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(54) Title: METHOD FOR DETERMINATION OF CHEMICAL IONS

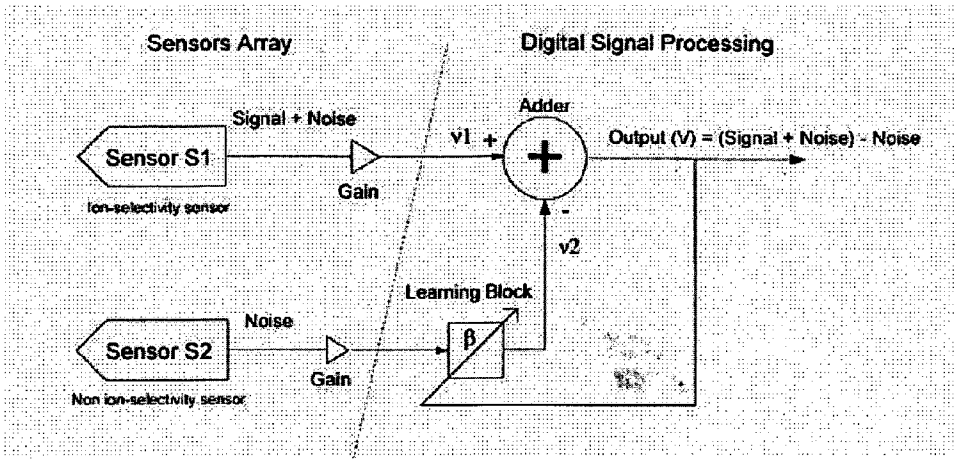

Figure 1

(57) Abstract: The present invention provides a method for reducing and/or eliminating signal interferences from other ions which are produced during detection of a particular chemical ion in a substance, said method comprise of at least two sensors (2,4) whereby at least one sensor is assigned to collect the interfering signals prior to the elimination of unwanted signals process. The method of the present invention leads to improved detection of the desired ion and thus provides real time monitoring of the substance, in particular for soil analysis.

WO 2009/069999 A2

METHOD FOR DETERMINATION OF CHEMICAL IONS

Field of Invention

The present invention relates to the ions detections, more particularly, the invention discloses a method for improving the detection of chemical ions; particularly in relation to soil analysis.

Background of Invention

The chemical sensors for use in the agricultural industry currently are very well known and much has been written about them. Nevertheless, with the rapid growth of various agronomical demands and precision management purposes globally, have inspired the respective innovators to constantly seek and thus create value-added and enhanced chemical sensing methods which are capable of generating a more precise and reliable outcome in regards to soil chemical measurements and analysis.

Formerly, typical methods for measuring nutrients within soil involves arduous steps, whereby soil sampling is a necessity, which is rather time consuming and inconvenient. With the

assistance of chemical sensors or in-field sensors at present, such tribulations can be alleviated. The chemical sensors detects chemical ions in a sample or in-field measurement, comprise of at least a sensing element and components which function to provide measurements and thus convert electrical data obtained from the said sensor or sensing element to a digital signal. As sensors are known in the art to have greater toleration for errors and providing greater overall accuracy, in addition to providing a real-time measurement for users, the usage has been gaining tremendous momentum. At present, the method has been enhanced with the progress of automated sensors, and a wide variation of sensing capability.

Whilst most of the prior art is expedient for users of the industry, users may find such method of measurement is rather inadequate at some degree. An eminent disadvantage is the disturbance of ions or interference of ions during employment of the sensing element within the sample, in particular in soil analysis. In this circumstance, a method that requires a single sensor detects selected ion activities with the presence of different other ions in the soil. Comprehendingly, the single ion detection is disrupted with the existence of other ions activities. The undesired disturbance which are also known as noise of interfering ions, adversely affects the primary ion detection and signature. In many cases, the riot of ions in the

measuring soil produces an extreme level of noises, and thus the retrieval of data is made difficult for users.

In addition to the above, there is a great need for a more efficient and reliable method in monitoring soil pollution with the assistance of chemical sensors. Increasing soil pollution issues has alerted respective organizations to put forward stringent methods to provide effective soil monitoring and thus provide early detection or warning to the public, in particular commercial operators, as they can be notified immediately on any event of soil contamination within the country.

Based on the above, a method for providing accurate and immediate result in relation to soil contamination analysis is essential in order to reduce pollution and its consequences to living things.

In order to prevail over the aforementioned drawback, the present invention has been accomplished in addition to significantly improve the detection of ions within the soil.

It is therefore the primary object of the present invention to provide a method for detection of chemical ions in soil with improved accuracy and devoid of any noise interference.

It is another object of the present invention to provide a method for detection of chemical ions in soil with real-time monitoring

and thus providing swift counteractive action in relation to soil pollution.

It is still further object of the present invention to provide a method of chemical ions detection in soil, said method alleviates the noise interference from other ions within the sample.

In is another object of the present invention to provide a method of chemical ions detection in soil, wherein the method improves the limitation of low immunity in the presence of multiple amounts of chemical ions.

Summary of Invention

The present invention discloses A method for reducing and/or eliminating signal interferences from other ions which are produced during detection of a particular chemical ion in a substance, said method comprise of :

providing a first sensor (2) for detecting the chemical ion and for providing a signal based on the said detection;

providing a second sensor (4) for collecting the interfering signals from other ions within the substance;

providing a digital signal processing means; said digital processing means comprising an adder (6) for combining the signals from the first and second sensors (2,4), and a learning block (8) for providing optimum output;

wherein the first sensor (2) and the second sensor (4) are connected to the digital signal processing means;

wherein the digital signal processing means reduces the interfering signals from other ions within the substance.

Brief Description of the Drawings

The invention will be more understood by reference to the description below taken in conjunction with the accompanying drawings herein:

Fig 1 is a circuit diagram that illustrates the sensor array linked to the digital processing means (DSP) in accordance to the present invention.

Detailed Description of the Invention

In addition to the drawings, further understanding of the object, construction, characteristics and functions of the invention, a

detailed description with reference to the embodiments is given in the following.

The present invention which is designed preferably for detecting chemical species and their concentration levels in soil comprise of a first and second sensor (2, 4) and a digital processing means as shown in Figure 1. Accordingly, the first sensor (2) and the second sensor (4) is coupled to an adder (6), said adder (6) is one of the digital processing (DSP) components.

The method of the present invention further includes an algorithm for eliminating interfering ions.

It is noted that both of first sensor (2) and second sensor (4) encompass the following properties:

a) The first sensor (2) is preferably selective to the respective ion to be detected, however the said sensor (2) is capable of detecting other interfering ions at a lower degree;

b) The second sensor (4) is preferably sensitive to all ions available within the sample.

In principle, the operational view of the method proceeds as follows. The first and second sensors (2, 4) are coupled to the adder (6) which is an essential component of the digital processing means. Suitably, the first sensor (2) is provided for detecting the desired chemical ion activities within the sample, in particular soil, and the second sensor (4) is provided for collecting the undesired signals of other ions activities within the said sample. The collected signal forms part of the noise elimination process which is performed by the digital signal processing (DSP) means.

Still referring to Figure 1, the digital signal processing (DSP) means which can be considered as the intelligence part of the method functions mainly to manipulate the inputs of both sensors (2,4) digitally in order to minimize the noise level or effects in the desired signal. The digital signal processing (DSP) means further comprise of an adder (6) for combination of the signals from sensors (2, 4), and a learning block (8). The signal from the second sensor (4) is sent to the learning block (8) of the digital processing means prior to the adder (6). Suitably, the learning block (8) is a special filter where the coefficients (ß) are updated every cycle of time for obtaining the optimum output, and thus improves the detection of the desired ion tremendously.

Upon employed the method of the present invention the signal from sensor (2) may be contaminated or interfered with other ions signals. Accordingly, both signals from the first sensor (2) and second sensor (4) are added into the noise cancellation process in order to eliminate the undesired noise level.

The formula which is associated with the main principle of the noise cancellation process is as follows:

Output = (Signal + Noise) - ß Noise = Desired Signal

From the aforementioned principle, the negative magnitude eliminates the noise level, and thus results to a more precise or accurate outcome.

It is noted that the noise levels detected by both first and second sensors (2, 4) are independent. With the incorporation of the two sensors array, the removal of interfering ions is achieved; said removal or elimination is based on the following algorithm:

$V\ 1 = a1 + \alpha\Sigma n_1$ is the observed output of the first sensor (2) and;

$V\ 2 = \Sigma\ n_i$ is the other ions total output from the second sensor (4);

Accordingly, the overall output from both sensors (2,4) is therefore:

$V = v\ 1 - ßv2$

$= a1 + \Sigma\ n_1 - ß\Sigma\ n_i;$

(for the purpose of simplification let ß= 1)

$= a1$

Wherein;

a1 is the desired ion for detection;

ß is the adaptive coefficient;

n_i is the other interfering ions;

V is the actual concentration of the chemical ion which is desired by user.

Based on the aforementioned principle, the second sensor (4) which mainly functions to collect the undesired signals together with the digital signal processing (DSP) means play a major role in providing more accurate and precise chemical ion detection method.

With the assistance of rapid mechanism or method of the present invention, the existence of pollutant in soil can be detected immediately and thus prevents the damaging effects of said pollutants to living things.

Although the present invention has been described with reference to the preferred embodiment thereof, it is apparent to those skilled in the art that a variety of modifications and changes may be made without departing from the scope of the present invention which is intended to be defined by the appended claims.

CLAIMS

1. A method for reducing and/or eliminating signal interferences from other ions which are produced during detection of a particular chemical ion in a substance, said method comprise of :

providing a first sensor (2) for detecting the chemical ion and for providing a signal based on the said detection;

providing a second sensor (4) for collecting the interfering signals from other ions within the substance;

providing a digital signal processing means; said digital processing means comprising an adder (6) for combining the signals from the first and second sensors (2,4), and a learning block (8) for providing optimum output;

wherein the first sensor (2) and the second sensor (4) are connected to the digital signal processing means;

wherein the digital signal processing means reduces the interfering signals from other ions within the substance.

2. A method as claimed in Claim 1, wherein the algorithm used for removal of interfering signals is as below:

$$V = v\,1 - ßv2$$

$= a1 + \Sigma n_1 - ß\Sigma n_i;$

(for the purpose of simplification let ß= 1)

$= a1$

Wherein;

a1 is the desired ion for detection;

ß is the adaptive coefficient;

n_i is the other interfering ions;

V is the actual concentration of the chemical ion which is desired by user.

3. A method as claimed in Claim 1 wherein the digital signal processing means digitally manipulates the interfering signals and provides a more accurate output signal.

4. A method as claimed in Claim 1 for use in soil analysis.

5. A method as claimed in Claim 1 wherein the first sensor (2) and the second sensor (4) is connected to the adder (6) of the digital signal processing means.

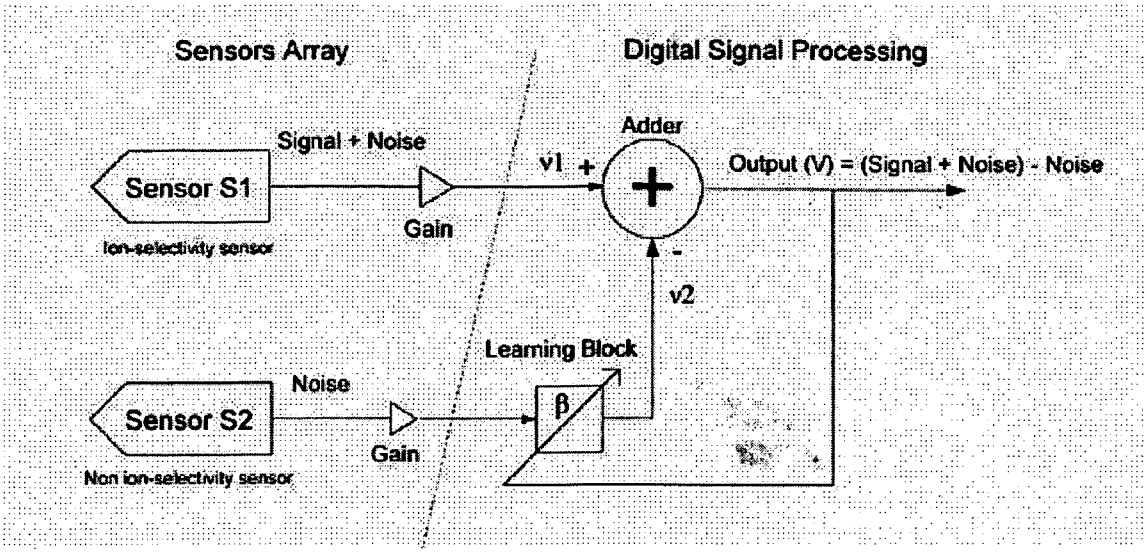
Sensors Array
Digital Signal Processing
Signal + Noise
Sensor S1
Ion-selectivity sensor
Gain
Adder
v1
+
Output (V) = (Signal + Noise) - Noise
-
v2
Learning Block
β
Noise
Sensor S2
Non ion-selectivity sensor
Gain

Figure 1