(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 843 757 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
20.10.1999 Bulletin 1999/42

(21) Application number: **96927319.2**

(22) Date of filing: **06.08.1996**

(51) Int Cl.6: **D21C 9/153**, D21C 11/06

(86) International application number:
PCT/US96/12776

(87) International publication number:
WO 97/06305 (20.02.1997 Gazette 1997/09)

(54) METHOD FOR REPROCESSING AN OZONE-CONTAINING GAS PRESENT IN A PULP BLEACHING PLANT

VERFAHREN ZUM WIEDERAUFBEREITEN VON EINEM OZONENTHALTENDEN GAS IN EINER ANLAGE ZUM ZELLSTOFFBLEICHEN

PROCEDE DE RETRAITEMENT D'UN GAZ CONTENANT DE L'OZONE, EXISTANT DANS UNE INSTALLATION DE BLANCHIMENT DE PATE A PAPIER

(84) Designated Contracting States:
AT DE ES FI PT SE

(30) Priority: **07.08.1995 US 19454**
05.08.1996 US 693919

(43) Date of publication of application:
27.05.1998 Bulletin 1998/22

(73) Proprietor: **BELOIT TECHNOLOGIES, INC.**
Wilmington, Delaware 19803 (US)

(72) Inventors:
- **ROUNSAVILLE, Jeffrey**
Milford, NH 03055 (US)
- **MINAMI, Shusuke**
Nashua, NH 03060 (US)

(74) Representative: **Schmitz, Jean-Marie et al**
Dennemeyer & Associates S.A.,
P.O. Box 1502
1015 Luxembourg (LU)

(56) References cited:
EP-A- 0 526 383
EP-A- 0 588 704
WO-A-93/18226
WO-A-94/11570

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND OF THE INVENTION

1.0 Field of the Invention

[0001] The present invention relates generally to the bleaching of lignocellulosic materials for use in the pulp and paper industry, and more particularly to a method for reprocessing an ozone-containing gas present in a pulp bleaching plant.

2.0 Related Art

[0002] Ozone gas has been used in a wide variety of industrial applications which has included water and waste treatment and certain semiconductor manufacturing processes. Additionally, there have been many recent efforts to utilize ozone as a bleaching reagent for wood pulp and other lignocellulosic materials, so as to avoid the use of chlorine (and the attendant environmental problems) in such bleaching processes. Although ozone may initially appear to be an ideal material for bleaching lignocellulosic materials, the exceptional oxidative properties of ozone and the relatively high cost associated with its use have limited the development of satisfactory devices and processes for ozone bleaching of lignocellulosic materials.

[0003] Ozone gas is very unstable, corrosive and is very toxic even in small concentrations. Environmental Protection Agency (EPA) air quality guidelines, indicate that the ozone concentration in the atmosphere should be less than 0.12 ppm by volume. Additionally, Occupational Safety and Health Administration (OSHA) guidelines stipulate that the allowable exposure of an individual to ozone for an eight hour period corresponds to a maximum ozone concentration in air of 0.1 ppm by volume. In situations where an ozone-containing gas is contained after process completion, the corrosive nature of ozone may create problems for subsequent use of the ozone-containing gas. Accordingly, in either situation it is desirable to destroy the residual ozone in the off-gas discharging from pulp bleaching stages in which the ozone has been reacted with pulp.

[0004] One known method for destroying residual ozone present in a wood pulp bleaching off-gas is thermal destruction. In this method, the ozone-containing off-gas is supplied to a thermal destruct unit where the ozone gas is heated, typically to a temperature greater than 350° C, so as to dissociate the ozone into diatomic oxygen. Another known method for the destruction of residual ozone has been the use of a solid catalyst which causes ozone to decompose. While these methods may be advantageously utilized in industrial applications using relatively small volumes of ozone-containing gas, they are subject to the following limitation when applied in pulp bleaching applications. The use of thermal methods to destroy ozone in pulp bleaching applications can be very expensive due to the relatively high gas volumes required in such applications and the corresponding significant electrical power required to operate the thermal destruct unit so as to destroy the residual ozone in the gas. Additionally, it is not uncommon for the flow of pulp within the pulp bleaching plant to be interrupted without warning, for a variety of reasons. In such instances, the thermal destruct unit may be required to process both the off-gas from the pulp bleaching process and additionally a volume of fresh bleaching gas, at a significantly higher concentration of ozone, from an ozone generator. Since the decomposition of ozone is exothermal, the sudden input of fresh bleaching gas can cause the internal temperature of the thermal destruct unit to increase rapidly. This in turn may result in severe thermal stresses on the thermal destruct unit which may result in component failure.

[0005] During the reaction of ozone with wood pulp, volatile organic compounds (VOC's) may be created which can poison the solid catalyst used to destroy residual ozone, thereby seriously impairing the effectiveness of the solid catalyst. Additionally, any residual pulp fibers present in the off-gas supplied to the solid catalyst bed may accumulate in the catalyst bed thereby restricting the gas flow and also reducing the gas-solids contact area.

[0006] WO-A-9318226 teaches reprocessing the off-gases of an ozone bleaching plant by passing the off-gases through a scrubber using an alkaline solution to reduce the ozone concentration. Various alkaline solution sources are taught, and EPO 526 383 teaches the use of oxidized white liquor and extraction filtrate.

[0007] The foregoing illustrates limitations known to exist in the present methods of destroying residual ozone in ozone-containing gases used in wood pulp bleaching operations. Thus, it is apparent that it would be advantageous to provide an alternative directed to overcoming one or more of the limitations set forth above. Accordingly, a suitable alternative is provided including features more fully disclosed hereinafter.

SUMMARY OF THE INVENTION

[0008] In one aspect of the present invention, this is accomplished by providing a method for reproducing an ozone-containing gas present in a pulp bleaching plant comprising the steps of:

supplying the ozone-containing gas to a first valve, the first valve being in communication with a pulp bleaching vessel and a bypass conduit, the first valve being open to the pulp bleaching vessel and closed to the bypass conduit when pulp is being supplied to the pulp bleaching vessel, the first valve being closed to the pulp bleaching vessel and open to the bypass conduit when pulp is not being supplied to the pulp bleaching vessel;

in the event pulp is being supplied to the pulp bleaching vessel, performing steps (a) through (d):

(a) flowing the ozone-containing gas into the pulp bleaching vessel to bleach the pulp and produce an ozone-containing off-gas;
(b) flowing the ozone-containing off-gas from the bleaching vessel to a scrubber;
(c) supplying an alkaline medium to the scrubber;
(d) flowing the ozone-containing off-gas in a countercurrent relationship with respect to the alkaline medium within the scrubber so as to provide intimate contact between the ozone-containing off-gas and the alkaline medium within the scrubber thereby substantially converting the ozone-containing off-gas into a substantially ozone-free gas;

in the event pulp is not being supplied to the pulp bleaching vessel, performing steps (e) through (h);

(e) flowing the ozone-containing gas into the bypass conduit;
(f) flowing the ozone-containing gas from the bypass conduit to the scrubber;
(g) supplying the alkaline medium to the scrubber;
(h) flowing the ozone-containing gas in a countercurrent relationship with respect to the alkaline medium within the scrubber so as to provide intimate contact between the ozone-containing gas and the alkaline medium within the scrubber thereby substantially converting the ozone-containing gas into a substantially ozone-free gas;

(2) separately discharging the substantially ozone-free gas and the alkaline medium from the scrubber.

BRIEF DESCRIPTION OF THE DRAWING

[0009] The foregoing and other aspects of the present invention will become more apparent from the subsequent Detailed Description of the invention when considered in conjunction with the accompanying drawing figure, wherein:

[0010] The Figure illustrates a portion of a pulp bleaching plant incorporating the method of the present invention for reprocessing an ozone-containing gas.

DETAILED DESCRIPTION

[0011] Referring now to the drawing, the Figure illustrates a portion of a pulp bleaching plant 10 for bleaching lignocellulosic materials, such as medium or high-consistency wood pulp, with a gaseous bleaching reagent comprising ozone according to the present invention. The pulp bleaching plant 10 is included in a pulp mill which also includes a brownstock washing plant (not shown) and an oxygen delignification plant (not shown), each of which precedes plant 10 within the pulp mill. As known in the art, wood pulp is obtained from a digestion of wood chips, from repulping of recycled paper or from other sources, and is commonly processed in pulp and paper mills, such as plant 10, in slurry form in water. As used herein, the term "consistency" is used to express the measured ratio of dry pulp fibers to water, or more specifically, the weight of dry pulp fibers in a given weight of pulp slurry or "pulp stock" as a percentage. Various definitions are used, such as air-dry consistency (a.d.%) or oven-dry consistency (o.d.%), or moisture-free consistency (m.f.%). The laboratory techniques for measuring these values can be found in references well known in the art, such as the TAPPI Standards Manual. Terms widely used to describe ranges of stock consistency useful in pulp and paper plants follow:

[0012] Low Consistency - below about 4-6% o.d.

[0013] Medium Consistency - about 9-18% o.d.

[0014] High Consistency - above about 18-20% o.d., but more commonly above about 25% o.d.

[0015] Pulp bleaching plant 10 includes a conventional ozone generator 12 which is effective for producing ozone in a carrier gas, such as oxygen or air. A feed gas 14 is supplied to the ozone generator and may comprise either air or an oxygen-enriched gas. As known in the art, due to the manner in which ozone is generated, ozone is typically available at a relatively low concentration within the carrier gas. Typically, with present technology commercially available ozone has a concentration ranging from about 6% to about 14%, by weight, when using oxygen as the carrier gas. As used herein, the term "off-gas" will refer to the mixture of ozone in an oxygen carrier gas, as well as other gases and vapors, such as gases which are produced as a by-product of the reaction of the ozone with the pulp, which are present at equilibrium conditions. The term "fresh bleaching gas" will be used to denote a mixture of ozone in an oxygen carrier gas, with an ozone concentration ranging from about 6% by weight to about 14% by weight, supplied from the ozone generator 12 which has not been reacted with the pulp and accordingly does not include reaction by-product gases.

[0016] The ozone-containing gas, comprising fresh bleaching gas, produced by ozone generator 12 is supplied from generator 12 to an inlet 16 of a valve indicated at 18, via a conduit 20. During normal operation of the pulp bleaching plant 10, the fresh bleaching gas discharges valve 18 through a first outlet 22 and is supplied to a pulp bleaching stage, indicated at 24, via a conduit 26. A wood pulp 28, which may comprise either medium or high consistency wood pulp, is also supplied to the pulp bleaching stage 24. The pulp bleaching stage comprises at least one, and may comprise a plurality of reactors (not shown), with at least a portion of the ozone in the fresh bleaching gas being reacted with the pulp within each of the reactors. Due to the reaction of the ozone with the pulp within the reactor or reactors of the pulp bleaching stage 24, the fresh bleaching gas supplied to the pulp bleaching stage 24 is converted into an off-gas which includes residual ozone which has not reacted with the pulp and by-product of reaction gases which includes carbon dioxide. The off-gas discharging from the pulp bleaching stage 24 is supplied to a first inlet 30 of a valve 32, via conduit 34. During normal operation of the pulp bleaching plant 10, the off-gas then discharges from the valve 32 through an outlet 34 of valve 32 and is supplied to a gas inlet 36 of a scrubber 38 via conduit 40, with the residual ozone being substantially completely destroyed within scrubber 38 as subsequently discussed in greater detail. The method for destroying the residual ozone within scrubber 38 constitutes a central feature of the present invention. During normal shut-down of the pulp bleaching plant 10, the fresh bleaching gas supplied from ozone generator 12 is allowed to purge through the pulp bleaching stage 24 where it is converted to off-gas having a relatively low ozone concentration and is then supplied to the inlet 36 of scrubber 38 via conduits 34 and 40 and valve 32. However, in certain instances when the flow of the wood pulp 28 to the pulp bleaching stage 24 is interrupted in a precipitous manner, the first outlet 22 of valve 18 is closed causing the fresh bleaching gas supplied from ozone generator 12 to flow through inlet 16 of valve 18 and discharge from valve 18 through a second outlet 42. The fresh bleaching gas then flows through a conduit 44 to a second inlet 46 of valve 32 so that the fresh bleaching gas by-passes the pulp bleaching stage 24. The fresh bleaching gas is then supplied to the gas inlet 36 of scrubber 38 via outlet 34 of valve 32 and conduit 40. Accordingly, in these situations, the concentration of ozone within the ozone-containing gas supplied to scrubber 38 may be significantly higher than the ozone concentration present in the off-gas supplied to scrubber 38 during normal operation and normal shut-down of plant 10.

[0017] Scrubber 38 is preferably substantially vertically oriented and includes a generally cylindrical housing 48 which forms an internal chamber 50 therewithin. As shown in The Figure, the gas inlet 36 of scrubber 38 is in fluid communication with a lower portion 52 of the internal chamber 50. Scrubber 38 further includes a gas outlet 54 and a liquid inlet 56, each of which are in fluid communication with an upper portion 58 of chamber 50, and a liquid outlet 60 which is in fluid communication with the lower portion 52 of chamber 50. In the illustrative embodiment shown in The Figure, scrubber 38 further includes a plurality of vertically spaced trays 62, with each of the trays 62 being attached to an inner wall of housing 48 and extending radially inwardly therefrom. Alternatively, the trays 62 may be omitted from scrubber 38 and replaced with a packing medium (not shown) which preferrably comprises a plurality of rings, saddles, beads or balls made of materials resistant to ozone as well as the alkaline medium 66. However, other suitable packing media may be used as long as sufficient contact surface area is provided.

[0018] A flow of an alkaline medium 66 is supplied to the liquid inlet 56 of scrubber 38. The alkaline medium 66 preferably comprises one of the following: a sodium hydroxide solution; white liquor which is comprised mainly of sodium hydroxide, sodium sulfide and sodium carbonate; filtrate from an Eo stage (oxidative extraction stage not shown) of plant 10; post oxygen stage filtrate from the oxygen delignification plant which precedes plant 10; or brownstock washing filtrate supplied from the brownstock washing plant which precedes both the oxygen delignification plant and plant 10, with the brownstock washing filtrate alternatively referred to in the art as weak black liquor. The foregoing alkaline media are readily available from a variety of sources (not shown) within the associated pulp mill and each of the alkaline media has an alkali concentration ranging from about 1 of alkali/liter of solution to about 100 g of alkali/liter of solution. The ozone-containing gas supplied to the gas inlet 36 of scrubber 38 flows upward through scrubber 38 while the alkaline medium 66 supplied to the liquid inlet 56 of scrubber 38 flows downward through scrubber 38 under the action of gravity. Accordingly, the ozone-containing gas and alkaline medium 66 flow in countercurrent relationship with one another within scrubber 38 so as to provide intimate contact between the ozone-containing gas and the alkaline medium 66 within scrubber 38. In the illustrative embodiment shown in The Figure, the flowpath of the ozone-containing gas and the alkaline medium 66 through scrubber 38 is established by the vertically spaced trays 62. Alternatively, when trays 62 are replaced with a packing medium, the flowpath of the ozone-containing gas and the alkaline medium 66 through scrubber 38 is determined by the packing medium. The use of the rings, saddles, beads or balls for the packing medium provides a very high surface area which facilitates intimate contact between the ozone-containing gas and the alkaline medium 66. Due to the intimate contact between the ozone-containing gas and the alkaline medium 66, the ozone present in the gas is substantially completely destroyed due to dissociation of the ozone into diatomic oxygen, thereby converting the ozone-containing gas into a substantially ozone-free gas. As a result, the substantially ozone-free gas discharging through gas outlet 54 of scrubber 38 has a reduced ozone concentration which meets allowable limits. As used herein, the term "substantially ozone-free gas" is intended to also encompass a gas which is free of ozone, at least within detectable limits as measured with conventional equipment. As a further advantage of the present invention, in the instances when the ozone-containing gas comprises the off-gas and the alkaline medium 66 comprises either a sodium hydroxide solution or white liquor, the intimate contact between the ozone-containing gas and the alkaline medium 66 within scrubber 38 results in any carbon dioxide present in the ozone-containing gas being substantially completely absorbed by the alkaline medium 66. The gas discharging scrubber 38 through outlet 54 may be supplied to a pulp bleaching stage 68 of plant 10 via conduits 70 and 72 or alternatively may be supplied, or recirculated to the ozone generator 12 via conduit 70 and a conduit 74 (shown in dashed line). It is noted that the pulp bleaching stage 68 may be disposed either upstream or downstream of the pulp bleaching stage 24 of plant 10. It is important to absorb the carbon dioxide if the off-gas is recirculated to ozone generator 12 to avoid an adverse impact on the efficiency of ozone generator 12 and it may also be advantageous to absorb any carbon dioxide present when the off-gas is supplied to pulp bleaching stage 68. For instance, stage 68 may comprise an Eo stage and the presence of any carbon dioxide may adversely affect the pulp processing in this stage. The alkaline medium discharges scrubber 38 through the liquid outlet 60 and may be supplied to other portions of the associated pulp mill for further processing as indicated by flow arrow 76.

[0019] The present invention provides a cost-efficient method for destroying residual ozone in an ozone-containing gas used in a pulp bleaching plant. The relatively high electrical cost associated with operation of known ozone thermal destruct units is avoided. As a further advantage, in some instances the method of the present invention also results in substantially complete absorption (by the alkaline medium) of any carbon dioxide which is present in the gas, which may not be achieved with the use of known thermal or catalytic destruct units. Furthermore, each of the alkaline media are commonly available from a variety of sources in the pulp mill which includes the pulp bleaching plant 10, which further enhances the cost-efficiency of the method of the present invention.

[0020] The invention is not limited to specific preferred embodiments as described, but is only limited as defined by the following claims.

Claims

1. A method for reducing an ozone concentration in an ozone-containing gas present in a pulp bleaching plant, the method comprising the steps of:

    (1) supplying the ozone-containing gas to a first valve, the first valve being in communication with a pulp bleaching vessel and a bypass conduit, the first valve being open to the pulp bleaching vessel and closed to the bypass conduit when pulp is being supplied to the pulp bleaching vessel, the first valve being closed to the pulp bleaching vessel and open to the bypass conduit when pulp is not being supplied to the pulp bleaching vessel;

    in the event pulp is being supplied to the pulp bleaching vessel, performing steps (a) through (d):

    (a) flowing the ozone-containing gas into the pulp bleaching vessel to bleach the pulp and produce an ozone-containing off gas;
    (b) flowing the ozone-containing off gas from the bleaching vessel to a scrubber;
    (c) supplying an alkaline medium to the scrubber;
    (d) flowing the ozone-containing off gas in a countercurrent relationship with respect to the alkaline medium within the scrubber so as to provide intimate contact between the ozone-containing off gas and the alkaline medium within the scrubber thereby substantially converting the ozone-containing off gas into a substantially ozone-free gas;

    in the event pulp is not being supplied to the pulp bleaching vessel, performing steps (e) through (h);

    (e) flowing the ozone-containing gas into the bypass conduit;
    (f) flowing the ozone-containing gas from the bypass conduit to the scrubber;
    (g) supplying the alkaline medium to the scrubber;
    (h) flowing the ozone-containing gas in a countercurrent relationship with respect to the alkaline medium within the scrubber so as to provide intimate contact between the ozone-containing gas and the alkaline medium within the scrubber thereby substantially converting the ozone-containing gas into a substantially ozone-free gas;

    (2) separately discharging the substantially ozone-free gas and the alkaline medium from the scrubber.

2. The method as recited in claim 1, wherein the alkaline medium comprises a sodium hydroxide solution.

3. The method as recited in claim 1, wherein the alkaline medium comprises white liquor.

4. The method as recited in claim 1, wherein the alkaline medium comprises a post oxygen stage filtrate

from an oxygen delignification process.

5. The method as recited in claim 1, wherein the alkaline medium comprises weak black liquor.

6. The method as recited in claim 1, wherein the alkaline medium comprises a filtrate from an Eo stage of the pulD bleaching plant.

7. The method as recited in claim 1, wherein the alkaline medium has an alkali concentration ranging from about 1 g of alkali/liter of solution to about 100 g of alkali/liter of solution.

8. The method as recited in claim 1, further comprising the step of:
reducing the carbon dioxide concentration of the ozone containing off-gas as the off-gas flows through the scrubber.

9. The method as recited in claim 1, wherein said step of separately discharging comprises the steps of:

discharging the alkaline medium from a liquid outlet of the scrubber;
discharging the substantially ozone-free gas from a gas outlet of the scrubber to an ozone generator.

10. The method as recited in claim 1, wherein said step of separately discharging comprises the steps of:

discharging the alkaline medium from a liquid outlet of the scrubber;
discharging the substantially ozone-free gas from a gas outlet of the scrubber to a pulp bleaching stage of the pulp bleaching plant.

11. The method as recited in claim 1, wherein:

the scrubber is substantially vertically oriented and includes a generally cylindrical housing forming an internal chamber therein, the internal chamber having an upper portion and a lower portion, and the scrubber further includes a gas inlet and a liquid outlet in fluid communication with the lower portion of the internal chamber, and a gas outlet and a liquid inlet in fluid communication with the upper portion of the internal chamber;
said step (b) further comprises flowing the ozone-containing off gas to the gas inlet of the scrubber;
said step (f) further comprises flowing the ozone-containing gas to the gas inlet of the scrubber;
said steps (c) and (g) further comprising supplying the alkaline medium to the liquid inlet of the scrubber;
said step of separately discharging comprises the steps of:

discharging the substantially ozone-free gas from the gas outlet of the scrubber; and discharging the alkaline medium from the liquid outlet of the scrubber.

12. The method of claim 1 wherein step (b) further comprises flowing the ozone-containing off gas to a second valve disposed opposite the bleaching vessel from the first valve, the second valve providing communication between the bleaching vessel and the scrubber, and, the bypass conduit and the scrubber, the second valve providing communication between the bleaching vessel and the scrubber when pulp is being supplied to the bleaching vessel, the second valve providing communication between the bypass line and the scrubber when pulp is not being supplied to the bleaching vessel.

13. The method of claim 12 wherein step (b) further comprising flowing the ozone-containing of gas to the second valve and step (f) further comprises flowing the ozone-containing gas to the second valve.

Patentansprüche

1. Verfahren zur Reduzierung einer Ozonkonzentration eines in einer zellstoffbleichenden Anlage vorkommenden ozonhaltigen Gases, umfassend die folgenden Schritte:

(1) Zuführen des ozonhaltigen Gases zu einem ersten Ventil, wobei das erste Ventil in Verbindung mit einem zellstoffbleichenden Behälter und einem Bypass steht; wenn dem zellstoffbleichenden Behälter Zellstoff zugeführt wird, so ist das erste Ventil zum zellstoffbleichenden Behälter hin geöffnet und zum Bypass hin geschlossen; wenn dem zellstoffbleichenden Behälter kein Zellstoff zugeführt wird, so ist das erste Ventil zum zellstoffbleichenden Behälter hin geschlossen und zum Bypass hin geöffnet;

Für den Fall, daß der Zellstoff dem zellstoffbleichenden Behälter zugeführt wird, werden die Schritt (a) bis (d) durchgeführt:

(a) Einströmen des ozonhaltigen Gases in den zellstoffbleichenden Behälter, um den Zellstoff zu bleichen und um ein ozonhaltiges Abgas zu produzieren;

(b) Strömen des ozonhaltigen Abgases von dem zellstoffbleichenden Behälter zu einem Gasreiniger;

(c) Zuführen eines alkalischen Mediums zu dem Gasreiniger;

(d) Strömen des ozonhaltigen Abgases in einer Gegenstrom-Beziehung hinsichtlich des alkalischen Mediums innerhalb des Gasreinigers, um so innerhalb des Gasreinigers einen engen Kontakt zwischen dem ozonhaltigen Abgas und dem alkalischen Medium zu erzeugen, wobei das ozonhaltige Abgas in ein im wesentlichen ozonfreies Gas umgewandelt wird,

Für den Fall, daß der Zellstoff nicht dem zellstoffbleichenden Behälter zugeführt wird, werden die Schritte (e) bis (h) durchgeführt:

(e) Einströmen des ozonhaltigen Gases in den Bypass;

(f) Strömen des ozonhaltigen Gases vom Bypass in den Gasreiniger;

(g) Zuführen des alkalischen Mediums zu dem Gasreiniger;

(h) Strömen des ozonhaltigen Gases in einer Gegenstrom-Beziehung hinsichtlich des alkalischen Mediums innerhalb des Gasreinigers, um so innerhalb des Gasreinigers einen engen Kontakt zwischen dem ozonhaltigen Gas und dem alkalischen Medium zu erzeugen, wobei das ozonhaltige Gas in ein im wesentlichen ozonfreies Gas umgewandelt wird;

(2) Separate Abgabe des im wesentlichen ozonfreien Gases und des alkalischen Mediums aus dem Gasreiniger.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das alkalische Medium eine Natriumhydroxid-Lösung beinhaltet.

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das alkalische Medium eine weiße Flüssigkeit beinhaltet.

4. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das alkalische Medium ein Postsauerstoffstufenfiltrat aus einem sauerstoffdelignifizierenden Prozeß beinhaltet.

5. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das alkalische Medium eine schwach schwarze Flüssigkeit beinhaltet.

6. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das alkalische Medium ein Filtrat aus einer oxidierenden Auszugsstufe der zellstoffbleichenden Anlage enthält.

7. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß das alkalische Medium eine alkalische Konzentration im Bereich von ca. 1 g Alkalien pro Liter Lösung bis ca. 100 g Alkalien pro Liter Lösung aufweist.

8. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß es ferner folgenden Schritt umfaßt: Reduzieren der Karbondioxidkonzentration des ozonhaltigen Abgases, während das Abgas durch den Gasreiniger strömt.

9. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Verfahrensschritt des separierten Ausströmens die Schritte umfaßt: Ausströmen des alkalischen Mediums aus einem Flüssigkeitsauslaß des Gasreinigers; Ausströmen des im wesentlichen ozonfreien Gases aus einem Gasauslaß des Gasreinigers zu einem Ozongenerator.

10. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Verfahrensschritt des separierten Ausströmens die Schritte umfaßt: Ausströmen des alkalischen Mediums aus einem Flüssigkeitsauslaß des Gasreinigers; Ausströmen des im wesentlichen ozonfreien Gases aus einem Gasauslaß zu einem zellstoffbleichenden Abschnitt der zellstoffbleichenden Anlage.

11. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Gasreiniger im wesentlichen vertikal ausgerichtet ist und ein im allgemeinen zylindrisches Gehäuse aufweist, das eine innere Kammer bildet, wobei die innere Kammer einen oberen und einen unteren Bereich aufweist, und der Gasreiniger zudem einen Gaseinlaß und einen Flüssigkeitsauslaß beinhaltet, wobei der Flüssigkeitsauslaß in flüssiger Verbindung mit dem unteren Bereich der inneren Kammer steht und der Gasreiniger einen Gasauslaß und einen Flüssigkeitseinlaß umfaßt, wobei der Flüssigkeitseinlaß in flüssiger Verbindung mit dem oberen Bereich der inneren Kammer steht;

der Verfahrensschritt (b) ferner das Einströmen des ozonhaltigen Abgases zum Gaseinlaß des Gasreinigers umfaßt;

der Verfahrensschritt (f) ferner das Einströmen des ozonhaltigen Gases zum Gaseinlaß des Gasreinigers umfaßt;

die Verfahrensschritte (c) und (g) zudem die Zuführung des alkalischen Mediums zum Flüssigkeitseinlaß des Gasreinigers umfassen;

der Verfahrensschritt des getrennten Ausströmens die Schritte umfaßt: Ausströmen des im wesentlichen ozonfreien Gases aus dem Gasaustritt des Gasreinigers; und Ausströmen des alkalischen Mediums aus dem Flüssigkeitsauslaß des Gasreinigers.

12. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Verfahrensschritt (b) desweiteren umfaßt Einströmen des ozonhaltigen Abgases von einem ersten Ventil zu einem gegenüber dem bleichenden Behälter angebrachten zweiten Ventil, wobei das zweite Ventil die Verbindung zwischen dem bleichenden Behälter und dem Gasreiniger sowie zwischen dem Bypass und dem Gasreiniger bereitstellt und wobei das zweite Ventil die Verbindung zwischen dem bleichenden Behälter und dem Gasreiniger bereitstellt, wenn der Zellstoff dem bleichenden Behälter zugeführt wird, und wobei das zweite Ventil die Verbindung zwischen dem Bypass und dem Gasreiniger bereitstellt, wenn der Zellstoff nicht dem bleichenden Behälter zugeführt wird.

13. Verfahren nach Anspruch 12, dadurch gekennzeichnet, daß der Verfahrensschritt (b) ferner das Strömen des ozonhaltigen Abgases zu dem zweiten Ventil und der Verfahrensschritt (f) ferner das Strömen des ozonhaltigen Gases zu dem zweiten Ventil umfaßt.

Revendications

1. Procédé pour réduire la concentration d'ozone dans un gaz contenant de l'ozone présent dans une installation de blanchiment de pâte, le procédé comprenant les étapes consistant à:

(1) acheminer le gaz contenant de l'ozone à une première vanne, la première vanne se trouvant en communication avec un récipient de blanchiment de pâte et avec un conduit de dérivation, la première vanne étant ouverte en direction du récipient de blanchiment de pâte et étant fermée en direction du conduit de dérivation lorsque de la pâte est acheminée au récipient de blanchiment de pâte, la première vanne étant fermée en direction du récipient de blanchiment de pâte et ouverte en direction du conduit de dérivation lorsque de la pâte n'est pas acheminée au récipient de blanchiment de pâte;

dans le cas où de la pâte est acheminée au récipient de blanchiment de pâte, passer par les étapes (a) à (d) consistant à:

(a) faire en sorte que le gaz contenant de l'ozone s'écoule dans le récipient de blanchiment de pâte pour blanchir la pâte et générer des gaz d'échappement contenant de l'ozone;
(b) faire en sorte que les gaz d'échappement contenant de l'ozone s'écoulent depuis le récipient de blanchiment jusqu'à une tour de lavage;
(c) acheminer un milieu alcalin à la tour de lavage;
(d) faire en sorte que les gaz d'échappement contenant de l'ozone s'écoulent à contre-courant par rapport au milieu alcalin à l'intérieur de la tour de lavage de façon à créer un contact intime entre les gaz d'échappement contenant de l'ozone et le milieu alcalin à l'intérieur de la tour de lavage pour ainsi essentiellement transformer les gaz d'échappement contenant de l'ozone en un gaz essentiellement exempt d'ozone;

dans le cas où de la pâte n'est pas acheminée au récipient de blanchiment de pâte, passer par les étapes (e) à (h) consistant à:

(e) faire en sorte que le gaz contenant de l'ozone s'écoule dans le conduit de dérivation;
(f) faire en sorte que le gaz contenant de l'ozone s'écoule depuis le conduit de dérivation jusqu'à la tour de lavage;
(g) acheminer le milieu alcalin à la tour de lavage;
(h) faire en sorte que le gaz contenant de l'ozone s'écoule à contre-courant par rapport au milieu alcalin dans la tour de lavage de façon à créer un contact intime entre le gaz contenant de l'ozone et le milieu alcalin dans la tour de lavage pour ainsi transformer essentiellement le gaz contenant de l'ozone en un gaz essentiellement exempt d'ozone;

(2) évacuer séparément de la tour de lavage le gaz essentiellement exempt d'ozone et le milieu alcalin.

2. Procédé selon la revendication 1, dans lequel le milieu alcalin comprend une solution d'hydroxyde de sodium.

3. Procédé selon la revendication 1, dans lequel le milieu alcalin comprend de la liqueur blanche.

4. Procédé selon la revendication 1, dans lequel le milieu alcalin comprend un filtrat issu d'une étape d'oxygénation ultérieure d'un procédé de délignification à l'oxygène.

5. Procédé selon la revendication 1, dans lequel le milieu alcalin comprend une liqueur noire peut consistante.

6. Procédé selon la revendication 1, dans lequel le milieu alcalin comprend un filtrat provenant d'une étape d'extraction par oxydation de l'installation de blanchiment de pâte.

7. Procédé selon la revendication 1, dans lequel le milieu alcalin possède une concentration d'alcalis se situant dans le domaine d'environ 1 g d'alcalis/litre de solution à environ 100 g d'alcalis/litre de solution.

8. Procédé selon la revendication 1, comprenant en outre l'étape consistant à:

réduire la concentration de dioxyde de carbone des gaz d'échappement contenant de l'ozone lorsque les gaz d'échappement s'écoulent à travers la tour de lavage.

9. Procédé selon la revendication 1, dans lequel ladite étape d'évacuation séparée comprend les étapes consistant à:

évacuer le milieu alcalin par une sortie de la tour de lavage destinée au liquide;
évacuer le gaz essentiellement exempt d'ozone par une sortie de la tour de lavage destinée au gaz, en direction d'un générateur d'ozone.

10. Procédé selon la revendication 1, dans lequel ladite étape d'évacuation séparée comprend les étapes consistant à:

évacuer le milieu liquide par une sortie de la tour de lavage destinée au liquide;
évacuer le gaz essentiellement exempt d'ozone par une sortie de la tour de lavage destinée au gaz en direction d'une étape de blanchiment de pâte de l'installation de blanchiment de pâte.

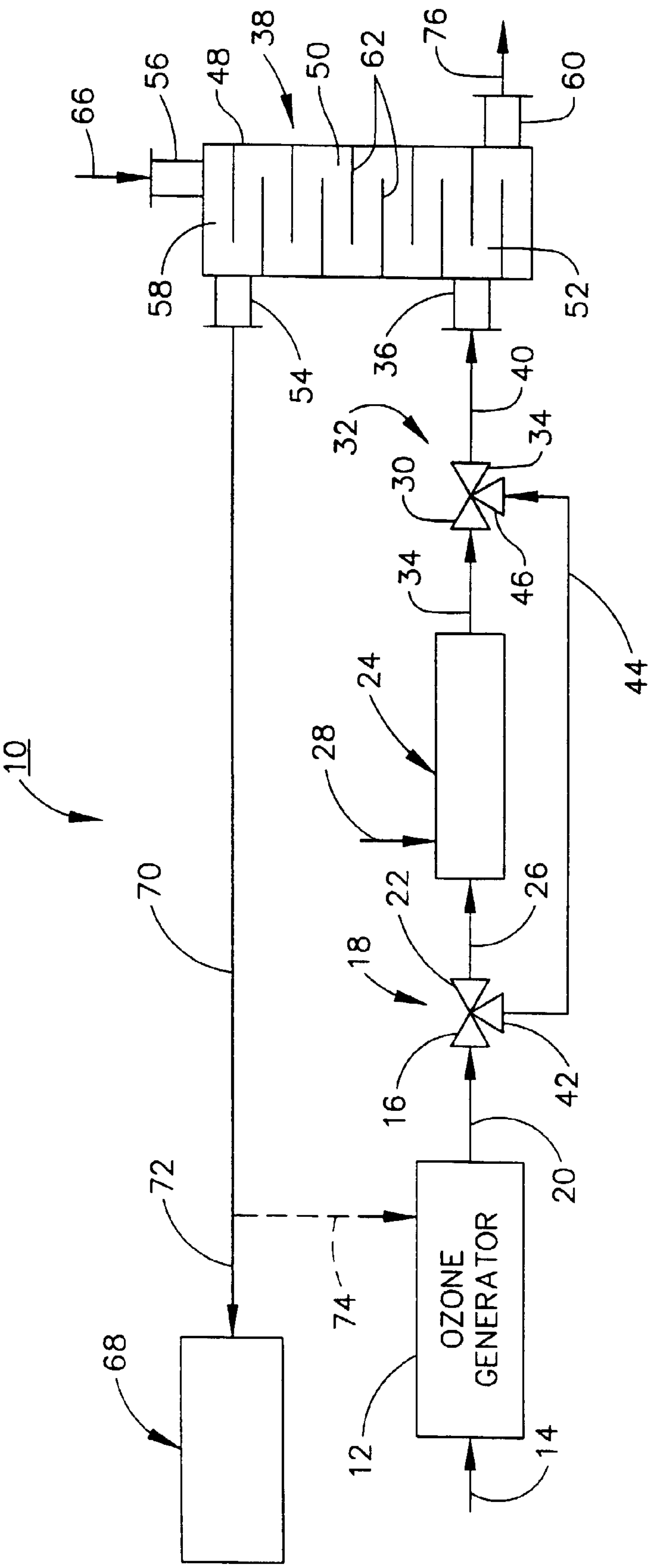
11. Procédé selon la revendication 1, dans lequel:

la tour de lavage est orientée essentiellement à la verticale et englobe un logement généralement cylindrique dans lequel est formée une chambre interne, la chambre interne possédant une portion supérieure et une portion inférieure, et la tour de lavage englobant en outre une entrée pour le gaz et une sortie pour le liquide en communication de fluide avec la portion inférieure de la chambre interne et une sortie pour le gaz et une entrée pour le liquide en communication de fluide avec la portion supérieure de la chambre interne;
ladite étape (b) comprend en outre l'écoulement des gaz d'échappement contenant de l'ozone en direction de l'entrée de la tour de lavage destinée au gaz;
ladite étape (f) comprend en outre l'écoulement du gaz contenant de l'ozone en direction de l'entrée de la tour de lavage destinée au gaz;
lesdites étapes (c) et (g) comprennent en outre le fait d'acheminer le milieu alcalin à l'entrée de la tour de lavage destinée au liquide;
ladite étape d'évacuation séparée comprend les étapes consistant à:

évacuer le gaz essentiellement exempt d'ozone par la sortie de la tour de lavage destinée au gaz; et
évacuer le milieu alcalin de la sortie de la tour de lavage destinée au liquide.

12. Procédé selon la revendication 1, dans lequel l'étape (b) comprend en outre l'écoulement des gaz d'échappement contenant de l'ozone en direction d'une seconde vanne disposée à l'opposé du récipient de blanchiment par rapport à la première vanne, la seconde vanne établissant une communication entre le récipient de blanchiment et la tour de lavage et entre le conduit de dérivation et la tour de lavage, la seconde vanne établissant une communication entre le récipient de blanchiment et la tour de lavage lorsque de la pâte est acheminée au récipient de blanchiment, la seconde vanne établissant une communication entre le conduit de dérivation et la tour de lavage lorsque de la pâte n'est pas acheminée au récipient de blanchiment.

13. Procédé selon la revendication 12, dans lequel l'étape (b) comprend en outre l'écoulement du gaz contenant de l'ozone en direction de la seconde vanne et l'étape (f) comprend en outre l'écoulement du gaz contenant de l'ozone en direction de la seconde vanne.


OZONE
GENERATOR