CLAIMS

1. A wastewater treatment process comprising at least one step of aerobic biological treatment of wastewater in a biological reactor, and further comprising an ozonation step during which ozone is directly injected and without a specific ozone contactor in one or more circuits arranged to convey a respective fluid into the biological reactor, an ozone chemical oxidation acting synergistically with the biological oxidation within the biological reactor, without a specific ozone contactor.

2. The process according to claim 1, wherein the ozonation step includes injecting ozone in a wastewater inlet circuit by means of a first injection device.

3. The process according to claim 2, wherein the amount of ozone injected into the wastewater inlet circuit during the ozonation step is lower than or equal to two grams per gram of total organic carbon of the wastewater.

4. The process according to any of claims 1 to 3, further comprising a separation step during which sludge is separated from the wastewater, this separation step being subsequent to the at least one aerobic biological treatment step, wherein the sludge from this separation step is conveyed in the biological reactor by a recirculation circuit, and wherein the ozonation step includes injecting ozone in this recirculation circuit by means of a second injection device.

5. The process according to claim 4, wherein the ozone amount injected in the recirculation circuit during the ozonation step is lower than or equal to two grams per gram of total organic carbon of the wastewater.

6. The process according to any of claims 1 to 5, further comprising an ozonation post-treatment step during which the wastewater exiting the biological reactor is contacted with ozone within an ozone contactor.

7. The process according to claim 6, wherein the ozone amount contacted with the wastewater in the ozone contactor during the ozonation post-treatment step is lower than or equal to two grams per gram of total organic carbon of the wastewater.

8. The process according to claim 6 or 7 considered as depending on claim 2 or 4, further comprising a gas recycling step during which at least one part of the ozone contacted with the wastewater in the ozone contactor is recirculated to the first and/or the second injection device, and/or is injected in an aeration zone of the biological reactor.

9. The process according to any of claims 1 to 8, wherein the ozone injected is gaseous or dissolved.

10. The process according to any of claims 1 to 9, wherein the ozone comprises oxygen.

11. A wastewater treatment device comprising:

- a biological reactor arranged to make at least one aerobic biological treatment step of the wastewater,

- one or more circuits arranged to convey a respective fluid into the biological reactor, and

- at least one injection device arranged to directly inject and without a specific ozone contactor ozone in one or more of said one or more circuits, an ozone chemical oxidation acting synergistically with the biological oxidation within the biological reactor, without a specific ozone contactor.

12. The device according to claim 11, further comprising:

- a wastewater inlet circuit arranged to convey the wastewater into the biological reactor, and

- a first injection device arranged to inject ozone in the inlet circuit.

13. The device according to claim 11 or 12, further comprising:

- a separator downstream of the biological reactor arranged to separate sludge from wastewater,

- a recirculation circuit arranged to convey the sludge into the biological reactor,

- a second injection device arranged to inject ozone in the recirculation circuit.

14. The device according to any of claims 11 to 13, further comprising an ozone contactor arranged to contact the wastewater exiting the biological reactor with ozone.

15. The device according to claim 14, wherein the biological reactor comprises an aeration zone, and

wherein the device further comprises a recycling circuit arranged to convey at least one part of the ozone contacted with the wastewater into the ozone contactor to:

- the at least one injection device, and/or
- said aeration zone.

16. The device according to any of claims 11 to 13, wherein the biological reactor is a conventional activated sludge reactor or a moving bed reactor or fixed bed reactor.