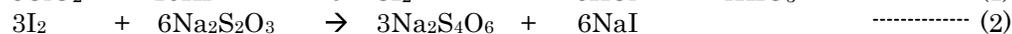


AQUACOUNTER Application Sheet	COM series	DATA No. H10	1st edition
Paper and Pulp		Quantification of chlorine dioxide in pulp bleaching solution	

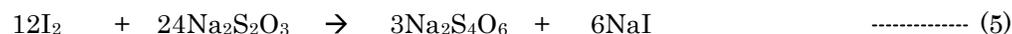
### 1. Measurement outline

Chlorine dioxide is an important chemical solution as the bleaching solution for pulp among the chemical solutions used in pulp industry, and its concentration control is an important process in pulp quality control. The analysis method introduced in this section (see p.I-142 of Loss Prevention Guide, edited by the Chemical Society of Japan) is a method in which chlorine dioxide is titrated successively, and potassium iodide is first added to the sample which has been adjusted to pH8 for titration of the iodine formed by chlorine dioxide with sodium thiosulfate titrant (a mL). Then it is adjusted to be acidic with sulfuric acid for titration of potassium iodate formed by chlorine dioxide with sodium thiosulfate titrant (b mL). This section introduces a measurement example in which total available chlorine, chlorine and chlorine dioxide are titrated successively based on the titration results obtained from 2 inflection points.

- (1) Sample is added to a solution mixing pH8 phosphate buffer and potassium iodide and the iodine formed is titrated with sodium thiosulfate titrant.



- (2) Then it is acidified with sulfuric acid and potassium iodate formed by chlorine dioxide is titrated with sodium thiosulfate.



Based on the titration values a and b to the first and second inflection points above, the concentration of each component is calculated.

$$\text{Total available chlorine (g/L)} = 35.46 \times (a + b) \times f \times M / S$$

$$\text{Chlorine dioxide (g/L)} = 16.86 \times b \times f \times M \times / S$$

$$\text{Chlorine (Cl}_2\text{) (g/L)} = \text{total available chlorine (g/L)} - \text{chlorine dioxide (g/L)} \times 177.3/67.5$$

【f: Titer of titrant M: Concentration of titrant S: Sample collection volume (mL)】

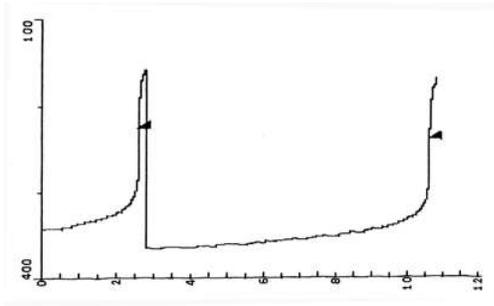
### 2. Reagents and Electrodes

(1) Reagents	Titrant	0.1mol/L sodium thiosulfate titrant
	Loading buffer	25mL of pH8 10% potassium iodide aqueous solution (1/15mol/L potassium dihydrogen phosphate and 1/15mol/L sodium dihydrogen phosphate are mixed) used for 1 measurement 10mL 10% sulfuric acid used for 1 measurement
(2) Electrodes	Indicator electrode	Platinum electrode PT-301 (P/N D231244-A)
	Reference electrode	*Reference electrode RE-201      *standard accessory

**3. Measurement conditions example** (for COM-1600S + 2 units of Buret B-2000-20)

<b>Master File No.1</b>					
<b>Condition file: 1 + 2 + 3 + 4</b>					
<b>Condition file.1</b> (For Disp. Buffer)		<b>Condition file.3</b> ( For Disp. H <sub>2</sub> SO <sub>4</sub> )		<b>Mode No.</b>	3
Method	Disp	Method	Disp	Pre Int	0
Buret No.	1	Buret No.	3	Del K	2
S Timer	0 sec	S Timer	0 sec	Del Sens	0
Disp volume	25 mL	Disp volume	10 mL	Int Time	1
				Int Sens	3
<b>Condition file.2</b> (For 1 <sup>st</sup> End point)		<b>Condition file.4</b> (For 2 <sup>nd</sup> End point)		<b>Brst Speed</b>	2
Method	AUTO	Method	AUTO	Pulse	40
Amp No.	2	Amp No.	2		
Buret No.	2	Buret No.	2		
Meas Unit	mV	Meas Unit	mV		
S Timer	30 sec	S Timer	60 sec		
CP	0 mL	CP	0 mL		
DP	0 mL	DP	0.5 mL		
End Sens	200	End Sens	150		
Over mL	0 mL	Over mL	0 mL		
Max. Vol.	25 mL	Max. Vol.	25 mL		
Mode No.	11	Mode No.	11		
Unit	g/L	Unit	g/L		
Formula	$(K \times (a+b) - 44.31 \times b) \times F \times M/S$	Formula	$(a-B) \times K \times F \times M/S$		
Blank	0	Blank	0		
Factor	Titer of titrant	Factor	Titer of titrant		
Molarity	0.1	Molarity	0.1		
K	35.453	K	16.86		

#### 4. Measurement example



#### Measurement results on chlorine

Sample No.	Sample volume (mL)	Titration value (mL)	Concentration (%)
1	2.0286	2.6097	1.0551
2	2.0286	2.5851	1.0196
3	2.0286	2.5889	1.0289
<b>Avg.</b>			<b>79.8 %</b>
<b>Std. Dev.</b>			<b>0.13 %</b>
<b>C.V.</b>			<b>0.17 %</b>

#### Measurement results on chlorine dioxide

Sample No.	Sample volume (mL)	Titration value (mL)	Concentration (%)
1	2.0286	8.0370	6.6997
2	2.0286	8.0193	6.6849
3	2.0286	8.0133	6.6800
<b>Avg.</b>			<b>24.3 %</b>
<b>Std. Dev.</b>			<b>0.066 %</b>
<b>C.V.</b>			<b>0.27 %</b>

#### 5. Outline

About automation of titration

Since this measurement is a successive titration with 2 inflection points and reagent dispensing operation is implemented at the beginning of titration as well as in the middle, it comprises of complex titration operations. It also applies to concentration calculation. It is possible to be freed from these complex measurement operations and calculations by utilizing the COM series. The titration sequence for this measurement will be dispensing + dispensing + titration (first inflection point) + dispensing + titration (second inflection point). With COM series, such measurement sequence can be easily prepared and executed by connecting the condition files.

#### Key words

Oxidation-reduction titration, chlorine, chlorine dioxide, total available chlorine, successive titration

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