SANILEC®

FOR HIGH ACCURACY USE OR WITH HIGH VISCOSITY FLUIDS

For more than 35 years, De Nora Water Technologies has offered seawater electrochlorination systems to economically and safely produce a powerful biocide and disinfecting agent for marine, offshore and industrial applications. De Nora Water Technologies is the world leader in the supply of equipment for seawater electrochlorination with more than 400 installations in 60 countries, producing more than 1.3 million kilograms per day of sodium hypochlorite from seawater and representing more than 65% percent of the world capacity for this type of technology.The SANILEC® and SEACLOR® seawater electrochlorination systems use a simple and straight forward electrochlorination process, combining two common consumables (seawater and electricity) to generate a disinfecting agent. Seawater electrochlorination eliminates the storage, handling and purchase of hazardous chemicals.

SANILEC® FEATURES & BENEFITS

SANILEC systems are the standard and preferred electrochlorination system for biofouling control in offshore and marine biofouling control as well as power and coastal applications. SANILEC systems range in capacity from 2.8 to 47,620 lb/day (1.2 to 21,600 kg/day), per train. Higher capacity can be achieved by adding trains.

Superior Design

- Optimum cell design — not too big or too small
- Minimal operation and maintenance requirements
- Once-through flow design eliminating recycle requirements
- Use of corrosion-resistant materials of construction
- Customized layout and supply to meet site-specific requirements
- Guaranteed lowest power consumption

Safety

- Low-strength sodium hypochlorite solution is non-hazardous, safe and easy to handle
- Systems designed for low voltage requirements: less than 50 volts DC
- Automatic operation eliminating the potential for operator error
- Designed for hazardous areas, i.e. ATEX, IEC Ex, Class 1, Div 2, if required
- Safe hydrogen removal process

Service

- Installation and construction consultation available
- Experienced service staff for start-up and commissioning
- Maintenance and service agreements available
- Single source for supply of spare parts
- Training services available
- Pre-project consultation available for budgetary capital estimates, project feasibility studies, equipment selection and specification and proposal evaluation

Reliability

- Active life of the DSA® anode is guaranteed
- Anodes can be recoated
- Long operating life with minimal downtime
- Control system ensures proper and safe operation
- Eliminates dependence on chemical suppliers

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SANILEC® APPLICATIONS

SANILEC systems take full advantage of our knowledge and experience in the design of offshore skid-mounted units, with strenuous area classification requirements. These systems generate sodium hypochlorite from seawater using an extensively field-proven electrochemical process suited for biofouling control in water flood, cooling water and fire water loops. SANILEC systems are also designed for industrial power and coastal biofouling control applications.

FIRE WATER SYSTEMS

For Use on Pump Caisson and Loop Antifouling

Biofouling, when mussels and algae restrict the intake to firewater and jockey pumps, must be considered by offshore facilities using seawater for their firewater systems so that these restrictions in flow do not compromise the performance of the vital safety equipment. De Nora Water Technologies offers skid-mounted systems that provide a shock dose of sodium hypochlorite at set intervals to the firewater pump caisson and a continuous does of sodium hypochlorite to the jockey pump caisson. This shock dose keeps the firewater pump caissons clean and free from macrofouling while also ensuring the firewater main loop is algae and slime free.

COOLING WATER

For Use on Vessels, Oil & Gas Facilities and Seachest

In applications where seawater is used for cooling, biofouling or the buildup of marine growth reduces the system efficiency, increases the frequency of system maintenance and decreases the life of process equipment. De Nora Water Technologies offers a skid-mounted system that receives pressurized seawater and produces sodium hypochlorite at a concentration of 40 to 1660 ppm that can then be injected, at any point, within the vessel to control marine growth. The product can be varied 0 to 100 percent to maintain the desired residual.

For Use at Power Plants and Industrial Complexes

Open-loop seawater cooling is a widely-accepted practice for providing cooling water to a power plant. Cooling towers are typically used when the distance from the sea to the power plant is so great that the cost of pumping is prohibitive. Seawater is used for make-up water. Sodium hypochlorite is injected at the intake structure and the intake basin to control biological growth.

For Use at Coastal or Inland Thermal Power Stations

Coastal or inland thermal power stations powered by nuclear energy or fossil fuel typically use seawater as a coolant in steam condensers. Controlling the fouling of the steam condensers in once-through cooling water systems can greatly increase the efficiency of power generation. Sodium hypochlorite is introduced into seawater intake of a power station to prevent fouling of the mechanical equipment, such as the seawater circulating pumps, bar screens and drum screens of the power station.

WATER FLOOD SYSTEMS

For Use on Oil and Gas Product

In a typical water flood package sodium hypochlorite is used to restrict marine growth in the seachest, condenser, heat exchanger and downhole. Reduced marine growth in the condenser and heat exchanger can increase efficiency and significantly reduce the requirement for maintenance. Sodium hypochlorite injected with the seawater in downhole applications can prevent slime and marine growth in the oil bearing substrate.

SANILEC® PROCESS DESCRIPTION

Pressurized seawater is delivered to the SANILEC system where it is strained to 0.8 mm to remove suspended solids. The seawater passes through a flow control assembly, which may include a flow control valve, and a flow transmitter with local indication and low flow shut down protection.

The seawater then passes through the electrolyzer cells and exits the cell as sodium hypochlorite solution and byproduct hydrogen gas. The solution is piped to a tank or cyclone where hydrogen is removed from the solution. The hydrogen is typically diluted with air using a set of redundant blowers to a safe level (typically less than 1%). Finally, the sodium hypochlorite solution is injected at required continuous and shock-dose rates.

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The process is based on the electrolysis of seawater as it flows through an unseparated electrolytic cell. The resulting solution exiting the cell is a mixture of seawater, hypochlorite, and hypochlorous acid. Electrolysis of sodium chloride solution (seawater) is the passage of direct current between an anode (positive pole) and a cathode (negative pole) to separate salt and water into their basic elements. Chlorine generated at the anode immediately goes through chemical reactions to form hypochlorite and hypochlorous acid. Hydrogen and hydroxide are formed at the cathode, the hydrogen forms a gas and the hydroxide aids in the formation of hypochlorite and increases the exit stream pH to approximately 8.5.

This overall chemical reaction can be expressed as follows: Salt + Water + Energy -> Sodium Hypochlorite + Hydrogen $NaCl + H2O + 2e \rightarrow NaClO + H2$

Product Characteristics

In chemical literature, hypochlorite concentrations are commonly referred to in terms of available or active chlorine (e.g. the quantity of chlorine having the same oxidizing effect as the hypochlorite, when analyzed by standard methods).

The available chlorine concentration in hypochlorite solutions produced by SANILEC systems is in the range of 1000 to
2500 ppm.

Producing sodium hypochlorite on site makes it possible to shockdose while storing a minimal amount of chemicals. Each shock treatment administered at regularly spaced intervals during the day, must correspond to the renewal of the hypochlorite solution in the storage tank. Long storage periods, such as two days or more, should not be considered as a design criteria.

Byproducts

Hydrogen gas is produced in the electrolyzer at the rate of about 0.35m3/kg chlorine. Dilution of hydrogen with air is effected in order to reduce the hydrogen concentration to less than 2 percent (v/v) immediately as it disengages from the liquid effluent in the hypochlorite collecting tank. In fact, the release of hydrogen to the atmosphere as an undiluted gas may create hazardous conditions.

SANILEC® PRODUCT OFFERING

Electrolyzer cell

- No hydrogen separation equipment
- Visual flow indicator PVC piping and valves
- Transformer
- Control/Rectifier Panel: PLC (AB1200), MMI (AB300), rectifier circuit, main circuit breaker, main contactor, no motor starters, seawater cooled rectifier, NEMA 4X enclosure

Area Classification

- ATEX, IEC Ex, Class 1, Div 2, Group C/D rated

Hydrogen Options

- Pressurized cyclone blower
- Atmospheric tank degas pump

Capacity Dosing Options

- 2 x 100% Trains
- 2 x 50% Trains

Inlet Options

- Cu/Ni inlet piping
- High pressure regulator
- Duplex basket strainer
- Automatic on/off valve
- Flow transmitter
- Pressure Indicator, 4 ½”
- CPVC piping and valves
- FRP piping

Outlet Options

- Cyclone
- Vent stack
- Blowers
- Degas tank
- Dosing pumps
- Level control valve
- Dosing header (x4)

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HMA INSTRUMENTATION

Control/Rectifier Panel Options

- Air cooled rectifier
- NEMA 3R enclosure
- NEMA 7 enclosure
- PLC (AB-SLC5/04)
- MMI
- Blower motor starters
- Dosing pump motor starters

General Options

- Custom painting
- Chemical cleaning system
- Skid coaming
- Severe temperature rating
- Sunshield

Systems Ratings

Model	Amount of seawater to be treated @ 2ppm	Amount of seawater to be treated @ 0.5 ppm	System output rating		Seawater flow rate	Max C_{l2}	Rectifier Output		AC Power Usage for Electrolyzer
	m^3/h	m^3/h	kg/h	lbs/day	m^3/h	ppm	DC Amps	DC Volts	AC kVA
SC-2	28	112	0.05	2.8	1.4	40	20	14	0.6
SC-5	56	224	1.10	5.6	1.4	80	20	28	1.2
SC-8	84	336	1.16	8.4	1.4	120	20	42	1.8
SC-12	112	448	0.22	12	5.6	40	100	14	2.5
SC-24	227	907	0.5	24	5.6	80	200	14	5
SC-48	454	1815	0.9	48	5.6	160	200	28	10
SC-72	681	2722	1.4	72	5.6	240	200	42	15
SC-96	907	3629	1.8	96	5.6	320	200	56	21
SC-120	1134	4537	2.3	120	5.6	400	200	70	26
SC-144	1361	5444	2.7	144	5.6	480	200	84	31
SC-192	1815	7259	3.6	192	5.6	640	400	56	41
SC-240	2268	9074	4.5	240	5.6	800	400	70	51
SC-288	2722	10,888	5.4	288	5.6	960	400	84	62
SC-384	3629	14,518	7.3	384	11.63	640	800	56	82
SC-480	4537	18,147	9.1	480	11.3	800	800	70	103
SC-576	5444	21,777	10.9	576	11.3	960	800	84	123
SC-768	7259	29,036	14.5	768	22.7	640	1600	56	165
SC-960	9074	36,295	18.1	960	22.7	800	1600	70	206
SC-1200	11,342	45,369	22.7	1200	22.7	830	5500	18	182
SC-1800	17,013	68,053	34.0	1800	22.7	1250	5500	27	273
SC-2400	22,684	90,737	45.4	2400	22.7	1660	5500	36	364

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