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LAMPIRAN

LAMPIRAN 1
PERHITUNGAN PENGENCERAN ASAM KLORIDA (HCL) DAN ASAM NITRAT (HNO_3)

Pengenceran Asam Klorida (HCl) 32%

Densitas = 1,159 g/mL

Massa molekul relatif (Mr) = 36,6 g/mol

$V_{larutan}$ = 1000 mL

$$\text{Molaritas (M)} = \frac{\%\ massa \times densitas \times V}{Mr}$$

$$= \frac{32\ \%\ \times 1{,}16\ \frac{g}{mL} \times 1000\ mL}{36{,}5\ g/mol}$$

$$= 10{,}17$$

$$M_1V_1 = M_2V_2$$

$$10{,}17 \text{ x } V_1 = 4 \text{ x } 1000 \text{ mL}$$

$$V_1 = \frac{4 \text{ x } 1000 \text{ mL}}{10{,}17}$$

$$V_1 = 393{,}31 \text{ mL} \approx 393\ mL$$

Pengenceran Asam Nitrat (HNO_3) 65%

Densitas = 1,39 g/mL

Massa molekul relatif (Mr) = 63 g/mol

$V_{larutan}$ = 1000 mL

$$\text{Molaritas (M)} = \frac{\%\ massa \times densitas \times V}{Mr}$$

$$= \frac{65\ \%\ \times 1{,}39\ \frac{g}{mL} \times 1000\ mL}{63\ g/mol}$$

$$= 14{,}34$$

$$M_1V_1 = M_2V_2$$

$$14{,}34 \text{ x } V_1 = 4 \text{ x } 1000 \text{ mL}$$

$$V_1 = \frac{4 \text{ x } 1000 \text{ mL}}{14{,}34}$$

$$V_1 = 278{,}94 \text{ mL} \approx 279\ mL$$

LAMPIRAN 2

HASIL ANALISIS *ATOMIC ABSORPTION SPECTROMETRY* (AAS)

PT. AISPEKTRA LABORATORY SERVICES
Office : Kompleks Komplek Puri Residence Blok D/7
Jl Tamalanrea Raya, Makassar 90245 Sulawesi Selatan
Telp/Fax. +62 4118994478 Email : info@aispektra.co.id

REPORT OF ANALYSIS

(Laporan Analisis)

Certificate Number/*Nomor Sertifikat*	: 000262023
Customer/*Pelanggan*	: SUFRIADIN
Subject / *Hal*	: Mineral Analysis
Description of Sample/ *Keterangan Sampel*	: Nickel Ore
Number of Sample (s) / *Jumlah Sampel*	: 1 (One)
Form of Sample / *Bentuk Sampel*	: Pulp
Test Required / *Analisa uji*	: Elemental (Fe, Co and Ni)
Date Received/ *Tanggal terima*	: 27/05/2023
Date of Analysis / *Tanggal Analisa*	: 07/06/2023
Method of Analysis/ *Metode analisa*	: AAS
Reference / *Referensi*	: -

RESULT

SAMPLE ID	Ni (mg/kg)	Co (mg/kg)	Fe (mg/kg)	Al (mg/kg)	Remarks
ORE	17026	208	306367	NR	NR=Not Reported

HASIL ANALISA TERSEBUT DIATAS HANYA MERUJUK PADA SAMPEL YANG DISERAHKAN DIMANA PENGAMBILAN SAMPEL TERSEBUT TIDAK DILAKUKAN OLEH AISPEKTRA LABORATORY

ANALIS

ARHAM A.Ma

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REPORT OF ANALYSIS

(Laporan Analisis)

Certificate Number/*Nomor Sertifikat*	: 000252023
Customer/*Pelanggan*	: SUFRIADIN
Subject / *Hal*	: Mineral Analysis
Description of Sample/ *Keterangan Sampel*	: Nickel Ore
Number of Sample (s) / *Jumlah Sampel*	: 12 (Twelve)
Form of Sample / *Bentuk Sampel*	: Liquid
Test Required / *Analisa uji*	: Elemental (Fe, Co and Ni)
Date Received/ *Tanggal terima*	: 27/05/2023
Date of Analysis / *Tanggal Analisa*	: 07/06/2023
Method of Analysis/ *Metode analisa*	: AAS
Reference / *Referensi*	: -

RESULT

SAMPLE ID	Ni (mg/L)	Co (mg/L)	Fe (mg/L)	Al (mg/L)	Remarks
NO25	370.12	10.02	17435.48	NR	NR=Not Reported
NO150	566.27	10.58	18305.5	NR	NR=Not Reported
NO300	1129.71	10.87	20943	NR	NR=Not Reported
NO450	1107.37	12.23	17572.75	NR	NR=Not Reported
NO600	1065.19	14.40	17000.5	NR	NR=Not Reported
NO750	937.85	16.48	16075.5	NR	NR=Not Reported
CL25	1197.30	12.71	10252.75	NR	NR=Not Reported
CL150	1204.31	12.81	28352.75	NR	NR=Not Reported
CL300	1519.69	17.71	33978.75	NR	NR=Not Reported
CL450	1448.68	21.01	33039	NR	NR=Not Reported
CL600	1253.26	22.28	32253.5	NR	NR=Not Reported
CL750	1203.93	23.40	30140.25	NR	NR=Not Reported

HASIL ANALISA TERSEBUT DIATAS HANYA MERUJUK PADA SAMPEL YANG DISERAHKAN

LAMPIRAN 3

PERHITUNGAN TINGKAT PELINDIAN

Tingkat pelindian logam pada penelitian ini dihitung menggunakan rumus efisiensi pelindian dalam Dong *et al.*, (2023) pada Persamaan 3 berikut.

$$ŋ = \frac{C_i \times V}{m \times W_i} \times 100\%$$

Dimana:

η = Tingkat pelindian (%)

C_i = Konsentrasi logam (mg/L) dalam *pregnant leach solution* (PLS)

V = Volume PLS (L)

m = Mass sampel (Kg)

W_i= Kadar logam (mg/Kg).

Tingkat Pelindian Nikel

Volume PLS (V) = 0,075 L

Mass sampel (m) = 0,01 Kg

Kadar Nikel (W_i) = 17.026 mg/Kg

1. Tingkat Pelindian Nikel HNO_3, 25°C (C_i= 370,12 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{370{,}12 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 16{,}30\%$$

2. Tingkat Pelindian Nikel HNO_3, 150°C (C_i= 566,27 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{566{,}27 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 24{,}94\%$$

3. Tingkat Pelindian Nikel HNO_3, 300°C (C_i= 1.129,71 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.129{,}71 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 49{,}76\%$$

4. Tingkat Pelindian Nikel HNO_3, 450°C (C_i=1.107,37 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.107{,}37 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 48{,}78\%$$

5. Tingkat Pelindian Nikel HNO_3, 600°C (C_i= 1.065,19 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.065{,}19 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 46{,}92\%$$

6. Tingkat Pelindian Nikel HNO_3, 750°C (C_i= 937,85 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{937{,}85 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 41{,}31\%$$

7. Tingkat Pelindian Nikel HCl, 25°C (C_i= 1.197,30 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.197{,}30 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 52{,}74\%$$

8. Tingkat Pelindian Nikel HCl, 150°C (C_i= 1.204,31 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.204{,}31 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 53{,}05\%$$

9. Tingkat Pelindian Nikel HCl, 300°C (C_i= 1.519,69 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.519{,}69 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 66{,}94\%$$

10. Tingkat Pelindian Nikel HCl, 450°C (C_i= 1.448,68 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.448{,}68 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 63{,}81\%$$

11. Tingkat Pelindian Nikel HCl, 600°C (C_i= 1.253,26 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.253{,}26 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 55{,}21\%$$

12. Tingkat Pelindian Nikel HCl, 750°C (C_i= 1.203,93 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{1.203{,}93 \times 0{,}075}{0{,}01 \times 17.026} \text{ x } 100\%$$

$$= 53{,}03\%$$

Tingkat Pelindian Kobalt

Volume PLS (V) = 0,075 L

Mass sampel (m) = 0,01 Kg

Kadar Kobalt (W_i) = 208 mg/Kg

1. Tingkat Pelindian Kobalt HNO_3, 25°C (C_i= 10,02 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{10{,}02 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 36{,}13\%$$

2. Tingkat Pelindian Kobalt HNO_3, 150°C (C_i= 10,58 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{10{,}58 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 38{,}15\%$$

3. Tingkat Pelindian Kobalt HNO_3, 300°C (C_i= 10,87 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{10{,}87 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 39{,}19\%$$

4. Tingkat Pelindian Kobalt HNO_3, 450°C (C_i= 12,23 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{12{,}23 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 44{,}10\%$$

5. Tingkat Pelindian Kobalt HNO_3, 600°C (C_i= 14,40 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{14{,}40 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 51{,}92\%$$

6. Tingkat Pelindian Kobalt HNO_3, 750°C (C_i= 16,48 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{16{,}48 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 59{,}42\%$$

7. Tingkat Pelindian Kobalt HCl, 25°C (C_i= 12,71 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{12{,}71 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 45{,}83\%$$

8. Tingkat Pelindian Kobalt HCl, 150°C (C_i= 12,81 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{12{,}81 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 46{,}19\%$$

9. Tingkat Pelindian Kobalt HCl, 300°C (C_i= 17,71 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{17{,}71 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 63{,}86\%$$

10. Tingkat Pelindian Kobalt HCl, 450°C (C_i= 21,01 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{21{,}01 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 75{,}76\%$$

11. Tingkat Pelindian Kobalt HCl, 600°C (C_i= 22,28 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{22{,}28 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 80{,}34\%$$

12. Tingkat Pelindian Kobalt HCl, 750°C (C_i= 23,40 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{23{,}40 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 84{,}38\%$$

Tingkat Pelindian Besi

Volume PLS (V) = 0,075 L

Mass sampel (m) = 0,01 Kg

Kadar Besi (W_i) = 306.367 mg/Kg

1. Tingkat Pelindian Besi HNO_3, 25°C (C_i= 17.435,48 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{17.435{,}48 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 42{,}68\%$$

2. Tingkat Pelindian Besi HNO_3, 150°C (C_i= 18.305,50 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{18.305{,}50 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 44{,}81\%$$

3. Tingkat Pelindian Besi HNO_3, 300°C (C_i= 20.943,00 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{20.943{,}00 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 51{,}27\%$$

4. Tingkat Pelindian Besi HNO_3, 450°C (C_i= 17.572,75 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{17.572{,}75 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 43{,}02\%$$

5. Tingkat Pelindian Besi HNO_3, 600°C (C_i= 17.000,50 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{17.000{,}50 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 41{,}62$$

6. Tingkat Pelindian Besi HNO_3, 750°C (C_i= 16.075,50)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{16.075{,}50 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 39{,}35\%$$

7. Tingkat Pelindian Besi HCl, 25°C (C_i= 10.252,75 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{10.252{,}75 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 25{,}10\%$$

8. Tingkat Pelindian Besi HCl, 150°C (C_i= 28.352,75 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{28.352{,}75 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 69{,}41\%$$

9. Tingkat Pelindian Besi HCl, 300°C (C_i= 33.978,75 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{33.978{,}75 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 83{,}18\%$$

10. Tingkat Pelindian Besi HCl, 450°C (C_i= 33.039,00 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{33.039{,}00 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 80{,}88\%$$

11. Tingkat Pelindian Besi HCl, 600°C (C_i= 32.253,50 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

$$= \frac{32.253{,}50 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 78{,}96\%$$

12. Tingkat Pelindian Besi HCl, 750°C (C_i= 30.140,25 mg/L)

$$\text{Tingkat Pelindian (\%)} = \frac{C_i \times V}{m \times W_i} \text{ x } 100\%$$

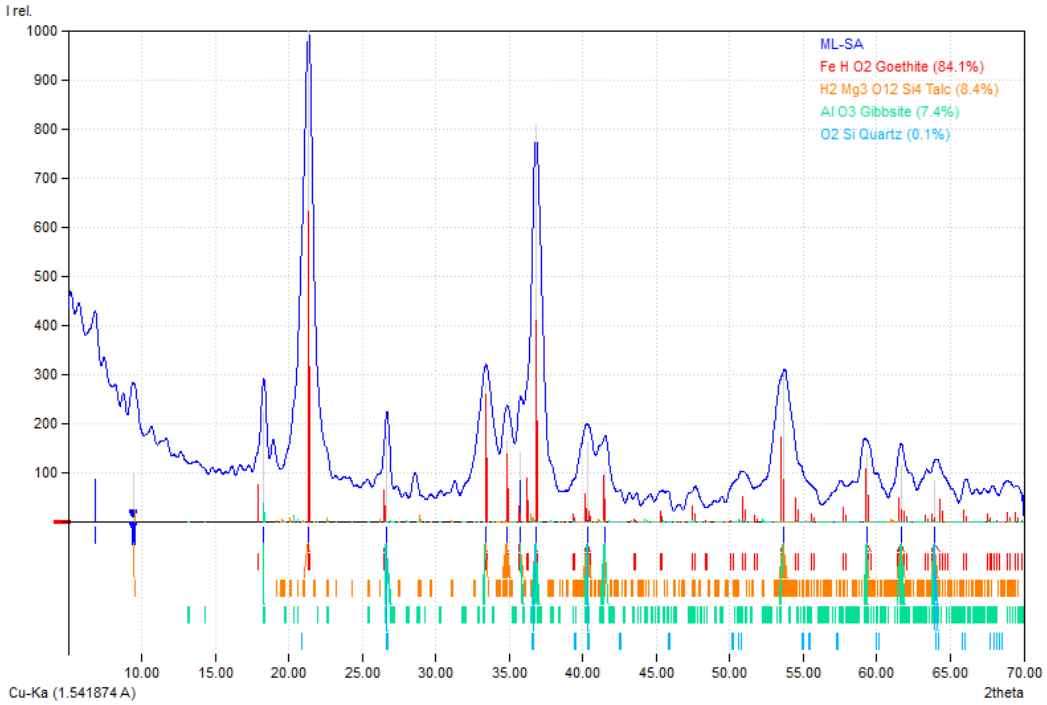
$$= \frac{30.140{,}25 \times 0{,}075}{0{,}01 \times 208} \text{ x } 100\%$$

$$= 73{,}78\%$$

LAMPIRAN 4

HASIL ANALISIS *X-RAY DIFFRACTION* (XRD)

Hasil Analisis XRD Sampel Awal

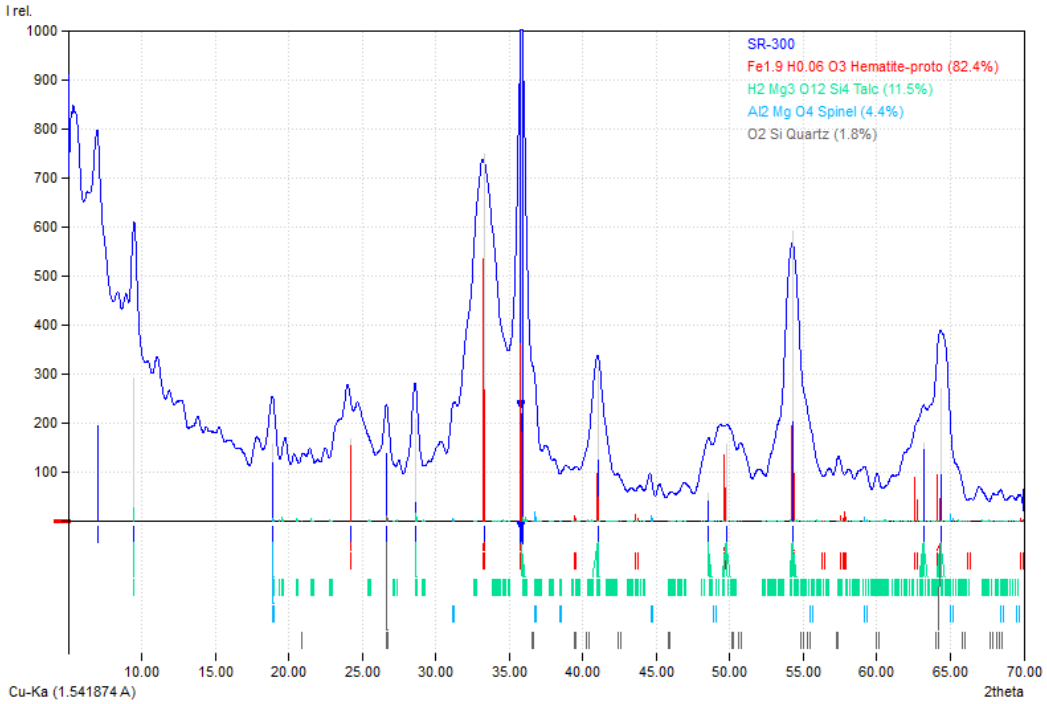


Index	Amount (%)	Name	Formula sum
A	84.1	Goethite	Fe H O2
B	8.4	Talc	H2 Mg3 O12 Si4
C	7.4	Gibbsite	Al O3
D	0.1	Quartz	O2 Si

Peak List

No.	2theta [°]	d [Å]	I/I0 (peak height)	Counts (peak area)	FWHM	Matched
1	6.83	12.9375	88.47	5.06	0.3520	
2	9.50	9.3142	97.33	7.19	0.4545	B
3	18.30	4.8469	222.84	16.05	0.4429	C
4	21.32	4.1686	1000.00	139.86	0.8603	A,B
5	26.68	3.3412	175.29	11.02	0.3869	A,C,D
6	33.41	2.6822	286.01	49.39	1.0623	A,B,C
7	34.87	2.5730	165.50	16.65	0.6187	A,B
8	35.77	2.5100	141.23	12.97	0.5648	A,B,C
9	36.86	2.4387	808.63	103.43	0.7868	A,B,C,D
10	40.32	2.2369	163.29	35.66	1.3432	A,B,C,D
11	41.52	2.1732	102.94	12.72	0.7600	A,B,C
12	53.67	1.7079	303.12	68.64	1.3928	A,B,C
13	59.29	1.5586	139.54	23.86	1.0517	A,B,C
14	61.69	1.5036	116.55	13.95	0.7362	A,B,C
15	63.96	1.4555	84.22	23.30	1.7016	A,B,C,D

Hasil Analisis XRD Sampel Pemanggangan

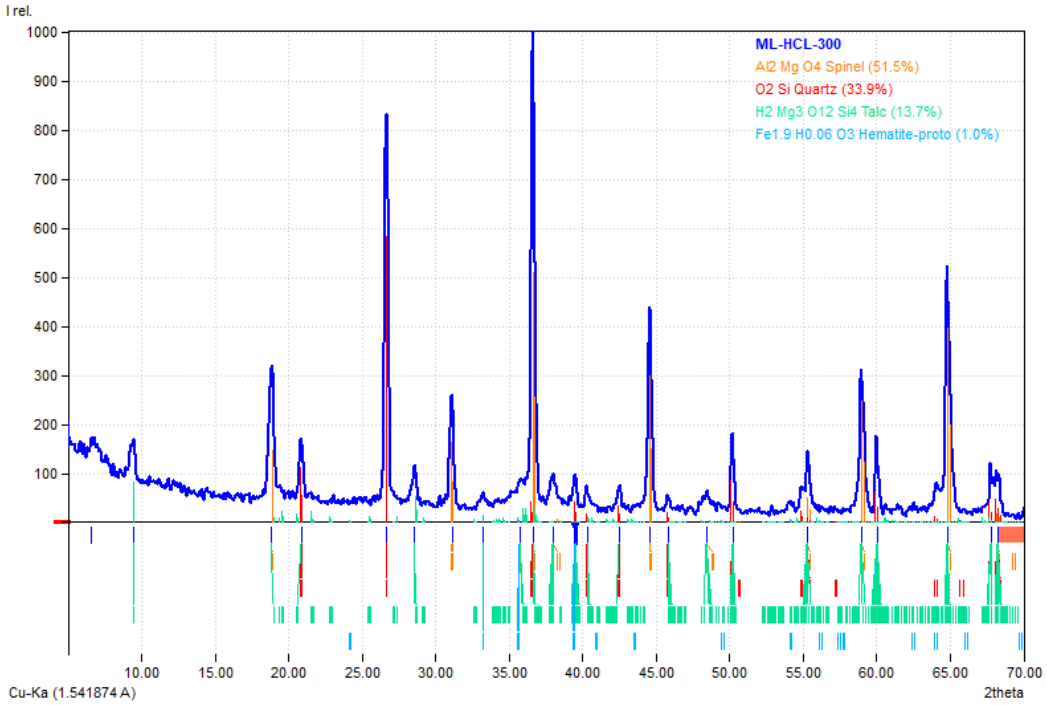


Index	Amount (%)	Name	Formula sum
A	82.4	Hematite-proto	Fe1.9 H0.06 O3
B	11.5	Talc	H2 Mg3 O12 Si4
C	4.4	Spinel	Al2 Mg O4
D	1.8	Quartz	O2 Si

Peak List

No.	2theta [°]	d [Å]	I/I0 (peak height)	Counts (peak area)	FWHM	Matched
1	6.99	12.6465	194.90	5.71	0.3049	
2	9.50	9.3117	293.05	11.67	0.4146	B
3	18.87	4.7021	158.63	7.32	0.4807	B,C
4	24.21	3.6757	169.61	29.79	1.8294	A
5	26.65	3.3454	139.04	4.34	0.3251	D
6	28.59	3.1220	209.98	7.66	0.3800	B
7	33.28	2.6923	751.05	148.98	2.0660	A
8	35.85	2.5051	1000.00	69.43	0.7231	A,B
9	41.02	2.2004	314.10	29.60	0.9814	A,B
10	48.56	1.8749	58.27	3.09	0.5528	B
11	49.78	1.8317	157.62	31.74	2.0971	A,B
12	54.28	1.6900	594.49	71.64	1.2551	A,B
13	63.22	1.4709	160.03	76.44	4.9749	B
14	64.38	1.4471	270.89	21.69	0.8340	A,B,D

Hasil Analisis XRD Residu HCl 300

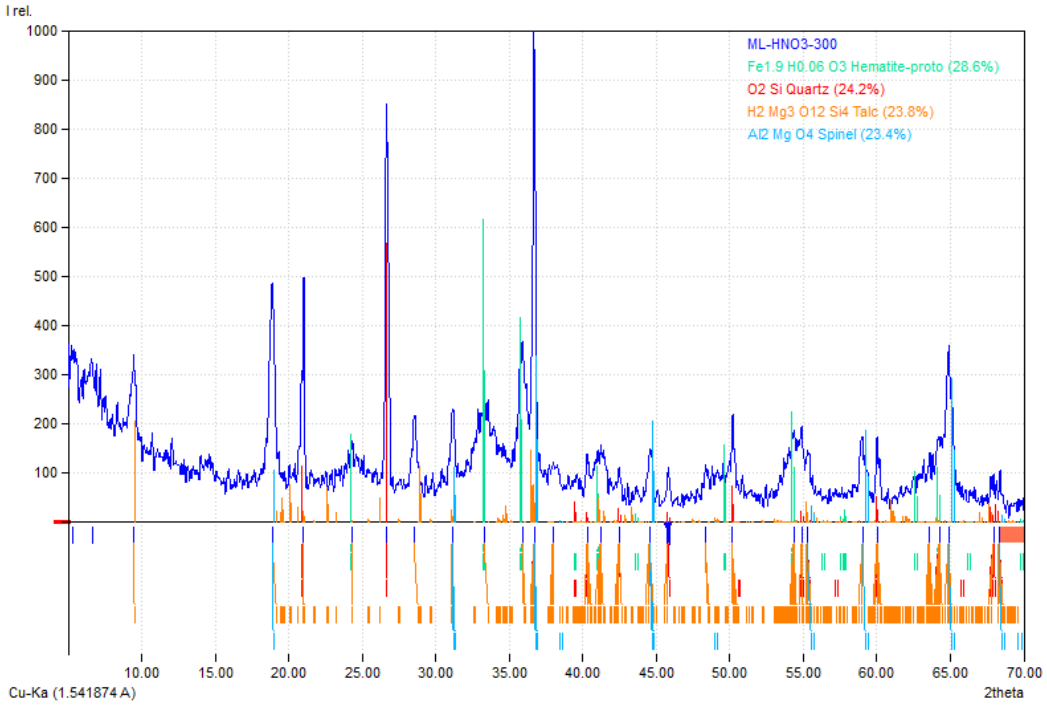


Index	Amount (%)	Name	Formula sum
A	51.5	Spinel	Al2 Mg O4
B	33.9	Quartz	O2 Si
C	13.7	Talc	H2 Mg3 O12 Si4
D	1.0	Hematite-proto	Fe1.9 H0.06 O3

Peak List

No.	2theta [°]	d [Å]	I/I0 (peak height)	Counts (peak area)	FWHM	Matched
1	6.62	13.3523	33.31	16.17	1.0630	
2	9.41	9.3945	80.55	13.85	0.3765	C
3	18.86	4.7047	282.51	45.98	0.3564	A,C
4	20.88	4.2537	130.22	17.30	0.2909	B,C
5	26.68	3.3411	869.26	105.92	0.2668	B
6	28.58	3.1229	75.27	12.13	0.3529	C
7	31.11	2.8746	233.78	30.09	0.2818	A
8	33.24	2.6957	25.03	4.48	0.3923	D
9	35.74	2.5121	51.74	12.82	0.5426	C,D
10	36.64	2.4530	1000.00	114.11	0.2499	A,B,C
11	38.02	2.3668	65.19	16.64	0.5587	A,C
12	39.50	2.2814	71.20	9.15	0.2814	B,C,D
13	40.32	2.2368	43.17	5.21	0.2642	B,C
14	42.52	2.1260	50.80	6.41	0.2764	B,C
15	44.60	2.0316	420.10	51.71	0.2695	A
16	45.84	1.9797	31.49	4.08	0.2838	B,C
17	48.48	1.8778	34.66	13.21	0.8347	A,C
18	50.21	1.8170	161.73	16.25	0.2200	B,C
19	55.32	1.6606	111.60	21.39	0.4196	A,B,C
20	59.01	1.5653	290.37	45.97	0.3467	A,C
21	60.02	1.5413	151.63	15.45	0.2230	B,C
22	64.85	1.4378	488.29	75.95	0.3406	A,C
23	67.76	1.3830	72.74	3.85	0.1158	B,C
24	68.21	1.3749	80.15	30.37	0.8296	A,B,C

Hasil Analisis XRD Residu HNO_3 300



Index	Amount (%)	Name	Formula sum
A	28.6	Hematite-proto	Fe1.9 H0.06 O3
B	24.2	Quartz	O2 Si
C	23.8	Talc	H2 Mg3 O12 Si4
D	23.4	Spinel	Al2 Mg O4

Peak List

No.	2theta [°]	d [Å]	I/I0 (peak height)	Counts (peak area)	FWHM	Matched
1	5.34	16.5515	87.31	11.13	0.5455	
2	6.66	13.2660	90.33	20.23	0.9585	
3	9.43	9.3747	197.36	23.80	0.5160	C
4	18.87	4.7023	453.93	39.96	0.3767	C,D
5	21.00	4.2301	413.93	17.98	0.1859	B,C
6	24.32	3.6599	61.21	12.98	0.9077	A,C
7	26.69	3.3407	864.73	45.79	0.2304	B
8	28.56	3.1258	160.09	12.09	0.3231	C
9	31.16	2.8707	182.71	13.72	0.3213	C,D
10	33.28	2.6922	199.34	32.99	0.7082	A,C
11	35.89	2.5019	318.74	51.24	0.6879	A,C
12	36.69	2.4492	1000.00	48.77	0.2087	B,C,D
13	38.03	2.3659	61.68	13.68	0.9492	C
14	40.34	2.2361	132.26	6.12	0.2877	B,C
15	41.20	2.1913	107.43	24.71	0.9844	A,C
16	42.48	2.1279	61.40	3.38	0.2357	B,C
17	44.60	2.0318	123.92	10.91	0.3665	C,D
18	45.83	1.9800	76.90	3.64	0.2028	B,C
19	48.36	1.8821	64.59	11.50	0.7617	C
20	50.18	1.8179	156.13	16.79	0.4712	B,C
21	54.36	1.6877	139.23	39.84	1.2245	A,C
22	54.88	1.6730	78.44	3.18	0.1733	B,C
23	55.30	1.6613	74.25	5.95	0.3431	B,C,D
24	59.02	1.5652	142.78	14.52	0.4351	C,D
25	60.05	1.5407	126.51	7.24	0.2448	B,C
26	63.60	1.4630	66.67	27.66	1.7753	C
27	64.24	1.4500	73.60	5.87	0.3411	A,B,C
28	64.90	1.4368	297.23	35.23	0.5072	C,D
29	67.93	1.3799	43.67	1.29	0.1036	B,C
30	68.38	1.3719	64.35	1.55	0.1034	B,C,D

LAMPIRAN 5
HASIL ANALISIS *X-RAY FLUORESCENCE* (XRF)

PT. AISPEKTRA LABORATORY SERVICES
Office : Kompleks Komplek Puri Residence Blok D/7
Jl Tamalanrea Raya, Makassar 90245 Sulawesi Selatan
Telp/Fax. +62 4118994478 Email : info@aispektra.co.id

REPORT OF ANALYSIS
(Laporan Analisis)

Certificate Number/*Nomor Sertifikat*	: 000292023
Customer/*Pelanggan*	: SUFRIADIN
Subject / *Hal*	: Mineral Analysis
Description of Sample/ *Keterangan Sampel*	: Nickel Ore
Number of Sample (s) / *Jumlah Sampel*	: 4 (Four)
Form of Sample / *Bentuk Sampel*	: Press pellet
Test Required / *Analisa uji*	: Elemental (Fe,Co,Ni,Si,Mg,Al,Mn,Ca,Ti,Cr)
Date Received/ *Tanggal terima*	: 15/07/2023
Date of Analysis / *Tanggal Analisa*	: 18/07/2023
Method of Analysis/ *Metode analisa*	: XRF
Reference / *Referensi*	: -

RESULT

SAMPLE ID	Ni (%)	Fe (%)	Co (%)	SiO_2 (%)	MgO(%)	Al_2O_3 (%)	CaO (%)	MnO (%)	TiO (%)	Cr_2O_3 (%)
ML-SA	0.97	56.64	0.45	25.98	16.43	2.73	0.32	2.63	0.21	0.78

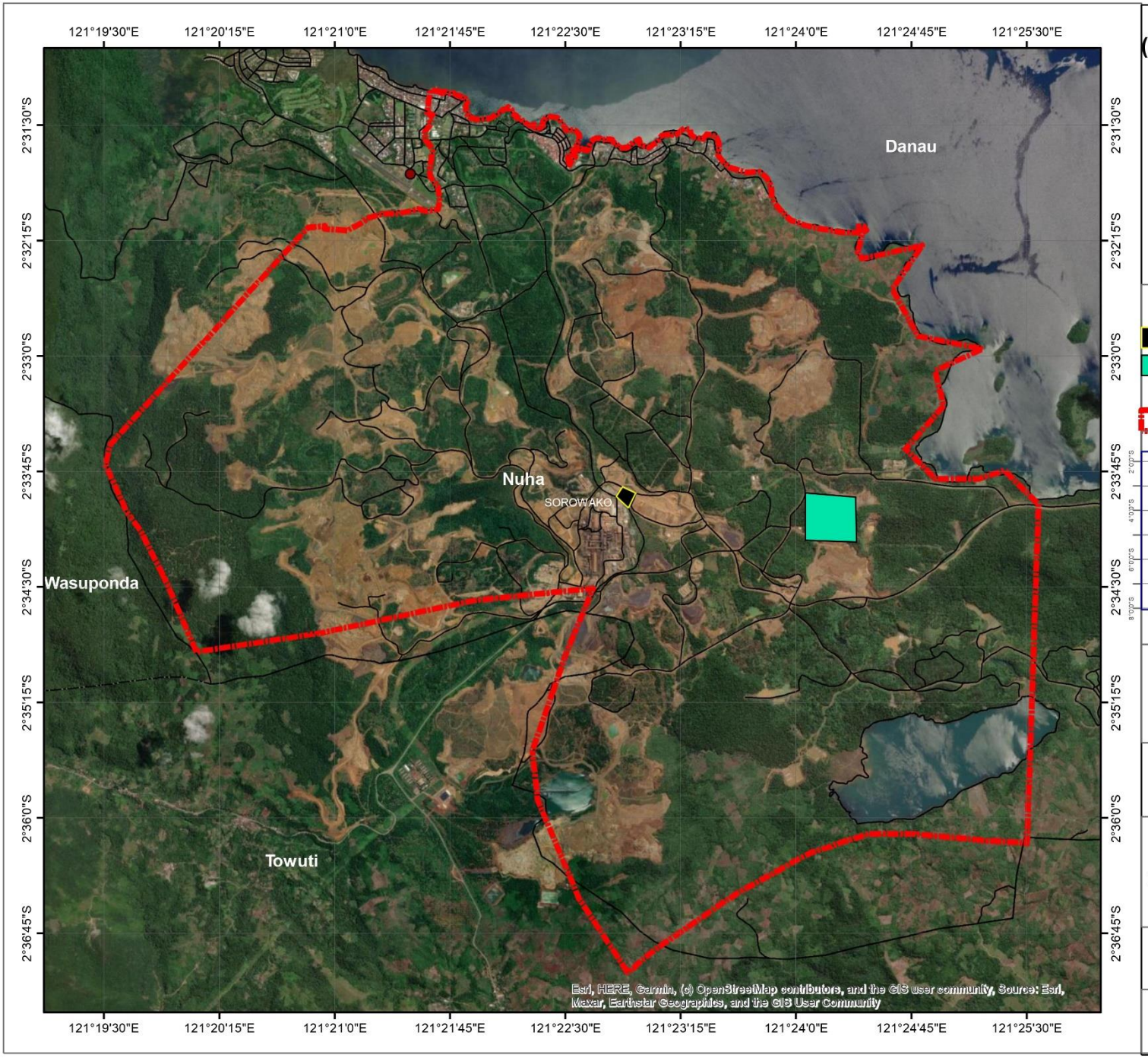
* Below detection limit

HASIL ANALISA TERSEBUT DIATAS HANYA MERUJUK PADA SAMPEL YANG DISERAHKAN DIMANA PENGAMBILAN SAMPEL TERSEBUT TIDAK DILAKUKAN OLEH AISPEKTRA LABORATORY

ANALIS

FARIN AHMAD, A.Ma

LAMPIRAN 6
PETA LOKASI PENGAMBILAN SAMPEL



PETA LOKASI PENELITIAN
(Lokasi Pengambilan Sampel)
Desa Sorowako
Kecamatan Nuha
Kabupaten Luwu Timur
Provinsi Sulawesi Selatan

N
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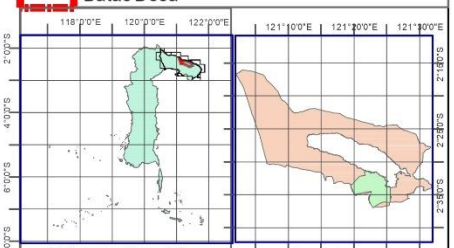
Legenda

- Harapan Mine Office PT Vale Indonesia Tbk
- Khatrine Hill
- Bandar Udara
- Batas Desa



SUMBER PETA:
PETA RUPA BUMI INDONESIA
PT VALE INDONESIA TBK

DIBUAT OLEH:
MALYANUS YEFTA
D111191042

PROGRAM STUDI TEKNIK PERTAMBANGAN
FAKULTAS TEKNIK
UNIVERSITAS HASANUDDIN

LAMPIRAN TUGAS AKHIR

LAMPIRAN 7
KARTU KONSULTASI TUGAS AKHIR

JUDUL: STUDI PENGARUH PEMANGGANGAN BIJIH TERHADAP LASU PELINDIAN NIKEL, KOBALT, DAN BESI DARI BIJIH LIMONIT MENGGUNAKAN ASAM KLORIDA DAN ASAM NITRAT

(Konsultasi minimal 8 kali)

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
3/07/23	- Penambahan judul - perubahan tujuan	
5/07/23	- perbaikan Latar Belakang - struktur penulisan abstrak	
7/07/23	- Penambahan sub-bab Tinjauan Pustaka - Penulisan bahasa asing	
10/07/23	- penulisan kata mineral - Penyajian data	
13/07/23	- koreksi pembacaan difraktogram - Pengolahan data hasil analisis	
17/07/23	- Perbaikan bab I, II, III, IV, dan V - Penulisan daftar Pustaka	
24/07/23	- Pembahasan tentang mineral terubah - Pembahasan di kesimpulan	
27/07/23	- Penulisan abstrak - Penyajian data	

TANGGAL	MATERI KONSULTASI	PARAF DOSEN
31/08/23	- Penambahan latar belakang terkait lokasi pengambilan sampel - Perbaikan grafik, tabel dan difraktogram - Pengubahan kata laju pelindian menjadi tingkat pelindian - Abstrak - kata pengantar	
9/09/23	- Penambahan Tinjauan pustaka pada artikel - pengecekan penggunaan kata bahasa Inggris pada artikel - Pembahasan pada artikel	
19/10/23	- Mineral pembawa kobalt - interaksi H^+ dan Cl^- saat pelindian - HNO_3 sebagai oksidan	20/10/23