205 Webster Street
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Integrated Chlorine Dioxide Onsite Supply System

Background

There are several methods for the supply of chlorine dioxide in small quantities (less than 6lbs/day). The most common are:

- the supply of two or more chemicals which are mixed with water close to the point of use and then injected into the use point
- the supply of a ready to use solution of chlorine dioxide in water
- an onsite generator which reacts two or more chemicals at a location close to the use point to generate chlorine dioxide in a continuous stream to the use point.

The first two methods result in a chlorine dioxide supply that costs between $100 and $1000 per contained pound of chlorine dioxide depending on the logistics and supply chain for the chemicals. The third method results in a chlorine dioxide supply that costs between $10 and $100 per contained pound of chlorine dioxide depending on the amortization and utilization of the capital equipment involved. The higher the utilization rate, the lower the cost.

The onsite generator is generally the most cost effective method of delivery when the requirement is for full time or nearly full time supply of a uniform quantity of chlorine dioxide. But onsite generators suffer from difficulties associated with operating reliability. They are prone to "drifting" in production rate and concentration; they can sometimes shut down from mechanical failure or power outages; and they require maintenance that can be demanded at irregular intervals. All of this can add cost and limit the use of generators due to concern about their reliability.

The Solution

These problems can be overcome through the use of an integrated system ("System") which combines the use of a chlorine dioxide generator ("Generator") with the supply of *CDG Solution 3000,* a stable, transportable storage and delivery vehicle for chlorine dioxide.

The System consists of the Generator, which serves as the primary source of supply for chlorine dioxide; one or more sensors which measure the chlorine dioxide content of the output of the system; one or more containers of Solution connected downstream of the Generator and upstream of the sensor(s); and an electronic control system that meters the Solution into the product stream whenever the Generator is not operating or is producing chlorine dioxide at less than the desired concentration.

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The advantage of this System is that it can supply chlorine dioxide reliably at either a constant or variable level of output at a lower total cost than either an onsite generator or the Solution alone. It can be serviced at normal intervals thereby reducing operation costs. The customer is assured of a consistent supply of product. The Generator can be sized for the average flow rate required rather than peak demand (since the Solution can supplement supply for peak demands) thereby lowering the capital cost for the Generator. The amount of Solution specified for a specific installation can be tailored to the specific load variability, peak demands, and on-stream reliability needed for the particular installation.

Invention Description

Referring to Figure 1 below, two or more chemicals are fed into a chlorine dioxide generator (the diagram shows three chemicals, but there may be as few as two or as many as five). Processes for generating chlorine dioxide generally include acidifying an alkali metal chlorite solution and contacting the acidified alkali metal chlorite solution with a solid phase chlorine containing material to produce chlorine dioxide. Such a system generally includes a water source (which is also shown on the diagram) in fluid contact with the acid and the chlorite. There may be other chemistries that are used for the Generator, but the System is agnostic with regard to the technology used to generate chlorine dioxide. There are several suppliers of generators that produce up to 6 pounds per day of chlorine dioxide. Examples include: Halox http://haloxtech.com/PDF/MKT-DOC-0041%20ClO2%20Generation%20and%20Delivery%20Systems.pdf; and Pureline http://pureline.com/pages/products/generators.html.

The quantity of Solution storage depends on the size of the System and the demands for load following and/or on stream uptime. It is likely the storage will be comprised of more than one vessel with automatic level monitoring and switchover so that when one vessel is depleted or near depletion, the System automatically switches to another vessel and alerts the operator to refill or change the depleted vessel.

One or two sensors are part of the System to control to a steady rate of chlorine dioxide injection into the System (Sensor 1) or to control to a steady rate of residual chlorine dioxide dosing in the stream to be treated (Sensor 2). There are several manufacturers of these sensors, but a typical unit would be the type manufactured by Halox http://haloxtech.com/pdf/MKT-DOC-0047MACSystem.pdf. The sensor(s) would communicate with a controller which would ensure a steady flow of chlorine dioxide and by optimizing the source to the lowest cost configuration. Sensor 2 or a third sensor could be located remotely at a location that is expected to see very little residual chlorine dioxide in order to ensure that

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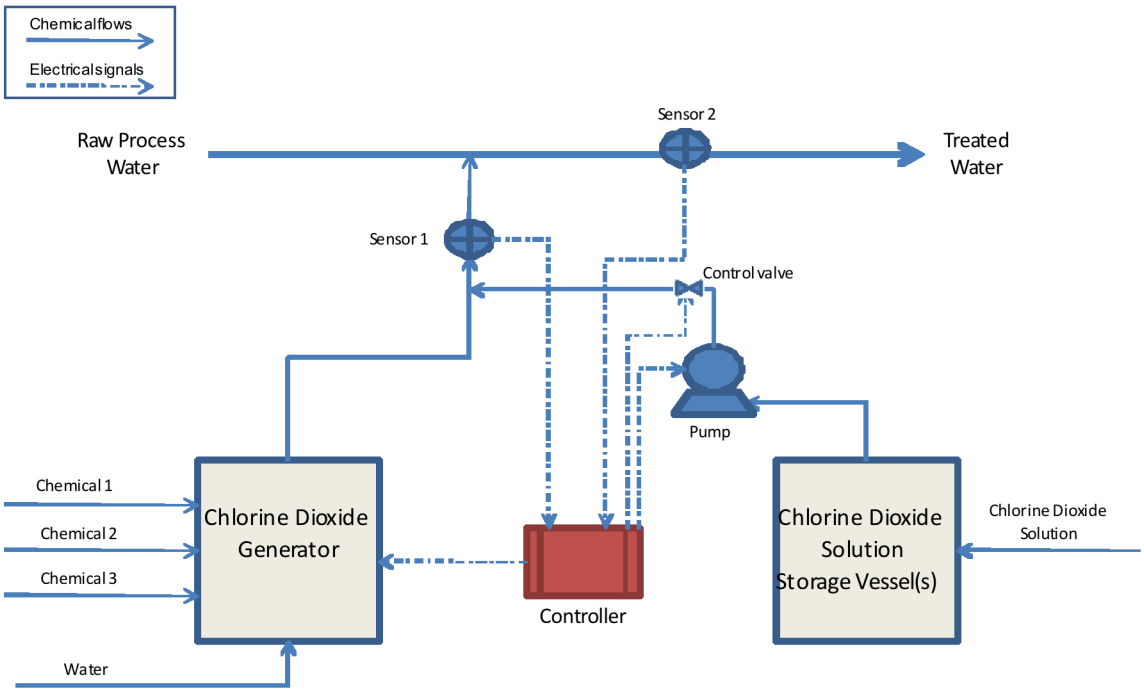
adequate quantities are being injected into the process water such that some amount remains available at the remote monitoring point.

A pump and control valve are used to inject Solution into the product stream at flow rates dictated by the controller.

Under normal operating conditions, the Generator is operating at a steady state and the Solution pump is turned off. When one of the sensors detects a reduction in chlorine dioxide concentration from the predetermined set point, the pump is activated and chlorine dioxide from the Solution vessel is added. The operating conditions of the Generator are simultaneously modified by the control system, enabling the Generator to produce more chlorine dioxide to meet the new conditions. As it does so, the Solution flows are reduced by adjusting the control valve or the pump if it is a dosing control pump; ultimately the pump is shut off when the Generator reaches the desired

Figure 1
Integrated Chlorine Dioxide Onsite Supply System



flow conditions.