

“An electrolyzer for electrolyzing saline water”**DESCRIPTION***Field of the invention*

The invention relates to the field of saline water treatment for the production
5 of hypochlorite. Specifically, the invention relates to an electrolyzer and relative
process for producing hypochlorite from saline water such as seawater or synthetic
brine.

State of the art

10 Typically, saline water electrochlorination system comprises electrolytic cell
assemblies, namely electrolyzers, electrically combined in series and hydraulically
connected by means of external pipeline elbows. The seawater passes through the
series of electrolyzers and exits a fluid comprising hypochlorite, preferably sodium
hypochlorite, hydrogen gas, residues of seawater and eventual impurities. This fluid
15 is then stored in a tank and the hydrogen gas is removed.

Namely, each electrolyzer comprises a body extended between a fluid inlet
and opposed fluid outlet respectively for receiving and ejecting a fluid. Electrolytic
cells are arranged along the body for the electrolysis of the seawater. Furthermore, an
electrode is arranged at the fluid inlet and at the fluid outlet respectively defining a
20 cathode and the anode of the electrolytic cells to which the electrodes are electrically
connected.

In the known seawater electrochlorination system, the outlet of one
electrolyzer is connected to the inlet of a downstream electrolyzer by the external

elbow pipeline. In this way, the seawater and the electrolysis products flow through the electrolyzers from a seawater source to the storing and degassing tank.

Problems of the prior art

5 It is to be noted that known electrolyzers need to be connected in series to treat the seawater for an efficient production of hypochlorite. Furthermore, each electrolyzer needs relative electrodes to define the electrolytic cells. In addition, such electrolyzers and relative connections increase the overall dimension of the system as well as the complexity of it.

10 In general, the seawater treatment for production of hypochlorite must consider cost, space and time constrains. Therefore, an electrolyzer for the treatment of seawater with reduced dimensions is desirable as well as in terms of complexity and costs.

 Therefore, it would be desirable to provide an apparatus for the treatment of
15 seawater overcoming the limitations of the prior art, in particular, an apparatus able to simplify the systems, reduce components and accessories, reduce footprint and reduce costs for construction.

Object of the invention

20 The object of the present invention is to provide an electrolyzer that can obviate the above discussed drawbacks of the prior art.

 In particular, the present invention has the object to provide a compact and simply electrolyzer for electrolyzing saline water.

The aforementioned technical purpose and objects are substantially fulfilled by an electrolyzer for electrolyzing saline water which comprise the technical features as disclosed in one or more of the accompanying claims.

5 *Advantages of the invention*

Advantageously, the electrolyzer of the present invention can reduce the overall dimensions and installation time in system/plant. Namely, the electrolyzer reduce the space occupied and then the overall costs. Furthermore, it is possible to install compact systems comprising electrolyzer inside containers.

10 Advantageously, the electrolyzer of the present invention can reduce number of electrodes to define the electrolytic cells.

DESCRIPTION OF DRAWINGS

Further features and advantages of the present invention will result more
15 clearly from the illustrative, non-limiting description of a preferred, non-exclusive embodiment of electrolyzer as shown in the accompanying drawings:

- Figure 1: shows a longitudinal lateral section view of the electrolyzer according to a first embodiment of the present invention;
- Figure 2: shows transversal section A-A of the electrolyzer of Figure 1;
- 20 - Figure 3: shows transversal section B-B of the electrolyzer of Figure 1;
- Figure 4 shows a longitudinal top section of the electrolyzer of Figure 1;
- Figure 5 shows a first enlargement of a portion of the electrolyzer of Figure 4;

- Figure 6 shows a second enlargement of a portion of the electrolyzer of Figure 4;
- Figures 7-10 show perspective views of the electrolyzer of Figure 1 with some components omitted to show others.

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DETAILED DESCRIPTION

For the purposes of the present invention the wording “comprising” does not exclude the possibility that further stages/ elements not explicitly listed after said wording are contemplated.

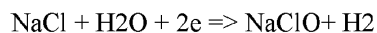
10 On the contrary the wording “consisting of” excludes the above possibility.

The present invention relates to an electrolyzer globally referred as 1 in the figures. The electrolyzer 1 is used to produce sodium hypochlorite from saline water for example for biofouling control in power plants, desalination plants or LNG terminals. It is worth noting that one or more electrolyzers 1 can be associated to the
15 above cited plant and terminals.

In the following it will be referred to hypochlorite intending sodium hypochlorite. The hypochlorite is used as biocide and disinfecting agent for use in industrial plants such as cited above.

It is to be noted that the hypochlorite together with hydrogen is produced by
20 the electrolysis of saline water carried out in an electrolyzer 1 or in two or more electrolyzers 1 fluidically connected in series. Namely, the saline water entering in the one or more electrolyzer 1 is a solution of sodium chloride and water. Generally, the overall well-known chemical reaction of the electrolysis can be expressed as follows:

Salt + Water + Energy => Sodium hypochlorite + Hydrogen



It is to be noted that saline water can be for example seawater with salt concentration ranged about 30g/l or synthetic brine with salt concentration ranged
5 about 30-300g/l.

Preferably, the saline water can comprise also impurities such as one or more of Mg, Ca, V, Ni, Mn, Co, Cr, Fe, Re Cu, As, Sb, oil and heavy organics, suspended solid and/or TOC in free and/or in compounds form.

In the following table an example of concentration of the impurities is reported.

SUBSTANCES	DESCRIPTION	CONC. LIMITS	REMARKS
V>Ni>Mn>Co	Fast decomposition of hypochlorite	< 10 ppb	Individually
Cr>Fe>Re>Cu>As> Sb>Actinides	Slow decomposition of hypochlorite	< 10 ppm	Total
Mn ⁺⁺ and Fe ⁺⁺	Substances that affect anodes	<< 50 ppb / < 1 ppm	-
Oil and Heavy Organics	Substances that affect anodes	< 15 ppm	Total
Suspended solids	Substances that affect anodes	< 100 ppm	Total
TOC	Substances that affect anodes	< 10-15 ppm	Total

However, it is to be noted that the impurities can depend on the sea/ocean.

The electrolyzer 1 comprises a housing 10 extending along a longitudinal direction X-X between a first end portion 11 and opposed end portion 12. The longitudinal direction X-X can be parallel to the ground when the electrolyzer 1 is arranged in a horizontal configuration or transversal to the ground, preferably perpendicular, when the electrolyzer 1 is arranged in a vertical configuration.

It is to be noted that the housing 10 comprises a first and second bases 17, 18 respectively associated to the first and second end portions 11, 12 and a lateral wall 19 connecting the first and second base 17, 18 defining the first and second end portion 12. Preferably, the first and second base 17, 18 comprise relative plates removably attached to the lateral wall 19.

The housing 10 defines within an inner volume V wherein the saline water is treated. It is worth noting, that the housing 10, namely, the lateral wall 19, has an inner surface 10a faced towards the inner volume V and an opposed outer surface 10b.

The housing 10 can have different prismatic shapes preferably cylindrical.

The housing 10 further comprises a feed fluid inlet 13 and a product fluid outlet 14. The feed fluid inlet 13 is configured to receive a fluid, such as saline water, from outside the electrolyzer 1 and the product fluid outlet 14 is configured to eject a fluid, such a product, from the electrolyzer 1.

According to one embodiment, the feed fluid inlet 13 and the product fluid outlet 14 are arranged proximate to the first end portion 11. Preferably, the feed fluid

inlet 13 and the product fluid outlet 14 define an inlet and outlet direction A-A perpendicular to longitudinal direction.

Advantageously, the arrangement of the feed fluid inlet 13 and the product fluid outlet 14 at the same end portion simplifies the hydraulic connections of the electrolyzer 1 to the plant/system and/or to other electrolyzers.

The electrolyzer 1 comprises two or more electrolytic cells 20 connected fluidically between the feed fluid inlet 13 and the product fluid outlet 14 within the housing 10. The electrolytic cells 20 are configured to electrolyze saline water entering the housing 10 to produce an electrolyzed fluid comprising hydrogen, hypochlorite and saline water. Namely, as previously reported, the electrolytic cells 20 causes the electrolysis of the saline water flowing within the housing 10 from the feed fluid inlet 13 to the feed fluid outlet 14. It is to be noted that, the concentration of saline water gradually decreases with the production of the hydrogen and hypochlorite from the feed fluid inlet 13 to the feed fluid outlet 14. Preferably, the saline water at the feed fluid outlet 14 can be in traces with respect to the other products.

Each electrolytic cell 20 comprises an anode 21 and a cathode 22. Preferably, the electrolyte solution instead is the saline water.

The housing 10 comprises an inner wall 30 extending from the first end portion 11 towards the second end portion 12. Namely, the inner wall 30 extends along the longitudinal direction X-X between the first end portion 11 and an intermediate portion 7 arranged between the first and second end portion 11, 12.

The inner wall 30 divides at least a portion of the housing 10 in an inlet channel 15 and an outlet channel 16 respectively associated to the feed fluid inlet 13 and to the product fluid outlet 14.

Preferably, the inlet and outlet direction A-A is perpendicular to the inner
5 wall 30.

The housing 10 comprises a diverting channel 40 at the second end portion 12 configured to divert the electrolyzed fluid from the inlet channel 15 to the outlet channel 16. It is to be noted that the inner wall 30 defines a space at the second end portion 12 wherein the diverting channel 40 is defined. Namely, the diverting
10 channel 40 connects the inlet channel 15 and the outlet channel 16 within the housing 10 extending longitudinally from the intermediate portion 7 to the second end portion 12.

It is to be noted that, the two or more electrolytic cells 20 are arranged along the inlet channel 15, the outlet channel 16 and the diverting channel 40. In this way,
15 the saline water and the electrolyzed fluid follow through the electrolytic cells 20.

Namely, the inlet channel 15, the outlet channel 16 and the diverting channel 40 define a path P inside the housing 10 from the feed fluid inlet 13 to the product fluid outlet 14 to channel the electrolyzed fluid. The path P is indicated in figure 1 with black dashed arrows.

20 Thanks to the inlet channel 15, the outlet channel 16 and the diverting channel 40, the saline water and electrolyzed fluid flow within the housing 10 following the path P through the electrolytic cells 20.

According to one embodiment, the electrolyzer 1 comprises a first electrode 2 and a second electrode 3 defining the cathode 22 of one electrolytic cell 20 and the

anode 21 of another electrolytic cell 20. Preferably, the cathode 22 is associated to the inlet channel 15 and the anode 21 is associated to the outlet channel 16. Namely, the first and second electrode 2, 3 are associated to the first end portion 11 preferably at the first base 17. Such first and second electrode 2, 3 are electrically powered by a
5 power unit.

Preferably, the first and second electrode 2, 3 are separated by the inner wall 30. More preferably, the first and second electrode 2, 3 are spaced apart along a transversal direction Z-Z perpendicular to the longitudinal direction X-X. Preferably, the transversal direction Z-Z is parallel to the inlet and outlet direction A-A.

10 According to one embodiment, the first electrode 2 and the second electrode 3 comprise respectively cathodic and anodic plates 4, 5 perpendicular to the inner wall 30 and mutually spaced apart along a spacing direction Y-Y perpendicular to the longitudinal direction X-X. Namely, each cathodic and anodic plate 4, 5 defines a relative developing plane and the spacing direction Y-Y is perpendicular to such
15 developing plane. Preferably, the cathodic and anodic plates 4, 5 extend along the longitudinal direction X-X in the first end portion 11 from the first base 17 towards the second end portion 12. Respectively the cathodic plates 4 are arranged in the inlet channel 15 and the anodic plates 5 are arranged in the in the outlet channel 16.

Preferably, the cathodic and anodic plates 4, 5 are substantially parallel to the
20 inlet and outlet direction A-A to simplify the inlet of the fluid and the outlet of the fluid.

In the following, it will be referred to bipolar plates. It is worth noting that each bipolar plate comprises a support having two opposed first and second surfaces. A cathodic area and an anodic area are defined on each first and second surface.

Preferably, the cathodic and anodic areas on the first surface respectively correspond to the cathodic and anodic areas on the second surface. Namely, each bipolar plate comprises a first and second activable material respectively at the cathodic and anodic area such that an anode electrically connected at cathodic area activate the
5 first material defining a relative cathode at such area and a cathode electrically connected at the anodic area activate the second material defining a relative anode at such area. For example, the first material and second material can be titanium Grade 1 with the anodic portion with catalytic coating.

According to one embodiment, the electrolyzer 1 comprises at least one first
10 group of bipolar plates 50 arranged at least in part in the diverting channel 40, preferably totally. The first group of bipolar plates 50 comprises first bipolar plates 51 parallel to the cathodic and anodic plates 4, 5 and mutually spaced apart along the spacing direction Y-Y. Namely, also in the present case each first bipolar plates 51 defines relative developing planes and the spacing direction Y-Y is perpendicular to
15 such developing planes. Preferably, first bipolar plates 51 are parallel to the anodic and cathodic plates 4, 5. It is to be noted that the first bipolar plates 51 are configured to electrically connect the cathodic and anodic plates 4, 5.

According to one embodiment, not shown in the figure, the first bipolar plates 51 are interleaved with the cathodic and anodic plates 4, 5 defining at least two
20 electrolytic cells 20 with the cathodic and anodic plates 4, 5.

According to one embodiment, the electrolyzer 1 comprises one or more second groups of bipolar plates 60 spacingly interleaved each other along the inlet channel 15 and outlet channel 16 between the first and second electrode 2, 3. Namely, each second group of bipolar plates 60 comprises second bipolar plates 61

parallel to first bipolar plates 51 and mutually spaced apart along the spacing direction Y-Y. Namely, also in the present case each second bipolar plates 61 defines relative developing planes and the spacing direction Y-Y is perpendicular to such developing planes. Preferably, second bipolar plates 61 are parallel to the anodic and cathodic plates 4, 5 and to the first bipolar plates 51.

It is worth noting that the second group of bipolar plates 60 are mutually spaced apart along the inlet channel 15 and outlet channel 16 and at least a portion of the relative second bipolar plates 61 are interleaved with the second bipolar plates 61 of adjacent second group of bipolar plates 60 and/or with the anodic and cathodic plates 4, 5 and with the first bipolar plates 51, as shown in the figures.

It is to be noted that the first groups of bipolar plates 51 together with the first and second electrodes 2, 3 and with second groups of bipolar plates 61 define the electrolytic cells 20.

Preferably, the at least one first group of bipolar plates 50 is interleaved with at least one second group of bipolar plates 60 arranged along the inlet channel 15 and with at least one second group of bipolar plates 60 arranged along the outlet channel 16. Namely, the first bipolar plates 51 are interleaved with second bipolar plates 61 of one group of the second bipolar plate 60 associated to the inlet channel 15 and with second bipolar plates 61 of one group of the second bipolar plate 60 associated to the outlet channel 16.

Preferably, the bipolar plates 51, 61, cathodic plates 4 and anodic plates 5 define gaps 70 therebetween along which the electrolyzed fluid is channelled from the feed fluid inlet 13 and to the product fluid outlet 14.

According to one embodiment, the housing 10 comprises first and second supporting walls 81, 82 extending along the longitudinal direction X-X between the first and second end portion 11, 12. Preferably, the first and second supporting walls 81, 82 are perpendicular to the inner wall 30 and are spaced apart along the spacing
5 direction Y-Y. Namely, the first and second supporting walls 81, 82 develop along a plane perpendicular to a plane defined by the inner wall.

It is to be noted that, the first and second supporting walls 81, 82 develop along the transversal direction Z-Z between opposed edges 81a, 81b, 82a, 82b associated to the inner surface 10a of the housing 10, namely of the lateral wall 19.
10 In details, the opposed edges 81a, 82a, 81b, 82b identify therebetween first connecting portions 83, 84 on the inner surface 10a which are opposed with respect to the inner wall 30. The opposed edges 81a, 82a, 81b, 82b also identify second connecting portions 85, 86 on the inner surface 10a complementary to the first connecting portions 83, 84.

15 It is worth noting that the first and second supporting walls 81, 82 longitudinally extends between relative base edges 81c, 82c, 81d, 82d respectively associated to the first and second bases 17, 18.

According to one embodiment, the first and second supporting walls 81, 82 can comprise semi-walls 88 mutually connected at the diverting channel 40 and
20 mutually connected by means of the inner wall 30 in the inlet and outlet channels 15, 16. Namely, semi-walls 88 extend substantially from a middle area between opposed edges 81a, 81b, 82a, 82b to the relative edges 81a, 81b, 82a, 82b splitting the first and second supporting walls 81, 82 substantially in the middle. It is to be noted that

such semi-wall 88 are coupled in the diverting channel 40 and are coupled to the inner wall in the inlet and outlet channels 15, 16.

The first and second support walls 81, 82 defining therebetween seats 90 for the electrolytic cells 20. Furthermore, the first and second support walls 81, 82 are
5 configured to support the first and second bipolar plates 51, 61.

Preferably, the first and second supporting walls 81, 82 comprise support elements 120 configured to firmly retain the first and second bipolar plates 51, 61 to the first and second supporting walls 81, 82 and to each other defining the gaps 70 spacing the first and second bipolar plates 51, 61 along the spacing direction Y-Y.

10 It is to be noted that the first and the second supporting walls 81, 82 delimit together with first connecting portion portions 83, 84 of the lateral wall 19 the inlet and outlet channel 15, 16 as well as the diverting channel 40 such that saline water and electrolyzed fluid flow therein from the feed fluid inlet 13 to the product fluid outlet 14.

15 In this way the fluid follows along the path P in the housing 10 forced between the first and second supporting walls 81, 82 and the first connecting portion portions 83, 84 wherein the electrolytic cells 20 are arranged.

It is worth noting that the first and the second supporting walls 81, 82, the second connecting portions 85, 86 and the inner wall 30 respectively define
20 therebetween a fillable volume 87 with fluid such as saline water, electrolyzed fluid or a mixing of them. The fillable volume 87 is configured to manage overpressure and correctly distribute the stress on the housing 10 as well as to provide stability to the housing 10.

According to one embodiment, the inner wall 30, the second supporting walls 81, 82 and the connecting portions 83, 84, the first base 17 and second base 18 define therebetween the inlet and outlet channels 15, 16 and the diverting channel 40.

According to one embodiment, the electrolyzer 1 comprises a diverting wall 100 proximate to the second end portion 12 and configured to divert electrolyzed fluid from the inlet channel 15 to the outlet channel 16. Preferably, the first and second supporting walls 81, 82 and at least a portion of the housing 1 at the second end portion 12 define the diverting channel 40. Namely, the diverting channel longitudinally extended between the intermediate portion 7 and the second end portion 12 and along the spacing direction Y-Y between the first connecting portion 83, 84. Preferably, the diverting wall 100 is arranged in the second end portion 12 reducing pressure drop on the flow passing from the inlet to the outlet channel 15, 16.

According to one embodiment, the housing 10 comprises first and second support frames 111, 112 mutually spaced apart along the longitudinal direction X-X and perpendicular to the inner wall 30 and respectively to the first and second supporting walls 81, 82. Namely, the first and second support frames 111, 112 are configured to connect the inner wall 30 and the first and second support walls 81, 82 to the inner surface of the housing 10a, namely to the lateral wall 19.

It is further object of the present invention electrolyzer assembly for electrolyzing saline water. The assembly comprises two or more electrolyzers 1 as above described arranged in series one subsequent to the other. Namely, the electrolyzers 1 are fluidically connected one to the other connecting the product fluid outlet 14 of an electrolyzer to the feed fluid inlet 13 of the subsequent electrolyzer.

It is further object of the present invention an electrolyzer system for electrolyzing saline water. The system comprises one or more electrolyzers 1 as above described fluidically connected in series. The system further comprises a pump unit configured to pipe the saline water to the one or more electrolyzers 1.

5 Preferably, the pump unit is configured to maintain pressure of the fluid in the one or more electrolyzers 1 in a specific pressure range for a continuous flow of the fluid. The range can be comprised between 1-10 bar, preferably 2-8 bar, more preferably 3-5 bar. The system further comprises a power source configured to supply electric power to the electrolytic cells 20. Namely, the power source is electrically connected

10 to the electrodes 2, 3 and to the bipolar plats 51, 61 through the electrolytic fluid.

It is further object of the present invention a process of electrolysis of saline water carried out in an electrolyzer 1 as above described. It is to be noted that the process can be carried out also in the assembly wherein the electrolyzers 1 are connected in series.

15 The process comprises the step a) of introducing saline water into the housing 10 through the feed fluid inlet 13. It is to be noted that in the case of an electrolyzers 1 connected in series with a previous one, during step a) electrolyzed fluid is introduced into the housing 10 through the feed fluid outlet 14.

The process comprises the step b) of electrolyzing through the one or more

20 electrolytic cells 20 electrized saline water along the inlet channel 14, the diverting channel 30 and the outlet channel 15 to generate hypochlorite and hydrogen and producing an electrolyzed fluid comprising hypochlorite, hydrogen and saline water.

The process comprises the step c) of guiding during electrolyzing the electrolyzed fluid along the inlet channel 15, the diverting channel 16 and the outlet

channel 16 from the feed fluid inlet 13 to the product fluid outlet 14. It is to be noted that the step c) is carried out within the housing 10 along the path P. Namely, the fluid is channelled from the feed fluid inlet 13 to the product fluid outlet 14 between the supporting walls 81, 82, the first connecting portions 83, 84.

5 The process comprises the d) of ejecting from the housing 10 at least hypochlorite and hydrogen through feed product outlet 16.

 Preferably the pressure during the steps a)-d) is in a range 1-10 bar, preferably 2-8 bar and more preferably 3-5 bar.

 More preferably, the steps a)-d) are carried out in continuous way.

10

CLAIMS

1. An electrolyzer (1) for electrolyzing saline water comprising:

- a housing (10) extending along a longitudinal direction (X-X) between a first end portion (11) and an opposed second end portion (12) and having a feed fluid inlet (13) and a product fluid outlet (14);

- two or more electrolytic cells (20) connected fluidically between the feed fluid inlet (13) and the product fluid outlet (14) and configured to electrolyze saline water entering the housing (10) to produce an electrolyzed fluid comprising hydrogen, hypochlorite and saline water; each electrolytic cell (20) comprising an anode (21) and a cathode (22);

characterized in that the housing (10) comprises:

- an inner wall (30) extending from the first end portion (11) towards the second end portion (12) along the longitudinal direction (X-X) and dividing at least a portion of the housing (10) in an inlet channel (15) and an outlet channel (16) respectively associated to the feed fluid inlet (13) and to the product fluid outlet (14);

- a diverting channel (40) at the second end portion (12) configured to divert the electrolyzed fluid from the inlet channel (15) to the outlet channel (16), the two or more electrolytic cells (20) being arranged along the inlet channel (15), the outlet channel (16) and the diverting channel (40).

2. The electrolyzer (1) according to claim 1, wherein the inlet channel (15), the outlet channel (16) and the diverting channel (40) define a path (P) inside the housing (10) from the feed fluid inlet (13) to the product fluid outlet (14) to channel the electrolyzed fluid.

3. The electrolyzer (1) according to claim 1 or 2, further comprising a first electrode (2) and a second electrode (3) defining the cathode (22) of one electrolytic cell (20) and the anode(21) of another electrolytic cell (20).

5 4. The electrolyzer (1) according to claim 3, wherein the first and second electrodes (2, 3) are spaced apart along a transversal direction (Z-Z) perpendicular to the longitudinal direction (X-X) and are arranged at the first end portion (11).

5. The electrolyzer (1) according to claim 3 or 4, wherein the first electrode (2) and
10 the second electrode (3) comprise respectively cathodic and anodic plates (4, 5) perpendicular to the inner wall (30) and mutually spaced apart along a spacing direction (Y-Y) perpendicular to the longitudinal direction (X-X).

6. The electrolyzer (1) according to claim 5, further comprising:
15 - at least one first group of bipolar plates (50) arranged at least in part in the diverting channel (40), the first group of bipolar plates (50) comprising first bipolar plates (51) parallel to the cathodic and anodic plates (4, 5) and mutually spaced apart along the spacing direction (Y-Y), the first bipolar plates (51) being configured to electrically connect the cathodic and anodic plates (4, 5).

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7. The electrolyzer (1) according to claim 6, further comprising:
- one or more second groups of bipolar plates (60) spacingly interleaved each other along the inlet channel (15) and outlet channel (16) between the first and second electrode (2, 3), each second group of bipolar plates (60) comprising second bipolar
25 plates (61) parallel to first bipolar plates (51) and mutually spaced apart along the

spacing direction (Y-Y), the first groups of bipolar plates (51) together with the first and second electrode (2, 3) and with second group of bipolar plates (61) defining the electrolytic cells (20), the first group of bipolar plates (50) being interleaved with at least one second bipolar plates (60) arranged along the inlet channel (15) and with at
5 least one second bipolar plates (60) arranged along the outlet channel (16).

8. The electrolyzer (1) according to claim 7, wherein the bipolar plates (51, 61), the cathodic plates (4) and the anodic plates (5) define gaps (70) therebetween along which the electrolyzed fluid is channelled from the feed fluid inlet (13) and to the
10 product fluid outlet (14).

9. The electrolyzer (1) according to claim 7 or 8 , wherein the housing (10) comprises first and second supporting walls (81, 82) extending along the longitudinal direction (X-X) between the first and second end portion (11, 12), the first and
15 second supporting walls (81, 82) being perpendicular to the inner wall (30) and being spaced apart along the spacing direction (Y-Y), the first and second supporting walls (81, 82) developing between opposed edges (81a, 82a) associated to an inner surface (10a) of the housing (10), the first and second support walls (81, 82) defining therebetween seats (90) for the electrolytic cells (20) and being configured to support
20 the first and bipolar plates (51, 61).

10. The electrolyzer (1) according to claim 9, further comprising:

- a diverting wall (100) proximate to the second end portion (12) and configured to divert electrolyzed fluid from the inlet channel (15) to the outlet channel (16);

- the diverting wall (100), the first and second supporting walls (81, 82) and at least a portion of the housing (10) at the second end portion (12) defining the diverting channel (40).

5 **11.** The electrolyzer (1) according to claim 10, wherein the housing (10) comprises first and second support frames (111, 112) mutually spaced apart along the longitudinal direction (X-X) and perpendicular to the inner wall (30) and respectively to the first and second supporting wall (81, 82), the first and second support frame (111, 112) be configured to connect the inner wall (30) and the first and second
10 support wall (81, 82) to the inner surface of the housing (10a).

12. The electrolyzer (1) according to any claims 1 to 11, wherein the feed fluid inlet (13) and the product fluid outlet (14) are arranged proximate to the first end portion (11) and define an inlet and outlet direction (A-A) perpendicular to the inner wall
15 (30).

13. An electrolyzer assembly for electrolyzing saline water comprising
- two or more electrolyzers (1) according to any claims 1 to 12 arranged in series one subsequent to the other fluidically connecting the product fluid outlet (13) of an
20 electrolyzer to the feed fluid inlet (14) of the subsequent electrolyzer.

14. An electrolyzer system for electrolyzing saline water comprising:
- one or more electrolyzers (1) according to any claims 1 to 12 fluidically connected in series;

- a pump unit configured to pipe the saline water to the one or more electrolyzers (1) and to maintain pressure of the fluid in the one or more electrolyzers (1) in a range of 1-10 bar, preferably 2-8 bar, more preferably 3-5 bar;
- a power source configured to supply electric power to the electrolytic cells (20)

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15. A process of electrolysis of saline water carried out in an electrolyzer according to any claims 1-12, the process comprising the step of:

- a) introducing saline water into the housing (10) through the feed fluid inlet (13);
- b) electrolyzing through the one or more electrolytic cells (20) electrized saline water
10 along the inlet channel (15), the diverting channel (40) and the outlet channel (30) to generate hypochlorite and hydrogen and producing an electrolyzed fluid comprising hypochlorite, hydrogen and saline water;
- c) guiding during electrolyzing the electrolyzed fluid along the inlet channel (15), the diverting channel (40) and the outlet channel (16) from the feed fluid inlet (13) to the
15 feed product outlet (14);
- d) ejecting from the housing (10) at least hypochlorite and hydrogen through feed product outlet (14).

16. The process according to claim 15, wherein the pressure during the steps a)-d) is
20 in a range 1-10 bar, preferably 2-8 bar, more preferably 3-5 bar.