumplimiento al presente requerimiento, la solicitud se considerará abandonada y perderá su prelación.

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 No.10 de 2001.


ALIX CARMONA CRESPEDES DE VERGEL
Jefe de la división de Nuevas Creaciones

El anterior requerimiento fue notificado por fijación en lista de
fecha 28 ABR 2008
adpall