LAMPIRAN 1

PERHITUNGAN KOEFISIEN KORELASI

1. Perhitungan Koefisien Korelasi NO_3

	Konsentrasi (X)	Absorbansi (Y)	X.Y	X^2	Y^2
	0,0000	0,0003	0,0000	0,0000	0,0000
	0,2000	0,0557	0,0111	0,0400	0,0031
	0,5000	0,1307	0,0654	0,2500	0,0171
	1,0000	0,2611	0,2611	1,0000	0,0682
	2,0000	0,5135	1,0270	4,0000	0,2637
	3,0000	0,7723	2,3169	9,0000	0,5964
	4,0000	1,0247	4,0988	16,0000	1,0500
	5,0000	1,2721	6,3605	25,0000	1,6182
Jumlah	15,7000	4,0304	14,1408	55,2900	3,6167
X^2 ; Y^2	246,4900	16,2441			

Intercept (a)	0,00424
Slope (b)	0,25455
Koefisien korelasi (R^2)	0,99996

Slope : $b = \frac{n \sum x.y - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$

$$= \frac{(8\ x\ 14{,}1408) - (15{,}7000\ x\ 4{,}0304)}{(8\ x\ 55{,}2900 - 246{,}4900)} = \frac{49{,}84912}{195{,}83} = 0{,}25455$$

Intercept : $\alpha = \frac{[\sum y - (b \sum x)]}{n}$

$$= \frac{[4{,}0304 - (0{,}25455 \text{ x } 15{,}7000)]}{8}$$

$$= \frac{0{,}033965}{8} = 0{,}004245625 = 0{,}00424$$

Koefisien korelasi : $r = \frac{n \sum xy - \sum x \sum y}{\left(\left|\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}\right|\right)}$

$$r = \frac{(8\ x\ 14{,}1408) - (15{,}7000\ x\ 4{,}0304\ )}{(\sqrt{[8\ x\ 55{,}2900 - 246{,}4900][8\ x\ 3{,}6167 - 16{,}2441]})} = \frac{49{,}84912}{\sqrt{2484{,}98478}} = 0{,}99996$$

2. Perhitungan Koefisien Korelasi NO_2

	Konsentrasi (X)	Absorbansi (Y)	X.Y	X^2	Y^2
	0,0000	0,0000	0,0000	0,0000	0,0000
	0,0050	0,0145	0,0001	0,0000	0,0002
	0,0100	0,0286	0,0003	0,0001	0,0008
	0,0200	0,0586	0,0012	0,0004	0,0034
	0,0500	0,1514	0,0076	0,0025	0,0229
	0,1000	0,3041	0,0304	0,0100	0,0925
	0,2500	0,7617	0,1904	0,0625	0,5802
	0,5000	1,5077	0,7539	0,2500	2,2732
Jumlah	0,9350	2,8266	0,9838	0,3255	2,9732
X^2 ; Y^2	0,8742	7,9897			

Intercept (a)	0,00005
Slope (b)	3,02200
Koefisien korelasi (R^2)	0,99997

Slope : $b = \frac{n \sum x.y - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$

$= \frac{(8\ x\ 0{,}9838) - (0{,}9350\ x\ 2{,}8266)}{(8\ x\ 0{,}3255 - 0{,}8742)} = \frac{5{,}227529}{1{,}7298} = 3{,}02200$

Intercept : $\alpha = \frac{[\sum y - (b \sum x)]}{n}$

$= \frac{[2{,}8266 - (3{,}02204243 \text{ x } 0{,}9350)]}{8}$

$= \frac{0{,}00103}{8} = 0{,}00005$

Koefisien korelasi : $r = \frac{n \sum xy - \sum x \sum y}{\left(\left|\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}\right|\right)}$

$r = \frac{(8\ x\ 0{,}9838) - (0{,}9350\ x\ 2{,}8266)}{(\sqrt{[8\ x\ 0{,}3255 - 0{,}8742][8\ x\ 2{,}9732 - 7{,}9897]})} = \frac{5{,}227529}{\sqrt{27{,}3237478}}$

$= \frac{5{,}227529}{5{,}22721224} = 0{,}99997$

3. Perhitungan Koefisien Korelasi NH_3

	Konsentrasi (X)	Absorbansi (Y)	X.Y	X^2	Y^2
	0,0000	0,0002	0,0000	0,0000	0,0000
	0,0500	0,0209	0,0010	0,0025	0,0004
	0,1000	0,0337	0,0034	0,0100	0,0011
	0,2000	0,0503	0,0101	0,0400	0,0025
	0,4000	0,1002	0,0401	0,1600	0,0100
	0,8000	0,2201	0,1761	0,6400	0,0484
	1,0000	0,2992	0,2992	1,0000	0,0895
	1,5000	0,4053	0,6080	2,2500	0,1643
	0,0000	0,0002	0,0000	0,0000	0,0000
Jumlah	4,0500	1,1299	1,1378	4,1025	0,3164
X^2 ; Y^2	16,4025	1,2767			

Intercept (a)	0,00114
Slope (b)	0,27726
Koefisien korelasi (R^2)	0,99735

Slope : $b = \frac{n \sum x.y - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$

$$= \frac{(9\ x\ 1{,}1378) - (4{,}0500\ x\ 1{,}1299)}{(9\ x\ 4{,}1025 - 16{,}4025)} = \frac{5{,}664105}{20{,}52} = 0{,}27726$$

Intercept : $\alpha = \frac{[\sum y - (b \sum x)]}{n}$

$$= \frac{[1{,}1299 - (0{,}27726 \times 4{,}0500)]}{9}$$

$$= \frac{0{,}006997}{9} = 0{,}00114$$

Koefisien korelasi : $r = \frac{n \sum xy - \sum x \sum y}{\left(\left|\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}\right|\right)}$

$$r = \frac{(9\ x\ 1{,}1378) - (4{,}0500\ x\ 1{,}1299)}{(\sqrt{[9\ x\ 4{,}1025 - 16{,}4025][9\ x\ 0{,}3164 - 1{,}2767]})} = \frac{5{,}664105}{\sqrt{32{,}234868}}$$

$$= \frac{5{,}664105}{5{,}67756589} = 0{,}99735$$

LAMPIRAN 2

PERHITUNGAN KADAR TOTAL NITROGEN

$N\text{-}NO_3 = \frac{Ar\ N}{Mr\ NO_3}$ x Konsentrasi NO_3

$N\text{-}NO_2 = \frac{Ar\ N}{Mr\ NO_2}$ x Konsentrasi NO_2

$N\text{-}NH_3 = \frac{Ar\ N}{Mr\ NH_3}$ x Konsentrasi NH_3

Diketahui :

Ar N = 14

Mr NO_3 = 62

Mr NO_2 = 46

Mr NH_3 = 17

Total Nitrogen = N-NO_3 + N-NO_2 + N-NH_3

Diketahui :

Analisa	Sebelum Proses	Teknik Biofilter						
		Hari ke 1	Hari ke 2	Hari ke 3	Hari ke 4	Hari ke 5	Hari ke 6	Hari ke 7
NH_3	1,134	0,851	0,788	0,720	0,667	0,522	0,503	0,161
NO_2	2,420	2,285	2,205	2,190	1,780	1,250	0,067	0,044
NO_3	3,421	3,514	3,556	3,672	3,711	3,890	4,171	4,175

Kadar Total Nitrogen

Sebelum Proses :

$N\text{-}NO_3 = \frac{14}{62}$ x 3,421 = *0,772*

$N\text{-}NO_2 = \frac{14}{46}$ x 2,420 = *0,737*

$N\text{-}NH_3 = \frac{14}{17}$ x 1,134 = *0,934*

Total Nitrogen = *0,772 + 0,737 + 0,934*

= *2,443*

Setelah Proses Biofilter

Hari Ke 1 :

$N\text{-}NO_3 = \frac{14}{62}$ x 3,514 = *0,793*

$N\text{-}NO_2 = \frac{14}{46}$ x 2,285 = *0,695*

$N\text{-}NH_3 = \frac{14}{17}$ x 0,851 = *0,701*

Total Nitrogen = *0,793 + 0,695 + 0,701*

= 2,190

**Perhitungan selanjutnya sama seperti contoh diatas sehingga didapatkan kadar total nitrogen sebagai berikut :

Analisa	Sebelum Proses	Teknik Biofilter						
		Hari ke 1	Hari ke 2	Hari ke 3	Hari ke 4	Hari ke 5	Hari ke 6	Hari ke 7
NH_3	1,134	0,851	0,788	0,720	0,667	0,522	0,503	0,161
N-NH₃	***0,934***	***0,701***	***0,649***	***0,593***	***0,549***	***0,430***	***0,414***	***0,133***
NO_2	2,420	2,285	2,205	2,190	1,780	1,250	0,067	0,044
N-NO₂	***0,737***	***0,695***	***0,671***	***0,667***	***0,542***	***0,380***	***0,020***	***0,013***
NO_3	3,421	3,514	3,556	3,672	3,711	3,890	4,171	4,175
N-NO₃	***0,772***	***0,793***	***0,803***	***0,829***	***0,838***	***0,878***	***0,942***	***0,943***
Total Nitrogen	***2,443***	***2,190***	***2,123***	***2,089***	***1,929***	***1,689***	***1,376***	***1,089***

LAMPIRAN 3

PERHITUNGAN EFISIENSI KADAR

$$\% \text{ Efisiensi} = \frac{\text{Selisih Konsentrasi Akhir dan Awal}}{\text{Konsentrasi Awal}} \text{ x } 100\ \%$$

Diketahui kadar sebelum dan setelah proses biofilter :

Analisa	Sebelum Proses	Teknik Biofilter						
		Hari ke 1	Hari ke 2	Hari ke 3	Hari ke 4	Hari ke 5	Hari ke 6	Hari ke 7
NH_3	1,134	0,851	0,788	0,720	0,667	0,522	0,503	0,161
NO_2	2,420	2,285	2,205	2,190	1,780	1,250	0,067	0,044
NO_3	3,421	3,514	3,556	3,672	3,711	3,890	4,171	4,175
Total Nitrogen	2,443	2,190	2,123	2,089	1,929	1,689	1,376	1,089

% Efisiensi NO_3

Hari ke 1 :

$\% \text{ Efisiensi} = \frac{3,514-3,421}{3,421} \text{ x } 100\ \% = 2,72\ \%$

% Efisiensi NO_2

Hari ke 1 :

$\% \text{ Efisiensi} = \frac{2,420-2,285}{2,420} \text{ x } 100\ \% = 5,58\ \%$

% Efisiensi NH_3

Hari ke 1 :

$\% \text{ Efisiensi} = \frac{1,134-0,851}{1,134} \text{ x } 100\ \% = 24,96\ \%$

% Efisiensi Total Nitrogen

Hari ke 1 :

% Efisiensi = $\frac{2,443-2,190}{2,443}$ x 100 % = 10,36 %

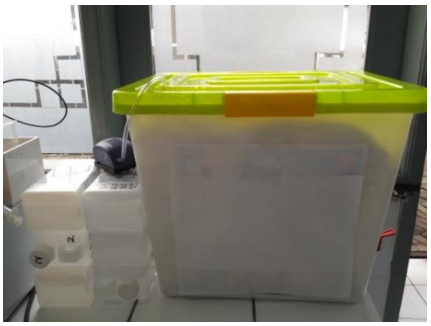
**Perhitungan selanjutnya sama seperti contoh diatas sehingga didapatkan persentase (%) efisiensi teknik biofilter dari penelitian ini sebagai berikut :

Analisa	% Efisiensi Teknik Biofilter						
	Hari ke 1	Hari ke 2	Hari ke 3	Hari ke 4	Hari ke 5	Hari ke 6	Hari ke 7
NH_3	24,96	30,51	36,51	41,18	53,97	55,64	85,80
NO_2	5,58	8,88	9,50	26,45	48,35	97,23	98,18
NO_3	2,72	3,95	7,34	8,48	13,71	21,92	22,04
Total Nitrogen	10,36	13,09	14,50	21,04	30,87	43,65	55,43

LAMPIRAN 4

DOKUMENTASI PENELITIAN

Inlet



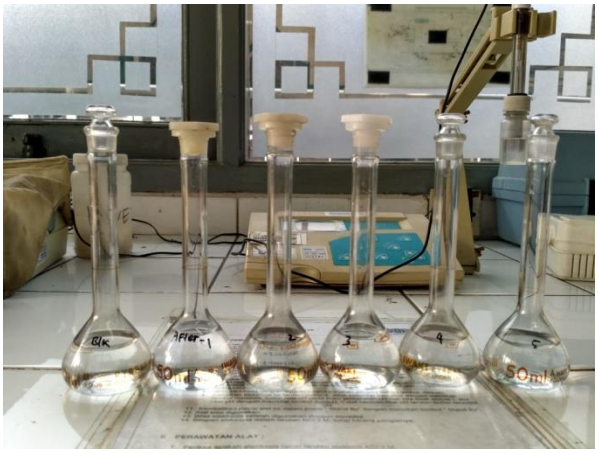
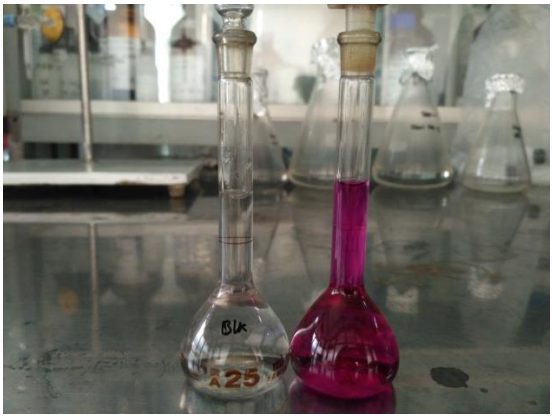
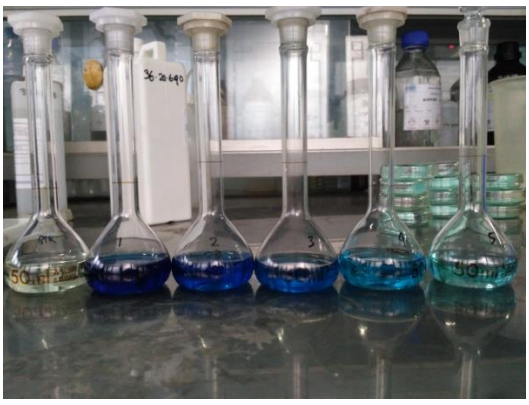
Proses Biofilter Berlangsung

Proses Sampling

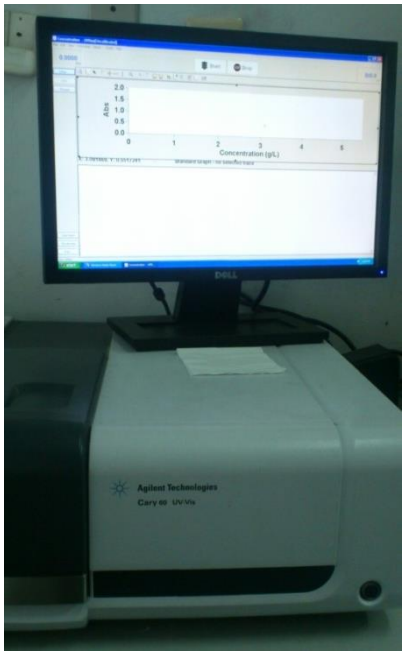
Media Sarang Tawon

Mikroorganisme yang Digunakan	
	

Proses Preparasi Sampel	
	
Proses Penyaringan	Proses Destilasi NH_3

Dokumentasi Analisa
 Analisa Kadar Nitrat (NO_3)
 Analisa Kadar Nitrit (NO_2)
 Analisa Kadar Ammonia (NO_3)

Dokumentasi Beberapa Alat yang Digunakan Pada Proses Penelitian



Spektrofotometer UV-VIS merek Agilent Cary 60

Portable pH-meter HORIBA D-55

Alat Sampling Air Limbah

LAMPIRAN 5

BAKU MUTU AIR LIMBAH

RESULT / DRAFT REPORT

SUCOFINDO

Lab. No :
Section :
Sample : Air Limbah
Analysis : PERMEN LH NO 5 TAHUN 2014 LAMP XLVII

Date Receiving :
Marking :

PARAMETER	SATUAN	HASIL	PERSYARATAN		METODA*)
			I	II	
Physical	-			-	
Temperature	^{o}C		38	40	2550 B
TDS	mg/l		2000	4000	2540 C
TSS	mg/l		200	400	2540 D
Chemical					
pH on site	-		6,0 –9,0		4500-H+-B
Iron (Fe)	mg/l		5	10	3111 B
Manganese (Mn)	mg/l		2	5	3111 B
Barium (Ba)	mg/l		2.00	3	3111 D
Copper (Cu)	mg/l		2	3	3111 B
Zinc (Zn)	mg/l		5	10	3111 B
Chrom Hexavalent (Cr^{6+})	mg/l		0.1	0.5	3500-Cr-B
Chrom Total (Cr)			0.5	1	3111 B
Cadmium, (Cd)	mg/l		0.05	0.1	3111 B
Mercury (Hg)	mg/l		0.002	0.005	3112 B
Lead (Pb)	mg/l		0.1	1	3111 B
Tin (Sn)	mg/l		2	3	3111 B
Arsen (As)	mg/l		0.1	0.5	3114 B
Selenium (Se)	mg/l		0.05	0.5	3114 B
Nickel (Ni)	mg/l		0.2	0.5	3111 B
Cobalt (Co)	mg/l		0.4	0.6	3111 B
Cyanide (CN)	mg/l		0.05	0.5	4500-CN-E
Sulfide (H2S)	mg/l		0.5	0.1	4500-S2-D
Flouride (F)	mg/l		2	3	4500-F-D
Free Chlorine (Cl2)	mg/l		1	2	4500-Cl-G
Amonia (NH3)	mg/l		1	10	4500-NH3-F **
Nitrate (NO3-N)	mg/l		20	30	4500-NO3-B
Nitrite (NO_2-N)	mg/l		1	3	4500-NO2-B
Total Nitrogen	mg/l		30	60	4500-N-B
BOD 5 Day $20^{o}C$	mg/l		50	150	5210 B
COD by K2Cr2O7	mg/l		100	300	5220 B
Suffactans Anionic MBAS	mg/l		5	10	5540 C
Phenol	mg/l		0.5	1	5530 C
Oil & Grease	mg/l		10	50	5520 D
Total Bakteri Coliform	MPN/100ml		10000		9221 B

Checked : .....
Approved : .....

FOR/BDG-LAB/74 Revisi : 03 Tgl. Berlaku : 15 Juli 2013 Hal 1 dari 1

LAMPIRAN 6

HASIL PENGUJIAN IPAL SUCOFINDO TAHUN 2016

Laboratorium Bandung
Tanggal: 11 Februari 2016

Kantor Penerbit:
Jl. Soekarno Hatta No 217 Bandung 40233
Telp./Faksimili: 022 6030262/6034549
Email: kkl.bdg@sucofindo.co.id

LAPORAN HASIL ANALISA

Parameter	Satuan	Hasil	Persyaratan		Metoda *)
			I	II	
Physical :					
Temperatur on site **	° C	25,1	38	40	2550 B
TDS	mg/l	86	2000	4000	2540 C
TSS **	mg/l	2	200	400	2540 D
Chemical :					
pH on site **	-	7,30	6,0 - 9,0		4500-H^+-B
Iron, (Fe)	mg/l	0,08	5	10	3111 B
Manganese (Mn)	mg/l	0,04	2	5	3111B
Barium (Ba)	mg/l	< 0,12	2,00	3	3111 B
Copper (Cu) **	mg/l	< 0,02	2	3	3111 B
Zinc (Zn)	mg/l	0,06	5	10	3111 B
Chrom Heksavalen (Cr^{6+})	mg/l	< 0,006	0,1	0,5	3500 Cr-B
Chrom Total (Cr)	mg/l	< 0,03	0,5	1	3111 B
Cadmium (Cd) **	mg/l	< 0,003	0,05	0,1	3111 B
Mercury (Hg)	mg/l	< 0,0008	0,002	0,005	3112 B
Lead (Pb)	mg/l	< 0,02	0,1	1	3111 B
Tin (Sn)	mg/l	< 0,30	2	3	3111 B
Arsen (As)	mg/l	< 0,002	0,1	0,5	3114 C
Selenium (Se)	mg/l	< 0,001	0,05	0,5	3114 C
Nickel (Ni)	mg/l	< 0,04	0,2	0,5	3111 B
Cobalt (Co)	mg/l	< 0,04	0,4	0,6	3111 B
Cyanide (CN)	mg/l	< 0,01	0,05	0,6	4500-CN--E
Sulfide (H_2S)	mg/l	< 0,01	0,05	0,1	4500-S_2-D
Floride, (F)	mg/l	0,02	2	3	4500-F-D
Free Chlorine (Cl_2)	mg/l	0,03	1	2	4500-Cl-B
Amonia, (NH_3-N) **	mg/l	1,47	1	5	4500-NH_3-F
Nitrat, (NO_3-N)	mg/l	0,46	20	30	4500-NO_3-B
Nitrit, (NO_2-N) **	mg/l	0,83	1	3	4500-NO_2-B
BOD_5 day 20°C	mg/l	3,04	50	150	5210 B
COD by $K_2Cr_2O_7$ **	mg/l	7,61	100	300	5220 B
Suffactans anionic MBAS	mg/l	< 0,05	5	10	5540 C
Phenol **	mg/l	< 0,005	0,5	1	5530 C
Oil & Grease **	mg/l	< 2	10	50	5520 D

*) Standard methods 22nd edition 2012,APHA-AWWA-WEF
**) Parameter Akreditasi Kan No. LP-781-IDN

Laboratorium Bandung
Tanggal: 29 Maret 2016

Kantor Penerbit:
Jl. Soekarno Hatta No 217 Bandung 40233
Telp./Faksimili: 022 6030262/6034549
Email: kkl.bdg@sucofindo.co.id

LAPORAN HASIL ANALISA

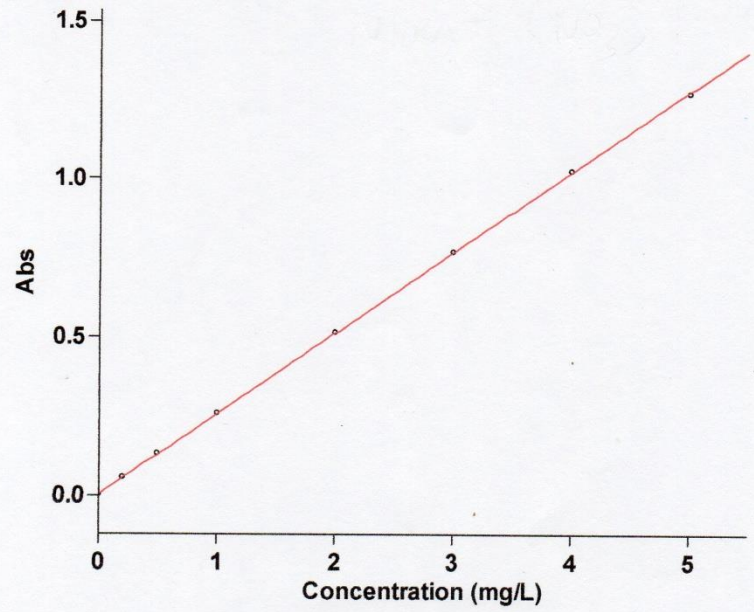
Parameter	Satuan	Hasil	Persyaratan		Metoda *)
			I	II	
Physical :					
Temperatur on site **	° C	34,1	38	40	2550 B
TDS	mg/l	80	2000	4000	2540 C
TSS **	mg/l	4	200	400	2540 D
Chemical :					
pH on site **	-	7,64	6,0 - 9,0		4500-H^+-B
Iron, (Fe)	mg/l	0,04	5	10	3111 B
Manganese (Mn)	mg/l	0,02	2	5	3111B
Barium (Ba)	mg/l	< 0,12	2,00	3	3111 B
Copper (Cu) **	mg/l	< 0,02	2	3	3111 B
Zinc (Zn)	mg/l	< 0,009	5	10	3111 B
Chrom Heksavalen (Cr^{6+})	mg/l	< 0,006	0,1	0,5	3500 Cr-B
Chrom Total (Cr)	mg/l	< 0,03	0,5	1	3111 B
Cadmium (Cd) **	mg/l	< 0,003	0,05	0,1	3111 B
Mercury (Hg)	mg/l	< 0,0008	0,002	0,005	3112 B
Lead (Pb)	mg/l	< 0,02	0,1	1	3111 B
Tin (Sn)	mg/l	< 0,30	2	3	3111 B
Arsen (As)	mg/l	< 0,002	0,1	0,5	3114 C
Selenium (Se)	mg/l	< 0,001	0,05	0,5	3114 C
Nickel (Ni)	mg/l	< 0,04	0,2	0,5	3111 B
Cobalt (Co)	mg/l	< 0,04	0,4	0,6	3111 B
Cyanide (CN)	mg/l	< 0,01	0,05	0,6	4500-CN--E
Sulfide (H_2S)	mg/l	< 0,01	0,05	0,1	4500-S_2-D
Floride, (F)	mg/l	0,10	2	3	4500-F-D
Free Chlorine (Cl_2)	mg/l	0,01	1	2	4500-Cl-B
Amonia, (NH_3-N) **	mg/l	0,40	1	5	4500-NH_3-F
Nitrat, (NO_3-N)	mg/l	1,52	20	30	4500-NO_3-B
Nitrit, (NO_2-N) **	mg/l	1,36	1	3	4500-NO_2-B
BOD_5 day 20°C	mg/l	5,02	50	150	5210 B
COD by $K_2Cr_2O_7$ **	mg/l	12,54	100	300	5220 B
Suffactans anionic MBAS	mg/l	< 0,05	5	10	5540 C
Phenol **	mg/l	0,01	0,5	1	5530 C
Oil & Grease **	mg/l	<2	10	50	5520 D

*) Standard methods 22nd edition 2012,APHA-AWWA-WEF
**) Parameter Akreditasi Kan No. LP-781-IDN

LAMPIRAN 7

HASIL PEMBACAAN KONSENTRASI

1. Nitrat (NO_3)



PT. SUCOFINDO-BANDUNG

Concentration Analysis Report

Report time	4/20/2017 2:46:06 PM
Method	C:\Documents and Settings\Dell\My Documents\Data spektro\TA GEA 2017\NO3 220.MCN
Batch name	C:\Documents and Settings\Dell\My Documents\Data spektro\TA GEA 2017\DATA\NO3 220.BCN
Application	Concentration 5.0.0.999
Operator	GEA

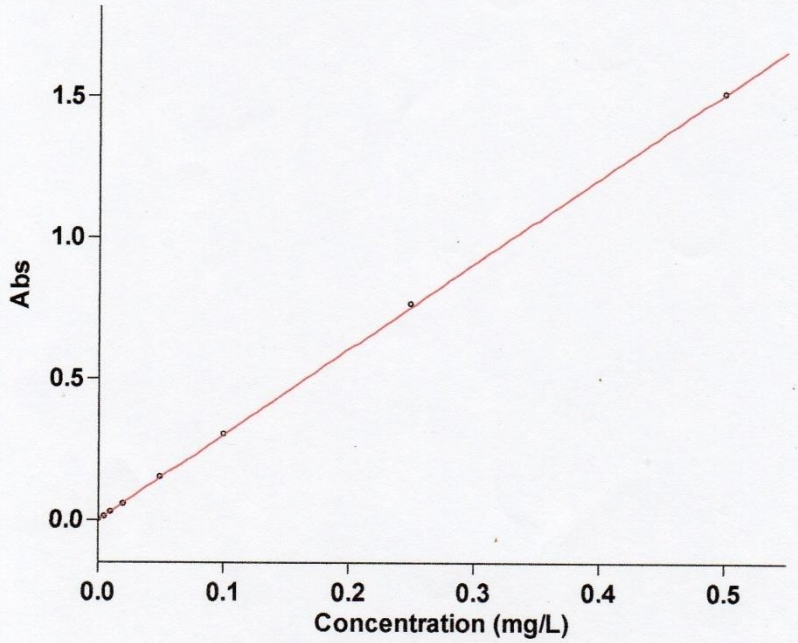
Instrument Settings

Instrument	Cary 60
Instrument version no.	2.00
Wavelength (nm)	220.0
Ordinate Mode	Abs
Ave Time (sec)	0.5000
Replicates	3
Standard/Sample averaging	OFF
Weight and volume corrections	OFF
Fit type	Linear
Min R^2	0.95000
Concentration units	mg/L

Calibration

Collection time 4/20/2017 2:22:15 PM

2. Nitrit (NO_2)



PT. SUCOFINDO-BANDUNG

Concentration Analysis Report

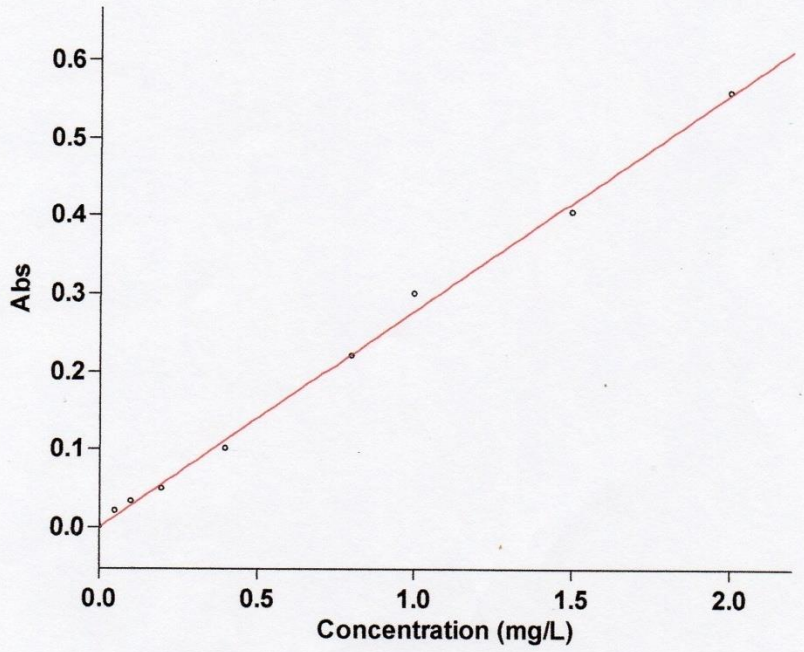
Report time	4/21/2017 2:16:49 PM
Method	C:\Documents and Settings\Dell\My Documents\Data Spektro\TA GEA 2017\NO2 543.MCN
Batch name	C:\Documents and Settings\Dell\My Documents\Data spektro\TA GEA 2017\DATA\NO2 543.BCN
Application	Concentration 5.0.0.999
Operator	GEA

Instrument Settings

Instrument	Cary 60
Instrument version no.	2.00
Wavelength (nm)	543.0
Ordinate Mode	Abs
Ave Time (sec)	0.2000
Replicates	3
Standard/Sample averaging	OFF
Weight and volume corrections	OFF
Fit type	Linear
Min R^2	0.95000
Concentration units	mg/L

Calibration

3. Ammonia (NH_3)



PT. SUCOFINDO-BANDUNG

Concentration Analysis Report

Report time	4/18/2017 6:09:44 PM
Method	C:\Documents and Settings\Dell\My Documents\Data spektro\TA GEA 2017\NH3.MCN
Batch name	C:\Documents and Settings\Dell\My Documents\Data spektro\TA GEA 2017\DATA\NH3.BCN
Application	Concentration 5.0.0.999
Operator	GEA

Instrument Settings

Instrument	Cary 60
Instrument version no.	2.00
Wavelength (nm)	640.0
Ordinate Mode	Abs
Ave Time (sec)	0.5000
Replicates	3
Standard/Sample averaging	OFF
Weight and volume corrections	OFF
Fit type	Linear
Min R^2	0.95000
Concentration units	mg/L

Calibration