LAMPIRAN

Lampiran 1. Perhitungan Pembuatan Larutan

a) Pembuatan larutan 0,5 M $FeCl_3 \cdot 6H_2O$

$$M = \frac{massa}{Mr} \times \frac{1000}{v}$$

$$0{,}5\ M = \frac{massa}{270{,}32\ g/mol} \times \frac{1000\ mL}{50\ mL}$$

$$massa = \frac{270{,}32\ g/mol\ X\ 50\ mL}{1000\ mL} \times 0{,}5\ M$$

massa = 6,758 g

b) Pembuatan larutan 0,25 M $FeSO_4 \cdot 7H_2O$

$$M = \frac{massa}{Mr} \times \frac{1000}{v}$$

$$0{,}25\ M = \frac{massa}{278{,}06\ g/mol} \times \frac{1000\ mL}{50\ mL}$$

$$massa = \frac{278{,}06\ g/mol\ X\ 50\ mL}{1000\ mL} \times 0{,}25\ M$$

massa = 3,476 g

c) Pembuatan larutan 0,5 M NaOH

$$M = \frac{massa}{Mr} \times \frac{1000}{v}$$

$$0{,}5\ M = \frac{massa}{40\ g/mol} \times \frac{1000\ mL}{250\ mL}$$

$$massa = \frac{40\ g/mol\ X\ 250\ mL}{1000\ mL} \times 0{,}5\ M$$

massa = 5 g

Lampiran 2. Persamaan Scherrer

$$D = \frac{K\ \lambda}{\beta\ \cos\theta}$$

Keterangan:
D = Ukuran kristal
λ = Panjang gelombang (1,54056 Å)
K = *Shape factor* (0,9)
β = FWHM (rad)
θ = Sudut bragg (°)

a) Fe_3O_4-NPs

$$D1 = \frac{K\ \lambda}{\beta\ \cos\theta} = \frac{0{,}9\ .1{,}54056\ Å}{0{,}008901179\ .\ 0{,}965608898} = 161{,}3140977\ Å$$

$$D2 = \frac{K\ \lambda}{\beta\ \cos\theta} = \frac{0{,}9\ .1{,}54056\ Å}{0{,}008726646\ .\ 0{,}952156066} = 166{,}8651389\ Å$$

D3 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}005759587\ .\ 0{,}929326043} = 259{,}0369476$ Å

D4 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}007853982\ .\ 0{,}877648572} = 201{,}1456278$ Å

D5 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}012042772\ .\ 0{,}853959734} = 134{,}820917$ Å

b) Fe_3O_4-NPs/CDs 15 mL

D1 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}00837758\ .\ 0{,}965540798} = 171{,}408318$ Å

D2 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}008726646\ .\ 0{,}952102712} = 166{,}8744897$ Å

D3 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}026179939\ .\ 0{,}928906533} = 57{,}01386495$ Å

D4 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}010297443\ .\ 0{,}877355617} = 153{,}4673825$ Å

D5 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}007330383\ .\ 0{,}853459851} = 221{,}6212351$ Å

c) Fe_3O_4-NPs/CDs 30 mL

D1 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}009948377\ .0{,}965267733} = 144{,}3846805$ Å

D2 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}009075712\ .0{,}952102712} = 160{,}456241$ Å

D3 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}009075712\ .\ 0{,}929100302} = 164{,}4287727$ Å

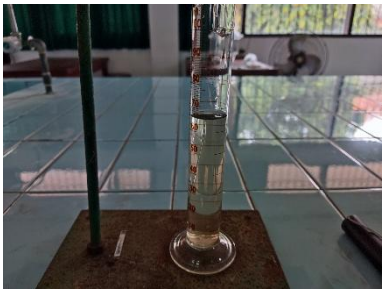
D4 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}010297443\ .\ 0{,}877564904} = 153{,}4307828$ Å

D5 $= \frac{K\lambda}{\beta \cos\theta} = \frac{0{,}9 \,.1{,}54056\ \text{Å}}{0{,}009599311\ .\ 0{,}853596261} = 169{,}2109895$ Å

Lampiran 3. Dokumentasi Penelitian

Alat *hydrothermal autoclave*

Sintesis CDs metode *hydrothermal*



Menyaring CDs hasil sintesis

CDs di bawah sinar UV

Larutan prekursor

Black liquid

Pencampuran prekursor

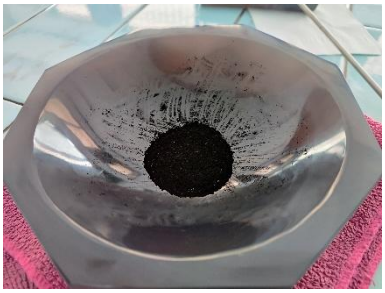
Setelah penambahan *black liquid*

Setelah penambahan NaOH

Setelah pH mencapai 11

Koloid Fe_3O_4-NPs

Fe_3O_4-NPs setelah dioven

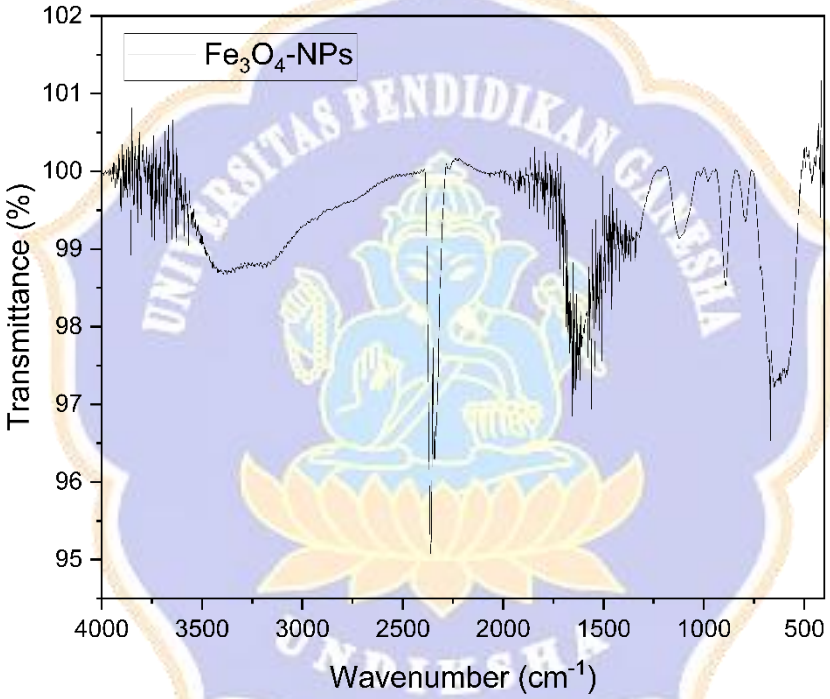


Penggerusan Fe_3O_4-NPs

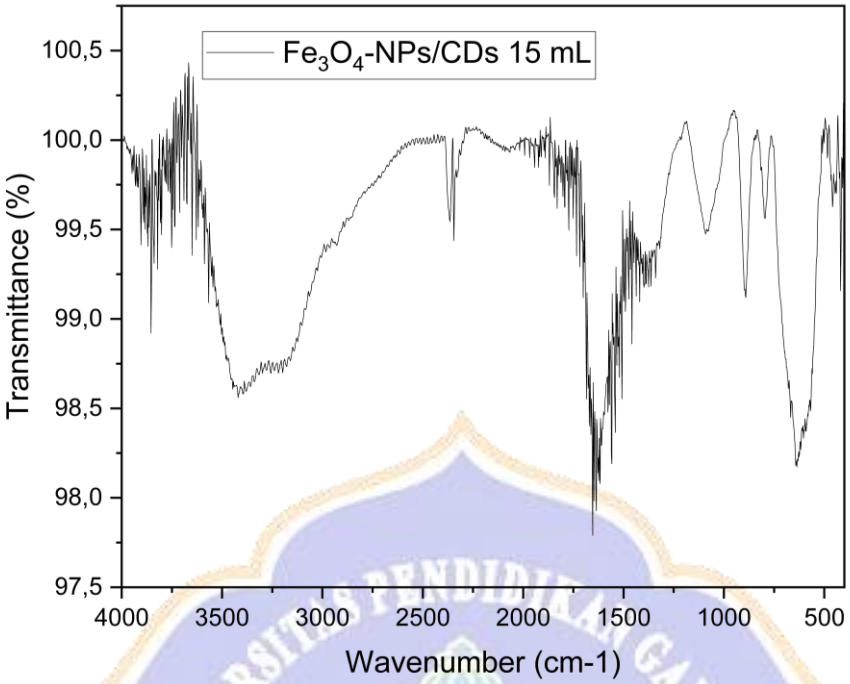
Fabrikasi Fe_3O_4-NPs dengan CDs dengan sonikasi

Lampiran 4. Karakterisasi Nanopartikel

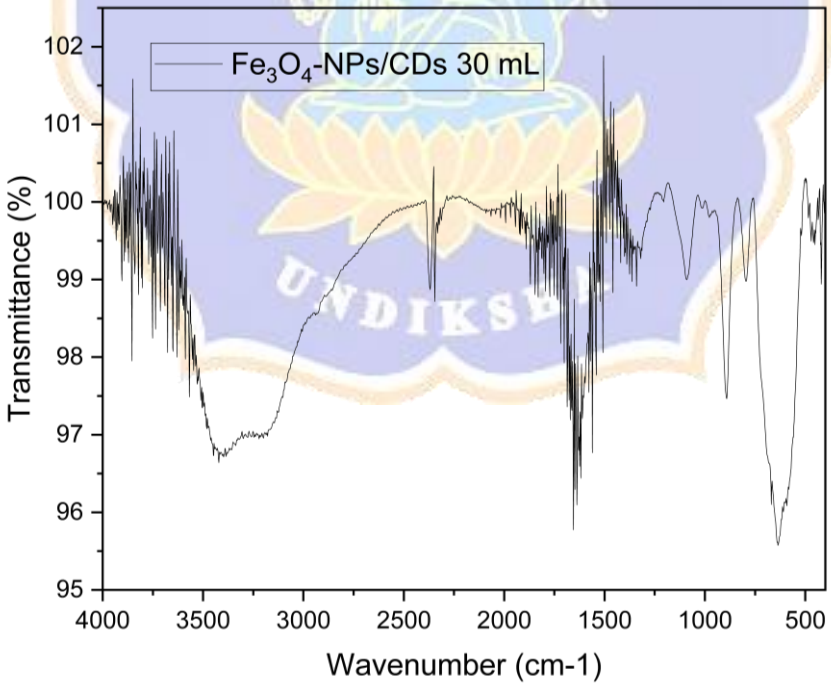
FTIR Fe_3O_4-NPs



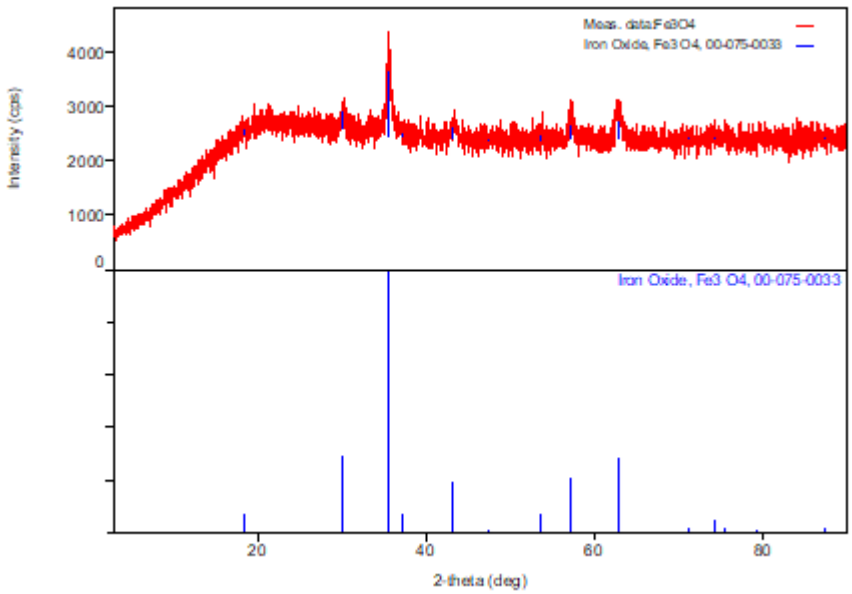
FTIR Fe_3O_4-NPs/CDs 15 mL



FTIR Fe_3O_4-NPs/CDs 30 mL

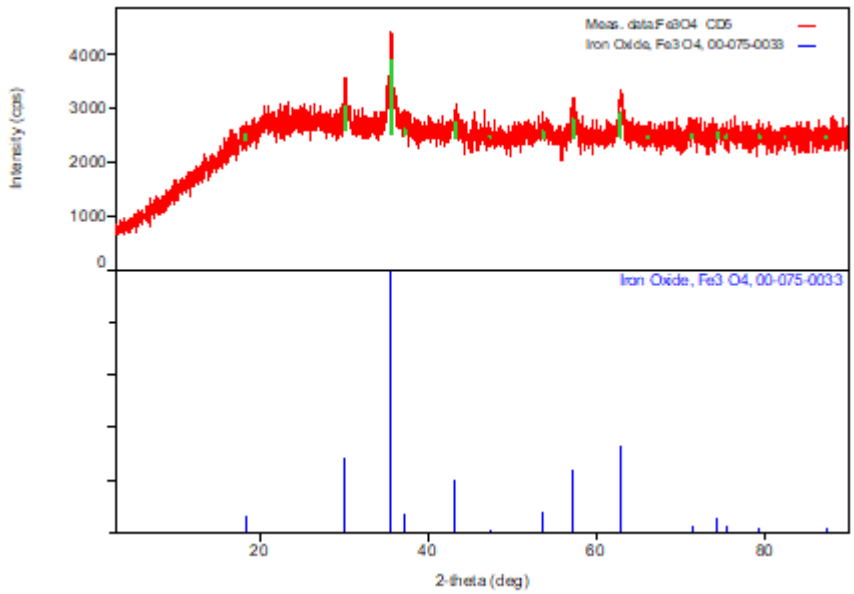


XRD Fe_3O_4-NPs



No.	2-theta(deg)	d(ang.)	Height(cps)	FWHM(deg)	Int. I(cps deg)	Int. W(deg)	Asym. factor
1	30.14(2)	2.962(2)	300(50)	0.51(7)	163(29)	0.55(19)	0.6(4)
2	35.59(3)	2.520(2)	1143(98)	0.50(4)	974(28)	0.85(10)	1.0(3)
3	43.34(3)	2.0863(14)	266(47)	0.33(8)	176(22)	0.7(2)	2(2)
4	57.28(4)	1.6071(11)	377(56)	0.45(7)	252(27)	0.67(17)	2.9(14)
5	62.71(2)	1.4804(4)	433(60)	0.69(7)	391(30)	0.90(19)	0.6(4)

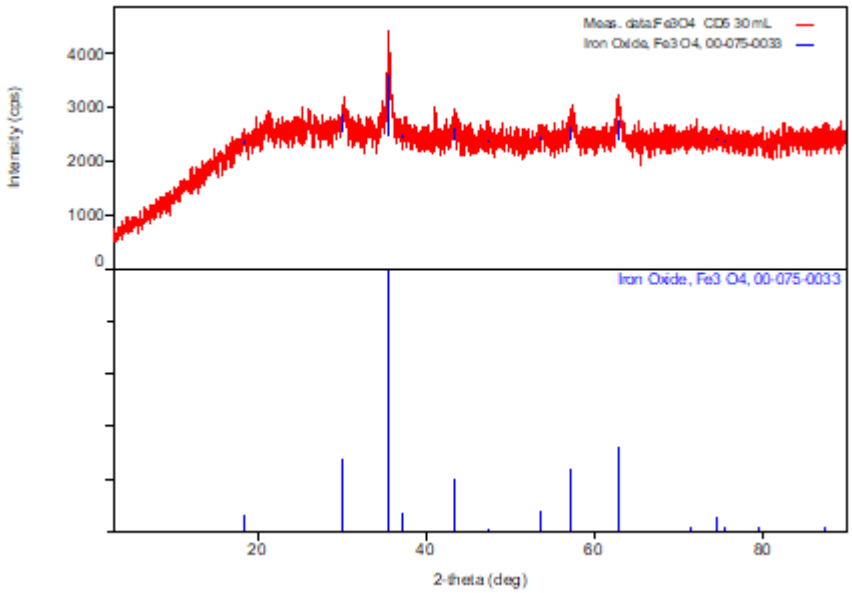
XRD Fe_3O_4-NPs/CDs 15 mL



No.	2-theta(deg)	d(ang.)	Height(cps)	FWHM(deg)	Int. I(cps deg)	Int. W(deg)	Asym. factor

1	30.17(2)	2.960(2)	433(60)	0.48(10)	374(29)	0.86(19)	0.5(4)
2	35.61(3)	2.5190(19)	1184(99)	0.50(5)	1122(34)	0.95(11)	0.9(2)
3	43.47(6)	2.080(3)	204(41)	1.5(3)	643(56)	3.2(9)	5(4)
4	57.35(4)	1.6052(11)	371(56)	0.59(8)	324(31)	0.9(2)	2.9(10)
5	62.82(4)	1.4781(9)	601(71)	0.42(10)	463(27)	0.77(14)	0.6(4)

XRD Fe_3O_4-NPs/CDs 30 mL

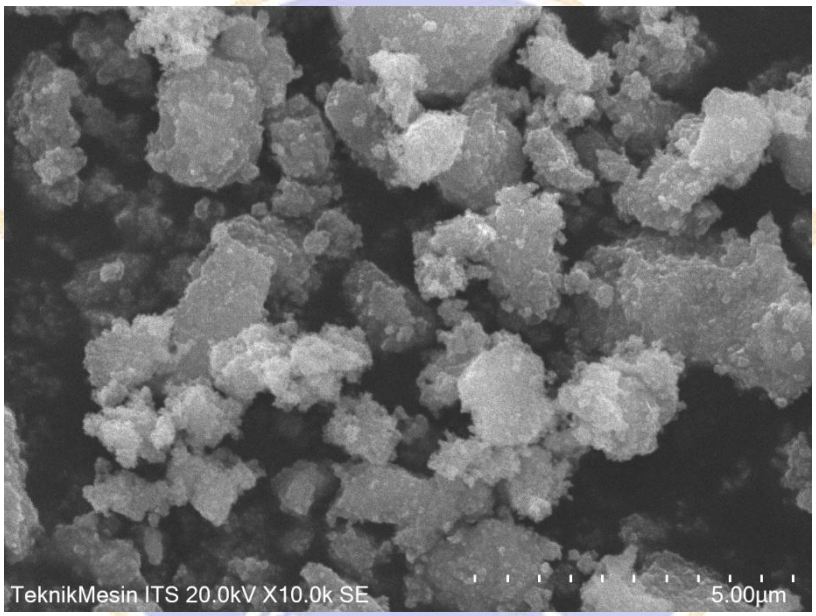


No.	2-theta(deg)	d(ang.)	Height(cps)	FWHM(deg)	Int. I(cps deg)	Int. W(deg)	Asym. factor
1	30.29(10)	2.948(9)	289(49)	0.57(11)	236(40)	0.8(3)	1.2(10)
2	35.61(3)	2.519(2)	1066(94)	0.52(4)	944(36)	0.89(11)	0.8(3)
3	43.41(4)	2.0830(19)	234(44)	0.52(19)	227(38)	1.0(3)	2(4)
4	57.33(11)	1.606(3)	273(48)	0.59(9)	194(35)	0.7(3)	1.3(10)
5	62.79(7)	1.4788(15)	444(61)	0.55(10)	328(37)	0.74(18)	0.5(4)

SEM-EDS Fe_3O_4-NPs

Smart Quant Results

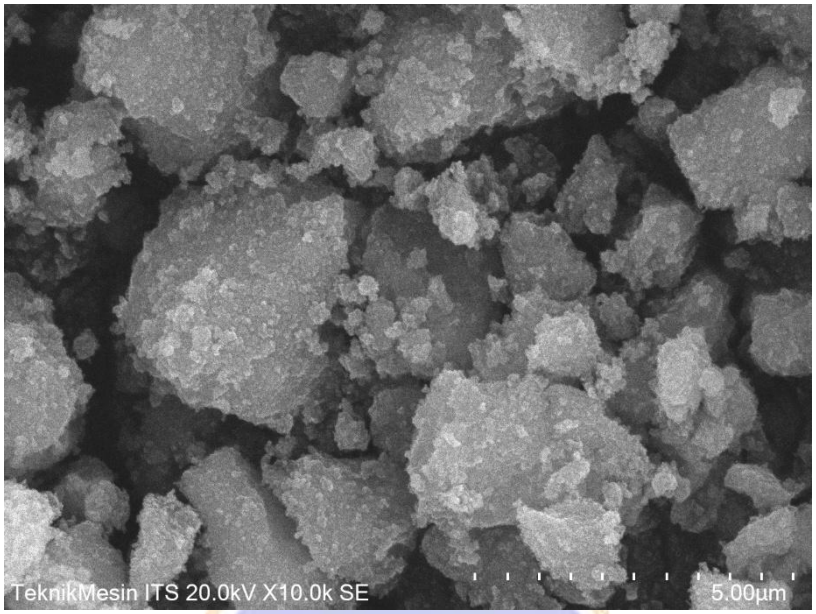
Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	A	F
C K	17.53	33.80	104.92	9.56	0.0536	1.1535	0.2650	1.0000
O K	29.29	42.42	407.23	8.17	0.1061	1.1078	0.3271	1.0000
NaK	1.62	1.63	12.31	15.42	0.0029	1.0099	0.1764	1.0005
AlK	0.87	0.75	18.47	13.04	0.0035	0.9910	0.4028	1.0019
SiK	0.51	0.42	14.76	14.03	0.0027	1.0136	0.5327	1.0032
ClK	0.58	0.38	18.05	12.33	0.0047	0.9463	0.8361	1.0134
CrK	1.03	0.46	20.26	9.21	0.0103	0.8639	1.0077	1.1499
FeK	48.57	20.15	656.22	1.95	0.4247	0.8597	1.0109	1.0062



SEM-EDS Fe_3O_4-NPs/CDs 15 mL

Smart Quant Results

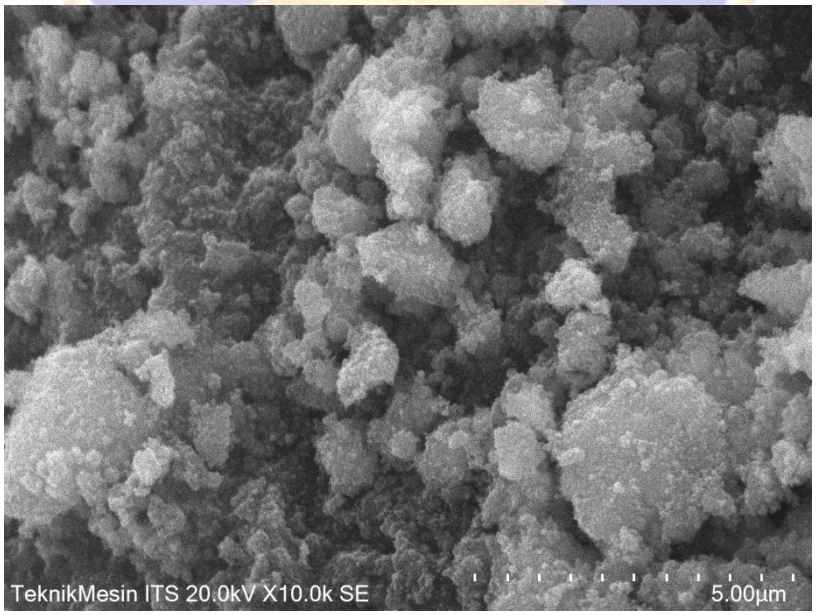
Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	A	F
C K	16.56	32.38	114.32	9.34	0.0542	1.1568	0.2830	1.0000
O K	31.04	45.58	492.39	7.94	0.1192	1.1111	0.3455	1.0000
FeK	52.40	22.04	766.83	1.93	0.4608	0.8628	1.0137	1.0054



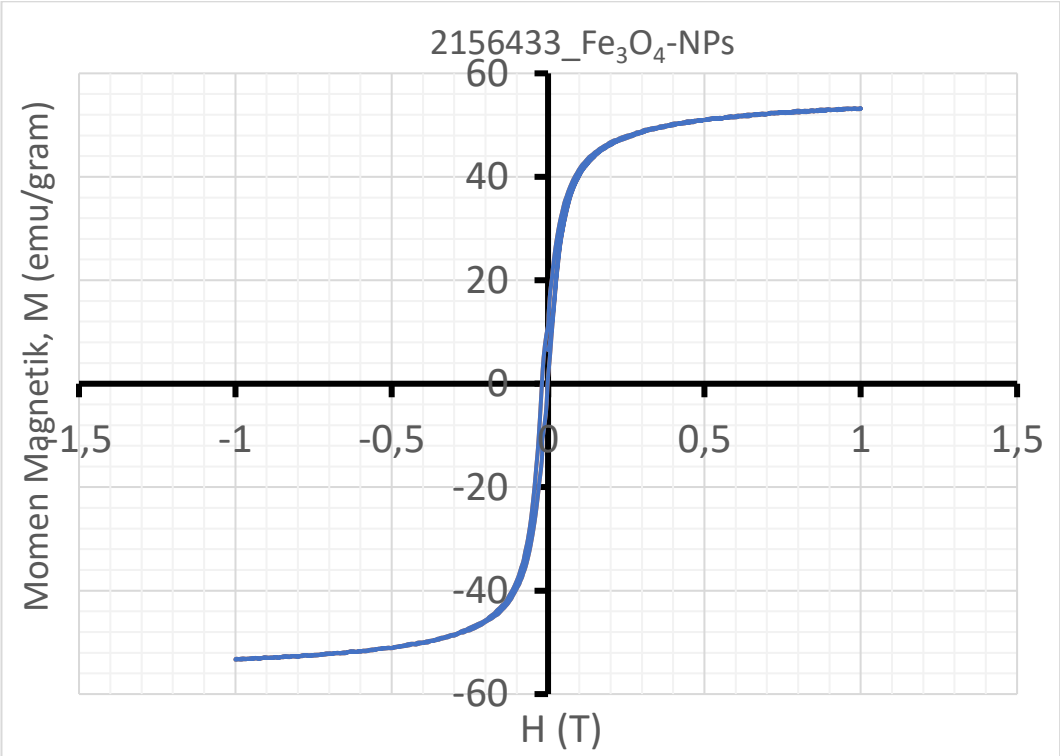
SEM-EDS Fe_3O_4-NPs/CDs 30 mL

Smart Quant Results

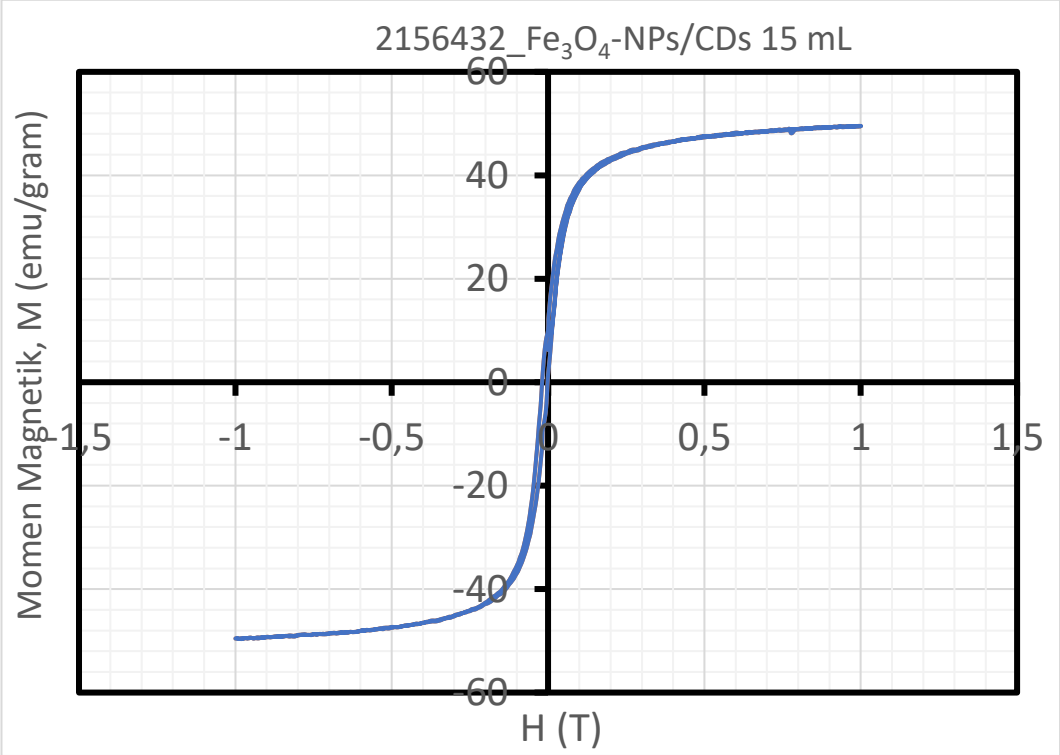
Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	A	F
C K	14.47	30.26	74.46	9.56	0.0460	1.1723	0.2711	1.0000
O K	27.93	43.84	356.27	7.84	0.1123	1.1263	0.3570	1.0000
FeK	57.59	25.90	655.28	1.89	0.5130	0.8761	1.0122	1.0044



VSM Fe_3O_4-NPs



VSM Fe_3O_4-NPs/CDs 15 mL



VSM Fe_3O_4-NPs/CDs 30 mL