



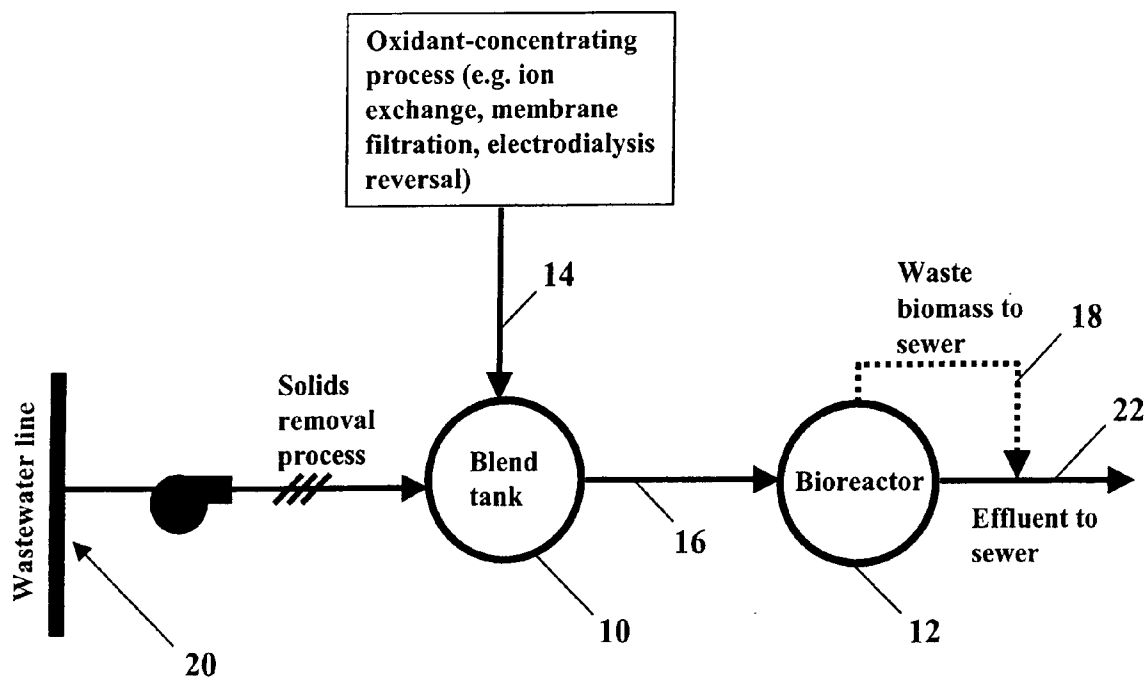
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(19) **United States**(12) **Patent Application Publication**
Brown et al.(10) **Pub. No.: US 2006/0196828 A1**(43) **Pub. Date: Sep. 7, 2006**(54) **BIODESTRUCTION OF BLENDED
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MURRIETA, CA 92564-0519 (US)**(21) Appl. No.: **11/239,797**(22) Filed: **Sep. 28, 2005****Related U.S. Application Data**(63) Continuation-in-part of application No. 11/070,923,
filed on Mar. 3, 2005, now abandoned.**Publication Classification**(51) **Int. Cl.**
C02F 3/02 (2006.01)(52) **U.S. Cl.** **210/620**(57) **ABSTRACT**

The oxidant waste stream treatment may provide for treatment of oxidant laden waste streams. A screened or clarified wastewater stream may be combined with an oxidant stream to produce a blended stream. The blended stream may be processed in a bioreactor.



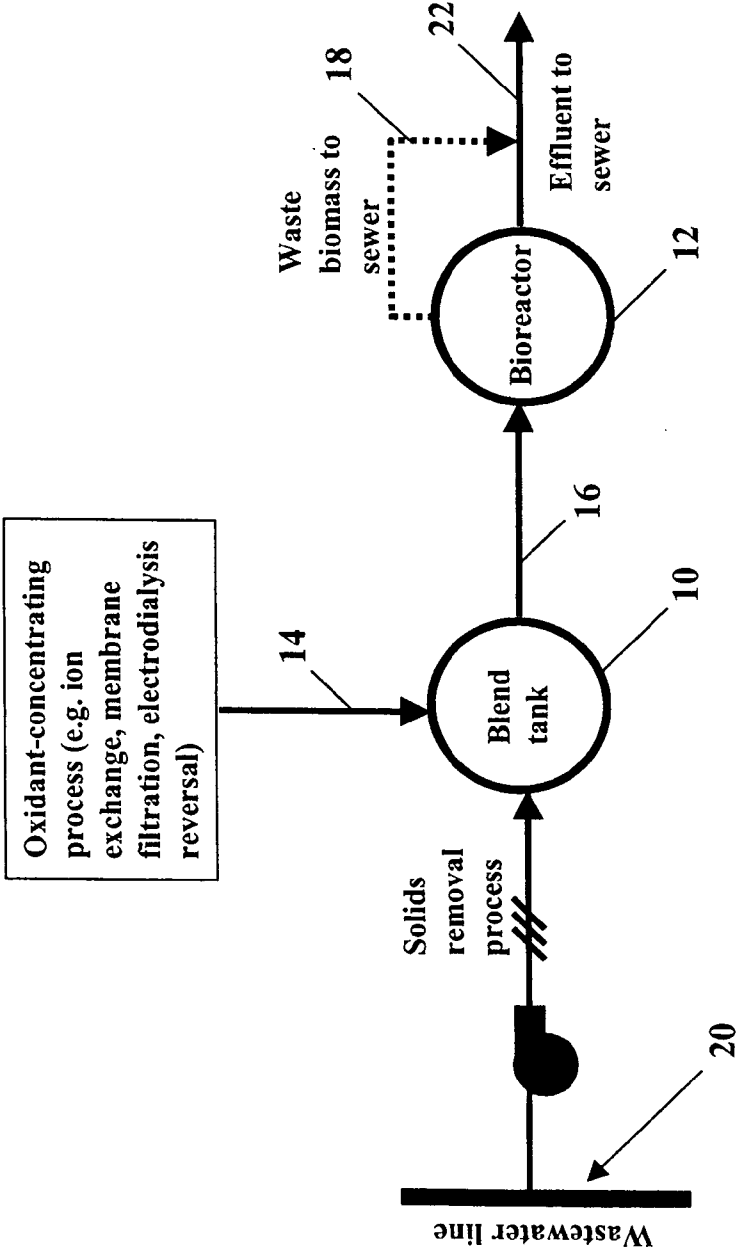


FIG. 1

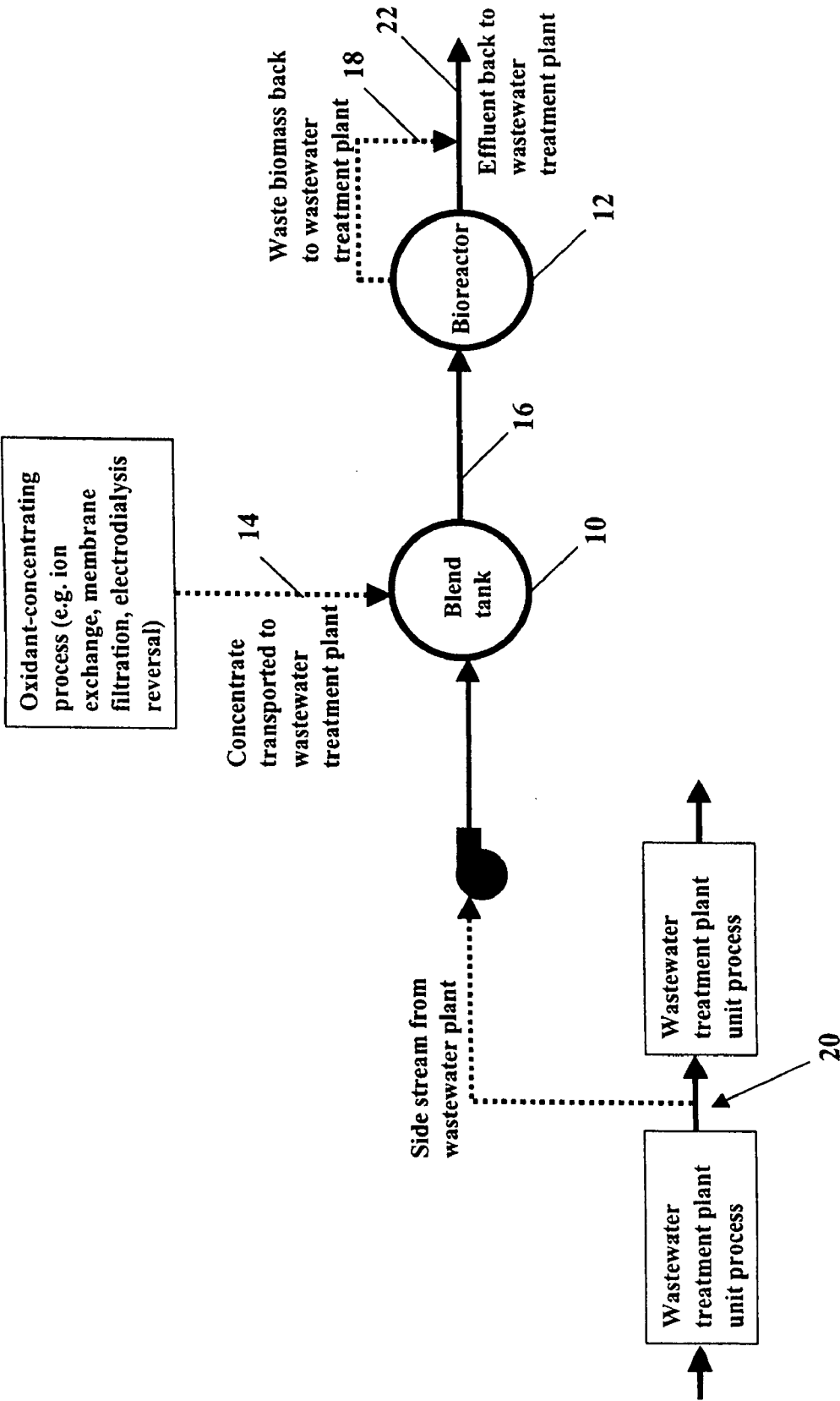


FIG. 2

BIODESTRUCTION OF BLENDED RESIDUAL OXIDANTS

[0001] This is a continuation-in-part of U.S. patent application Ser. No. 11/070,923 Filed on Mar. 3, 2005. U.S. patent application Ser. No. 10/070,923 is pending.

BACKGROUND OF THE INVENTION

[0002] This invention relates to processes for treatment of concentrated oxidant waste streams. The new method may combine a wastewater stream with an oxidant laden stream to produce a blended stream that may be treated in a bioreactor.

[0003] Existing processes used to biologically treat concentrated oxidant streams may typically require a dedicated deoxygenating step, require long residence times due to high solution salinities, require the addition of an exogenous substrate such as ethanol, or require inoculation with exogenous salt tolerant bacteria. As an example, nitrate and perchlorate may be removed in a drinking water treatment process. If a brine line discharge may not exist or be permitted, the waste streams may often be treated using a dedicated brine bioreactor designed to degrade nitrate and perchlorate in a waste stream. There may be several problems associated with biologically treating saline waste streams. Microbial cultures may be very sensitive to slight changes in ionic strength, that is, total dissolved solids. Increased salinity may tend to disrupt normal metabolic function and thereby reduce degradation kinetics. Treating saline wastewaters can increase the concentration of effluent solids. Acclimating effective salt tolerant cultures using traditional microbial sources, for example, sludge from a municipal wastewater treatment plant, may be difficult.

[0004] Other considerations for dedicated brine bioreactors may be that the waste stream must be anoxic/anaerobic to achieve biological oxidant reduction. Also, an exogenous electron donor such as acetic acid or ethanol must be added to the system to serve as a substrate, an electron donor.

SUMMARY OF THE INVENTION

[0005] The present invention is directed to methods and processes for treatment of oxidant laden waste streams. A wastewater stream may be combined with an oxidant stream to produce a blended stream. The blended stream may be processed in a bioreactor.

[0006] These and other features, aspects and advantages of the present invention will become better understood with reference to the following drawings, description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 illustrates a flow diagram of the process according to an embodiment of the invention;

[0008] FIG. 2 illustrates a flow diagram of the process according to an embodiment of the invention.

DETAILED DESCRIPTION

[0009] The following detailed description represents the best currently contemplated modes for carrying out the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention.

[0010] Referring to FIGS. 1 and 2, a method for treatment of oxidant laden waste, for example, nitrate, perchlorate, bromate and the like, residual streams may combine a processed, for example, screened or clarified wastewater stream 20 with an oxidant stream 14 to produce a blended stream. The blended stream 16 may be treated in a bioreactor 12 that reduces the oxidants to innocuous by-products. The bioreactor 12 may be a suspended growth reactor, a granular media fixed film reactor, a membrane based fixed film reactor or the like. The bioreactor effluent 22 and waste biomass 18 may be discharged to a sewer or other collection system.

[0011] The use of municipal wastewater 20 may decrease the bulk dissolved oxygen concentration. This may decrease the contact time required to achieve biological oxidant reduction since dissolved oxygen may competitively inhibit biological nitrate, perchlorate and bromate reduction. Blending the oxidant concentrated waste stream 14 with municipal wastewater 20 may typically decrease the salinity and thereby may improve biodegradation kinetics. The background organics present in municipal wastewater 20 may serve as the substrate for biological oxidant reduction such that no exogenous substrate may need to be added to the system, which may reduce costs and concerns associated with chemical amendments. The bioreactor 12 may be acclimated with organisms indigenous to the local wastewater thereby eliminating the need for an exogenous microbial enrichment or seed.

[0012] The wastewater should contain organics that may serve as an electron donor to reduce oxidants present in the oxidant stream. The wastewater stream may contain lower concentrations of dissolved oxygen than the oxidant stream such that the dissolved oxygen concentration in the blended stream may be lower than the dissolved oxygen concentration in the oxidant stream. The wastewater stream may also contain lower concentrations of total dissolved solids, that is, salinity, than the oxidant stream such that the total dissolved solids concentration in the blended stream may be lower than the total dissolved solids concentration in the oxidant stream. The wastewater stream may contain perchlorate reducing bacteria that may seed the biological reactor.

[0013] The treatment process or method may combine screened or clarified wastewater 20 scalped from a local wastewater system with a concentrated oxidant stream 14 at the site where the oxidant stream 14 may be generated, for example, a drinking water treatment plant, a chemical plant such as for solid rocket fuel manufacturing, or the like, and then treat the blended stream 16 in a dedicated bioreactor 12. The concentrated oxidant stream 14 may be collected and transported to a municipal wastewater treatment facility where it may be combined with a side stream of screened or clarified wastewater and treated in a dedicated bioreactor 12.

[0014] Blending of the oxidant stream 14 and screened or clarified municipal wastewater stream may occur at a wide range of ratios that may be site specific. Ambient wastewater quality may be used as a wide range of acceptable water quality may be anticipated.

[0015] The oxidant stream 14 may be combined with a municipal wastewater stream at a ratio of 20% to 75% to produce a blended stream 16. The combining ratio relationship is defined as the flow rate of the oxidant stream divided by the sum of the flow rate of the oxidant stream and the flow rate of the municipal wastewater stream. The blended stream 16 may contain lower concentrations of dissolved oxygen

and total dissolved solids, and a higher concentration of biodegradable organic matter than the oxidant stream 14.

[0016] Of the bioreactors 12 available, the fixed film bioreactor for perchlorate reducing metabolic activity may be more stable than that of suspended cultures. Research may have shown that when suspended perchlorate reducing bacteria are exposed to dissolved oxygen their perchlorate reducing metabolic activity may recover slowly when anaerobic conditions are reestablished. Perchlorate degradation kinetics in fixed film processes may not be significantly impacted by transient dissolved oxygen exposure. A gradient of redox potential may develop across the depth of a reactor bed. This may allow for the development of semidistinct dissolved oxygen, nitrate and perchlorate reducing zones in the bed that may force bacteria to utilize a specific metabolic activity instead of continuously altering metabolic states. A redox potential gradient may be established across the depth of a given biofilm that may permit perchlorate reduction even if the bulk solution may not be fully anaerobic.

[0017] Experiments have shown that destruction of perchlorate concentrates to below detection may be achieved through wastewater blending and treatment in a fixed bed bioreactor. The results show that no amendments may be necessary other than wastewater and that required empty bed contact times may be approximately 10 minutes or less. The blended stream 16 may have a pH between 5 and 9; although, higher or lower pH levels may be used, it has been found that additional chemical components may need to be added for treatment of the blended stream. Such chemical treatment may make the process less efficient, particularly concerning the overall cost of the process. The temperature of the blended stream may be maintained between approximately 5 and 30 degrees Celsius. The empty bed contact time may vary between approximately 3 and 60 minutes.

[0018] While the invention has been particularly shown and described with respect to the illustrated embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

1. A method for treatment of oxidant laden waste streams comprising:

combining a wastewater stream with an oxidant stream having oxy-anions at a ratio of between 20% volumetric flow rate and 75% volumetric flow rate to produce a blended stream; and

processing said blended stream in a bioreactor.

2. The method as in claim 1 wherein said ratio for combining is the flow rate of said oxidant stream divided by the sum of the flow rate of said oxidant stream and the flow rate of said municipal wastewater stream.

3. The method as in claim 1 wherein said blended stream having lower concentrations of dissolved oxygen and total dissolved solids, and a higher concentration of a biodegradable organic matter than said oxidant stream.

4. The method as in claim 1 wherein said blended stream having a pH between approximately 5 and 10.

5. The method as in claim 1 wherein the temperature of said blended stream is between approximately 5 degrees and 40 degrees Celsius.

6. The method as in claim 1 wherein the empty bed contact time in said bioreactor is between approximately 3 minutes and 120 minutes.

7. The method as in claim 1 wherein said wastewater stream is a portion of a wastewater stream source at a wastewater treatment facility.

8. The method as in claim 1 wherein said wastewater stream is a portion of a wastewater stream source channeled to an oxidant stream source site.

9. The method as in claim 1 wherein said wastewater stream is processed for the removal of suspended solids prior to being combined with said oxidant stream.

10. The method as in claim 1 wherein said bioreactor is selected from the group consisting of a suspended growth reactor and a fixed film reactor.

11. (canceled)

12. The method as in claim 1 wherein said wastewater stream having an organic content that serves as an electron donor source to reduce the oxidants present in said oxidant stream.

13. The method as in claim 12 wherein said wastewater stream having a lower concentration of dissolved oxygen than said oxidant stream.

14. The method as in claim 12 wherein said wastewater stream having a lower concentration of total dissolved solids than said oxidant stream.

15. The method as in claim 12 wherein said wastewater stream having a perchlorate-reducing bacteria to seed said bioreactor.

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