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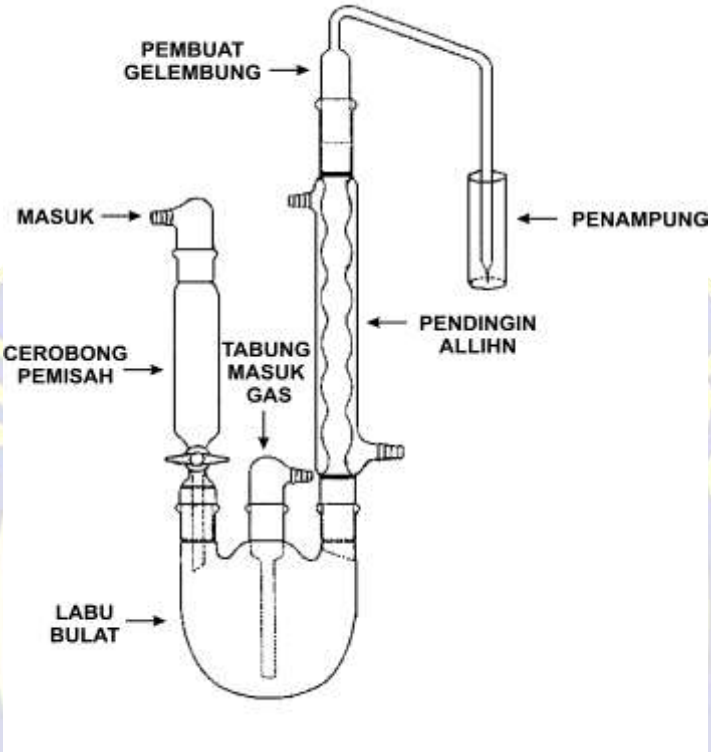
LAMPIRAN 1

GAMBAR ALAT METODE OPTIMASI MONIER-WILLIAM



Gambar IV.1
(Alat optimasi Monier – William)

LAMPIRAN 2

PEMERIKSAAN BAHAN BAKU NATRIUM SULFIT

Tabel. IV.1

Hasil Pemeriksaan Bahan Baku Natrium Sulfit

Bahan Baku	Pustaka [9,10]	Pemeriksaan
Rumus Molekul	Na_2SO_3 (anhidrat).	Na_2SO_3.
Bobot Molekul	126,04.	126,0418.
Pemerian	Hablur; putih atau tidak berwarna.	Hablur; putih atau tidak berwarna.
Kelarutan	Dalam air 25g/100ml, sedikit larut dalam alkohol.	Pada suhu 25^oC, larut dalam air : etanol (95:5 v/v).

LAMPIRAN 3

DATA HASIL PEMBAKUAN $KMnO_4$ dan PENENTUAN KADAR H_2O_2

Reaksi :

$$5C_2O_4^{2-} + 2\,MnO_4^- + 16\,H^+ \longleftrightarrow 2\,Mn^{2+} + 10\,CO_2 + 8\,H_2O$$

Tabel. IV.2
Hasil Pembakuan $KMnO_4$ terhadap Asam Oksalat

Berat asam oksalat (mg)	Volume $KMnO_4$ (ml)
50,0	7,7
50,0	7,5l
50,0	7,6
	$V_{rata\text{-}rata}$ = 7,6

Perhitungan Normalitas $KMnO_4$:

$$N = \frac{Berat_{asamoksalat}}{BE_{asamoksalat} x volume} = \frac{50,0}{63x7,6} = 0,1044\ N.$$

LAMPIRAN 3
(Lanjutan)

Reaksi Permanganat dan Hidrogen Peroksida :

Dalam suasana asam :

$$2\ MnO^{4-} + 5\ H_2O_2 + 16\ H^+ \longleftrightarrow 2\ Mn^{2+} + 5\ O_2 + 8\ H_2O$$

Terdiri dari reduksi permanganat :

$$2\ MnO^{4-} + 16\ H^+ + 10\ e^- \longrightarrow 2\ Mn^{2+} + 8\ H_2O$$

Dan oksidasi hidrogen peroksida :

$$5\ H_2O_2 \longrightarrow 5\ O_2 + 10\ H^+ + 10\ e^-$$

Elektron yang dilepaskan oleh H_2O_2 diambil oleh MnO^{4-}.

Tabel. IV.3
Hasil Titrasi Penentuan Kadar H_2O_2 dengan $KMnO_4$ 0,1044 N

Titrasi ke-	Volume $KMnO_4$ 0,1044 N (ml)
1	34,15
2	34,375
3	34,45
	$V_{rata\text{-}rata}$ = 34,325

LAMPIRAN 3
(Lanjutan)

Kadar H_2O_2 :

1ml $KmnO_4$ 0,1 N setara dengan 1,701mg H_2O_2

1ml $KmnO_4$ 0,1044 N = 1,701mg H_2O_2

1ml $KmnO_4$ 0,1044 N = $\frac{0,1044}{0,1}$ x 1,701mg H_2O_2

= 1,7758 mg H_2O_2

1ml $KmnO_4$ 0,1044 N = 1,7758 mg H_2O_2

34,325ml $KmnO_4$ 0,1044 N = 34,325 x 1,7758 mg H_2O_2

= 60,9558 mg H_2O_2

= 0,06095 gram H_2O_2

% b/v = $\frac{0,06095}{20\,ml}$ x 100%

= 0,305 %

Faktor pengenceran 100x = 0,305 % x 100 = 30,5 %

Jadi kadar H_2O_2 = 30,5%

LAMPIRAN 4

DATA HASIL PEMBAKUAN NaOH

Tabel. IV.4
1. Hasil Pembakuan NaOH dengan Asam Oksalat

Titrasi ke-	Berat asam oksalat (mg)	Volume NaOH (ml)
1	10,0	15,60
2	10,0	15,55
3	10,0	15,65
		$V_{rata\text{-}rata}$ = 15,5833

Perhitungan Normalitas NaOH :

$$N = \frac{Berat_{asamoksalat}}{BE_{asamoksalat} x volume} = \frac{10,0}{63 x 15,5833} = 0,0101 \text{ N.}$$

2. Hasil Pembakuan NaOH dengan Asam Oksalat

Titrasi ke-	Berat asam oksalat (mg)	Volume NaOH (ml)
1	5,1	8,20
2	5,0	8,28
	$Berat_{rata\text{-}rata}$ = 5,05	$V_{rata\text{-}rata}$ = 8,24

Perhitungan Normalitas NaOH :

$$N = \frac{Berat_{asamoksalat}}{BE_{asamoksalat} x volume} = \frac{5,05}{63 x 8,24} = 0,0097 \text{ N.}$$

LAMPIRAN 4
(Lanjutan)

3. Hasil Pembakuan NaOH dengan Asam Oksalat

Titrasi ke-	Berat asam oksalat (mg)	Volume NaOH (ml)
1	10,0	16,15
2	10,0	16,5l
3	10,0	16,85
		$V_{rata\text{-}rata}$ = 16,50

Perhitungan Normalitas NaOH :

$$N = \frac{Berat_{asamoksalat}}{BE_{asamoksalat} x volume} = \frac{10,0}{63 x 16,50} = 0,0096 \text{ N.}$$

4. Hasil Pembakuan NaOH dengan Asam Oksalat

Titrasi ke-	Berat asam oksalat (mg)	Volume NaOH (ml)
1	5,0	8,66
2	5,5	8,84
	Berat $_{rata\text{-}rata}$ = 5,25	$V_{rata\text{-}rata}$ = 16,50

Perhitungan Normalitas NaOH :

$$N = \frac{Berat_{asamoksalat}}{BE_{asamoksalat} x volume} = \frac{5,25}{63 x 8,75} = 0,0095 \text{ N.}$$

LAMPIRAN 5

DATA HASIL TITRASI SO_2 yang DIHASILKAN SETELAH DESTILASI dan PERHITUNGAN KADAR SO_2 DALAM BLANKO dan PRODUK SIMULASI

Tabel. IV.5
Hasil Titrasi SO_2 yang Dihasilkan Setelah Destilasi, dalam Produk Gula Pasir (Blanko)

Titrasi ke-	Berat sampel (g)	Volume NaOH 0,0096N (ml)	Kadar SO_2 (ppm)
1	50,0000	1,48	9,1016
2	50,0001	1,26	7,7487
3	50,0000	1,54	9,4706
4	50,0001	1,38	8,4866
	Berat $_{rata\text{-}rata}$ = 50,00005	V $_{rata\text{-}rata}$ = 1,415	Kadar $_{rata\text{-}rata}$ = 8,7018

Perhitungan Kadar SO_2 :

$$SO_2, \text{ ppm} = \frac{32{,}03 x V_B x N_{NaOH} x 1000}{Berat(gram)}$$

Contoh Perhitungan :

1. SO_2, ppm $= \frac{32{,}03 x 1{,}48 x 0{,}0096 x 1000}{50{,}0000} = 9{,}1016$ ppm

2. SO_2, ppm $= \frac{32{,}03 x 1{,}26 x 0{,}0096 x 1000}{50{,}0001} = 7{,}7487$ ppm

3. SO_2, ppm $= \frac{32{,}03 x 1{,}54 x 0{,}0096 x 1000}{50{,}0000} = 9{,}4706$ ppm

4. SO_2, ppm $= \frac{32{,}03 x 1{,}38 x 0{,}0096 x 1000}{50{,}0001} = 8{,}4866$ ppm

Kadar SO_2 blanko rata-rata :

$$SO_2, \text{ ppm} = \frac{9{,}1016 + 7{,}7487 + 9{,}4706 + 8{,}4866}{4} = 8{,}7018 \text{ ppm.}$$

LAMPIRAN 5
(Lanjutan)

Tabel. IV.6
Hasil Titrasi SO_2 yang Dihasilkan Setelah Destilasi, dalam Produk Simulasi

No.	Berat sampel (g)	Volume NaOH 0,0101N (ml)	Kadar SO_2 (ppm)
1	50,0008	16,72	108,1776
2	50,0011	17,095	110,6032
3	50,0009	16,92	109,4714
	Berat $_{rata\text{-}rata}$ = 50,00093	V $_{rata\text{-}rata}$ = 16,9116	Kadar $_{rata\text{-}rata}$ = 109,4147

Perhitungan kadar SO_2 (dlm ppm) secara percobaan :

$$SO_2, \text{ ppm} = \frac{32{,}03 x V_B x N_{NaOH} x 1000}{Berat(gram)}$$

$$1.\ SO_2, \text{ ppm} = \frac{32{,}03 x 16{,}72 x 0{,}0101 x 1000}{50{,}0008} = 108{,}1776 \text{ ppm}$$

$$2.\ SO_2, \text{ ppm} = \frac{32{,}03 x 17{,}095 x 0{,}0101 x 1000}{50{,}0011} = 110{,}6032 \text{ ppm}$$

$$3.\ SO_2, \text{ ppm} = \frac{32{,}03 x 16{,}92 x 0{,}0101 x 1000}{50{,}0009} = 109{,}4714 \text{ ppm}$$

Kadar SO_2 simulasi rata-rata :

$$SO_2, \text{ ppm} = \frac{108{,}1776 + 110{,}6032 + 109{,}4714}{3} = 109{,}4147 \text{ ppm.}$$

LAMPIRAN 6

DATA HASIL TITRASI SO_2 yang DIHASILKAN SETELAH DESTILASI dan PERHITUNGAN KADAR SO_2 DALAM BEBERAPA PRODUK SAMPEL

Tabel. IV.7
Hasil Titrasi SO_2 yang Dihasilkan Setelah Destilasi, dalam Gula Pasir pada Sampel 1

Volume titrasi yang didapat :

Titrasi ke-	Berat sampel (g)	Volume NaOH 0,0096N (ml)	Kadar SO_2 (ppm)
1	50,0001	0,44	2,7059
2	50,0000	0,42	2,5829
	Berat $_{rata\text{-}rata}$ = 50,00005	V $_{rata\text{-}rata}$ = 0,43	Kadar $_{rata\text{-}rata}$ = 2,6444

Perhitungan Kadar SO_2 :

$$SO_2, \text{ ppm} = \frac{32{,}03 x V_B x N_{NaOH} x 1000}{Berat(gram)}$$

Contoh Perhitungan :

1. SO_2, ppm $= \frac{32{,}03 x 0{,}44 x 0{,}0096 x 1000}{50{,}0001} = 2{,}7059$ ppm

2. SO_2, ppm $= \frac{32{,}03 x 0{,}42 x 0{,}0096 x 1000}{50{,}0000} = 2{,}5829$ ppm

Kadar SO_2 rata-rata :

SO_2, ppm $= \frac{2{,}7059 + 2{,}5829}{2} = 2{,}6444$ ppm.

LAMPIRAN 6
(Lanjutan)

Tabel. IV.7
Hasil Titrasi SO_2 yang Dihasilkan Setelah Destilasi, dalam Gula Pasir pada Sampel 2

Volume titrasi yang didapat :

Titrasi ke-	Berat sampel (g)	Volume NaOH 0,0096N (ml)	Kadar SO_2 (ppm)
1	50,0002	0,54	3,3208
2	50,0001	0,44	2,7059
3	50,0001	0,50	3,0749
	Berat $_{rata\text{-}rata}$ = 50,0001	V $_{rata\text{-}rata}$ = 0,4933	Kadar $_{rata\text{-}rata}$ = 3,0338

Perhitungan Kadar SO_2 :

$$SO_2, \text{ ppm} = \frac{32{,}03 x V_B x N_{NaOH} x 1000}{Berat(gram)}$$

Contoh Perhitungan :

1. SO_2, ppm $= \frac{32{,}03 x 0{,}54 x 0{,}0096 x 1000}{50{,}0002} = 3{,}3208$ ppm

2. SO_2, ppm $= \frac{32{,}03 x 0{,}44 x 0{,}0096 x 1000}{50{,}0001} = 2{,}7059$ ppm

3. SO_2, ppm $= \frac{32{,}03 x 0{,}50 x 0{,}0096 x 1000}{50{,}0001} = 3{,}0749$ ppm

Kadar SO_2 rata-rata :

SO_2, ppm $= \frac{3{,}3208 + 2{,}7059 + 3{,}0749}{3} = 3{,}0338$ ppm.

LAMPIRAN 6
(Lanjutan)

Tabel. IV.7
Hasil Titrasi SO_2 yang Dihasilkan Setelah Destilasi, dalam Gula Pasir pada Sampel 3

Volume titrasi yang didapat :

Titrasi ke-	Berat sampel (g)	Volume NaOH 0,0096N (ml)	Kadar SO_2 (ppm)
1	50,0001	1,48	9,1016
2	50,0001	1,26	7,7487
3	50,0000	1,54	9,4706
	Berat $_{rata\text{-}rata}$ = 50,00006	V $_{rata\text{-}rata}$ = 1,4267	Kadar $_{rata\text{-}rata}$ = 8,7736

Perhitungan Kadar SO_2 :

$$SO_2, \text{ ppm} = \frac{32{,}03 x V_B x N_{NaOH} x 1000}{Berat(gram)}$$

Contoh Perhitungan :

1. SO_2, ppm $= \frac{32{,}03 x 1{,}48 x 0{,}0096 x 1000}{50{,}0001} = 9{,}1016$ ppm

2. SO_2, ppm $= \frac{32{,}03 x 1{,}26 x 0{,}0096 x 1000}{50{,}0001} = 7{,}7487$ ppm

3. SO_2, ppm $= \frac{32{,}03 x 1{,}54 x 0{,}0096 x 1000}{50{,}0000} = 9{,}4706$ ppm

Kadar SO_2 rata-rata :

SO_2, ppm $= \frac{9{,}1016 + 7{,}7487 + 9{,}4706}{3} = 8{,}7736$ ppm.

LAMPIRAN 6
(Lanjutan)

Tabel. IV.7
Hasil Titrasi SO_2 yang Dihasilkan Setelah Destilasi, dalam Gula Pasir pada Sampel 4

Volume titrasi yang didapat :

Titrasi ke-	Berat sampel (g)	Volume NaOH 0,0095N (ml)	Kadar SO_2 (ppm)
1	50,0001	1,80	10,9542
2	50,0000	1,74	10,5891
3	50,0002	1,88	11,4411
	Berat $_{rata\text{-}rata}$ = 50,0001	V $_{rata\text{-}rata}$ = 1,8067	Kadar $_{rata\text{-}rata}$ = 10,9948

Perhitungan Kadar SO_2 :

$$SO_2, \text{ ppm} = \frac{32{,}03 x V_B x N_{NaOH} x 1000}{Berat(gram)}$$

Contoh Perhitungan :

1. SO_2, ppm $= \frac{32{,}03 x 1{,}80 x 0{,}0095 x 1000}{50{,}0001} = 10{,}9542$ ppm

2. SO_2, ppm $= \frac{32{,}03 x 1{,}74 x 0{,}0095 x 1000}{50{,}0000} = 10{,}5891$ ppm

3. SO_2, ppm $= \frac{32{,}03 x 1{,}88 x 0{,}0095 x 1000}{50{,}0002} = 11{,}4411$ ppm

Kadar SO_2 rata-rata :

$$SO_2, \text{ ppm} = \frac{10{,}9542 + 10{,}5891 + 11{,}4411}{3} = 10{,}9948 \text{ ppm.}$$

LAMPIRAN 6
(Lanjutan)

Tabel. IV.7
Hasil Titrasi SO_2 yang Dihasilkan Setelah Destilasi, dalam Gula Pasir pada Sampel 5

Volume titrasi yang didapat :

Titrasi ke-	Berat sampel (g)	Volume NaOH 0,0097N (ml)	Kadar SO_2 (ppm)
1	50,0000	1,06	6,5866
2	50,0002	1,14	7,0837
3	50,0000	1,08	6,7110
	Berat $_{rata\text{-}rata}$ = 50,00006	V $_{rata\text{-}rata}$ = 1,0933	Kadar $_{rata\text{-}rata}$ = 6,7937

Perhitungan Kadar SO_2 :

$$SO_2, \text{ ppm} = \frac{32{,}03 x V_B x N_{NaOH} x 1000}{Berat(gram)}$$

Contoh Perhitungan :

1. SO_2, ppm $= \frac{32{,}03 x 1{,}06 x 0{,}0097 x 1000}{50{,}0000} = 6{,}5866$ ppm

2. SO_2, ppm $= \frac{32{,}03 x 1{,}14 x 0{,}0097 x 1000}{50{,}0002} = 7{,}0837$ ppm

3. SO_2, ppm $= \frac{32{,}03 x 1{,}08 x 0{,}0097 x 1000}{50{,}0000} = 6{,}7110$ ppm

Kadar SO_2 rata-rata :

SO_2, ppm $= \frac{6{,}5866 + 7{,}0837 + 6{,}711}{3} = 6{,}7937$ ppm.

LAMPIRAN 7

HASIL PEROLEHAN KEMBALI DAN PENENTUAN KADAR SO_2 DALAM BEBERAPA PRODUK

Tabel. IV.8
Hasil Penentuan Kadar SO_2 dalam Gula Pasir (Blanko)

No.	Berat sampel (gram)	Kadar SO_2 dalam blanko (ppm)
1	50,0000	9,1016
2	50,0001	7,7487
3	50,0000	9,4706
4	50,0001	8,4866
Rata-rata		8,7018
Standar Deviasi		0,7540
Koefisien Variasi (%)		8,6650

Tabel. IV.9
Hasil Penentuan Kadar SO_2 dalam Sediaan Produk Simulasi

No.	Kadar SO_2 Teoritik (ppm)	Kadar SO_2 yang diperoleh (ppm)	Perolehan Kembali (%)
1.	135,73	108,18	79,70
2.	135,98	110,60	81,33
3.	135,73	109,47	80,65
Rata-rata	135,81	109,41	80,56
Standar Deviasi	0,14	1,21	0,82
Koefisien Variasi (%)	0,10	1,10	1,02

Ket: Produk Simulasi = 50 mg Na_2SO_3 + 200 gram gula pasir

LAMPIRAN 7
(Lanjutan)

Tabel. IV.10
Hasil Penentuan Kadar Sulfur Dioksida (SO_2) dalam Beberapa Sampel

Sampel gula pasir	Berat sampel gula (gram)	Kadar SO_2 (ppm)	Simpangan Baku	Koefisien Variasi (%)
1	50,00005	3,2825	0,1079	3,2871
2	50,0001	3,7660	0,3842	10,2018
3	50,00006	10,8907	1,1253	10,3326
4	50,0001	13,6479	0,5305	3,8870
5	50,00006	8,4332	0,3211	3,8076

LAMPIRAN 8

DATA HASIL PERHITUNGAN KADAR SO_2 SECARA TEORITIS

Contoh perhitungan kadar SO_2 secara teoritis :

Reaksi :

$SO_3^{2-} + 2\ H^+ \longrightarrow SO_2 + H_2O$

$SO_2 + H_2O_2 \longrightarrow SO_4^{2-} + 2\ H^+$

50 mg Na_2SO_3 + 200 gram gula pasir = 200,05 gram

50 mg Na_2SO_3 ~ χmg SO_2

$$\frac{50}{126{,}0418} = \frac{\chi mg SO_2}{64{,}0628} \longrightarrow SO_2 = 25{,}4133 \text{ mg}$$

Jadi, 50 mg Na_2SO_3 ~ 25,4133mg SO_2

Kadar SO_2 dalam gula pasir (blanko) terdapat 8,7018 ppm

(dapat dilihat pada lampiran 5)

Jadi, kadar SO_2 secara teoritis :

Kadar $SO_2 = \frac{25{,}4133_{mg}}{200{,}05_{g}}$ = 127,0347 ppm + 8,7018 ppm = 135,7365 ppm.

LAMPIRAN 9

DATA HASIL PENENTUAN KADAR SO_2 DALAM BEBERAPA SAMPEL

Contoh perhitungan :

- **Sampel 1**

$$\frac{100\%}{80{,}56\%} \text{ x } 2{,}7059 \text{ ppm} = 3{,}3588 \text{ ppm}$$

$$\frac{100\%}{80{,}56\%} \text{ x } 2{,}5829 \text{ ppm} = 3{,}2062 \text{ ppm}$$

$$\text{Kadar } SO_{2 \text{ rata-rata}} = \frac{3{,}3588 + 3{,}2062}{2} = 3{,}2825 \text{ ppm.}$$

SD = 0,1079

KV = 3,2871 %

- **Sampel 2**

$$\frac{100\%}{80{,}56\%} \text{ x } 3{,}3208 \text{ ppm} = 4{,}1221 \text{ ppm}$$

$$\frac{100\%}{80{,}56\%} \text{ x } 2{,}7059 \text{ ppm} = 3{,}3588 \text{ ppm}$$

$$\frac{100\%}{80{,}56\%} \text{ x } 3{,}0749 \text{ ppm} = 3{,}8170 \text{ ppm}$$

$$\text{Kadar } SO_{2 \text{ rata-rata}} = \frac{4{,}1221 + 3{,}3588 + 3{,}8170}{3} = 3{,}7660 \text{ ppm.}$$

SD = 0,3842

KV = 10,2018 %

LAMPIRAN 9
(Lanjutan)

- **Sampel 3**

$\frac{100\%}{80,56\%}$ x 9,1016 ppm= 11,2979 ppm

$\frac{100\%}{80,56\%}$ x 7,7487 ppm= 9,6185 ppm

$\frac{100\%}{80,56\%}$ x 9,4706 ppm= 11,7559 ppm

Kadar $SO_{2\ rata\text{-}rata}$ = $\frac{11,2979 + 9,6185 + 11,7559}{3}$ = 10,8907 ppm.

SD = 1,1253

KV = 10,3326 %

- **Sampel 4**

$\frac{100\%}{80,56\%}$ x 10,9542 ppm= 13,5975 ppm

$\frac{100\%}{80,56\%}$ x 10,5891 ppm= 13,1444 ppm

$\frac{100\%}{80,56\%}$ x 11,4411 ppm= 14,2019 ppm

Kadar $SO_{2\ rata\text{-}rata}$ = $\frac{13,5975 + 13,1444 + 14,2019}{3}$ = 13,6479 ppm.

SD = 0,5305

KV = 3,8870 %

LAMPIRAN 9
(Lanjutan)

- **Sampel 5**

$\frac{100\%}{80,56\%}$ x 6,5866 ppm= 8,1760 ppm

$\frac{100\%}{80,56\%}$ x 7,0837 ppm= 8,7931 ppm

$\frac{100\%}{80,56\%}$ x 6,7110 ppm= 8,3304 ppm

Kadar $SO_{2\ rata\text{-}rata}$ = $\frac{8,1760 + 8,7931 + 8,3304}{3}$ = 8,4332 ppm.

SD = 0,3211

KV = 3,8076 %