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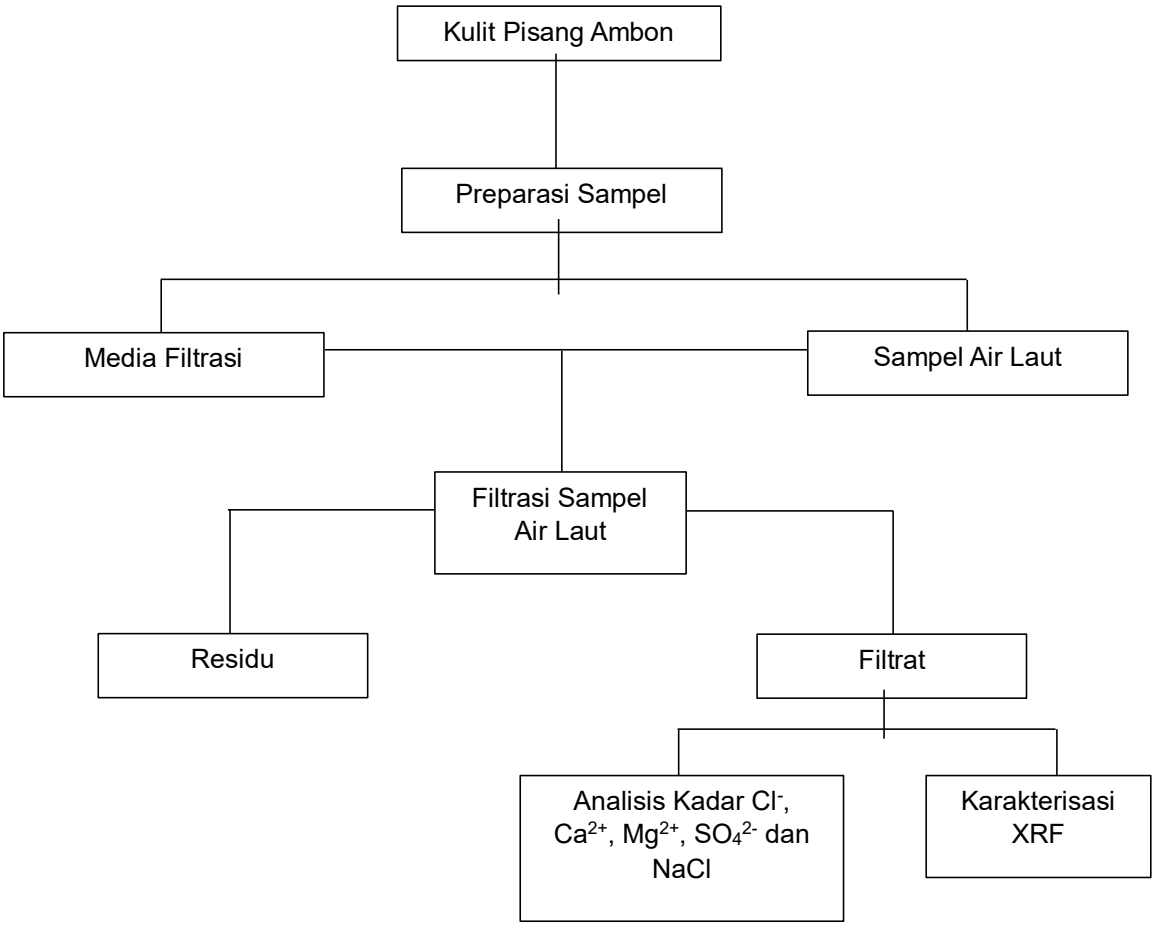
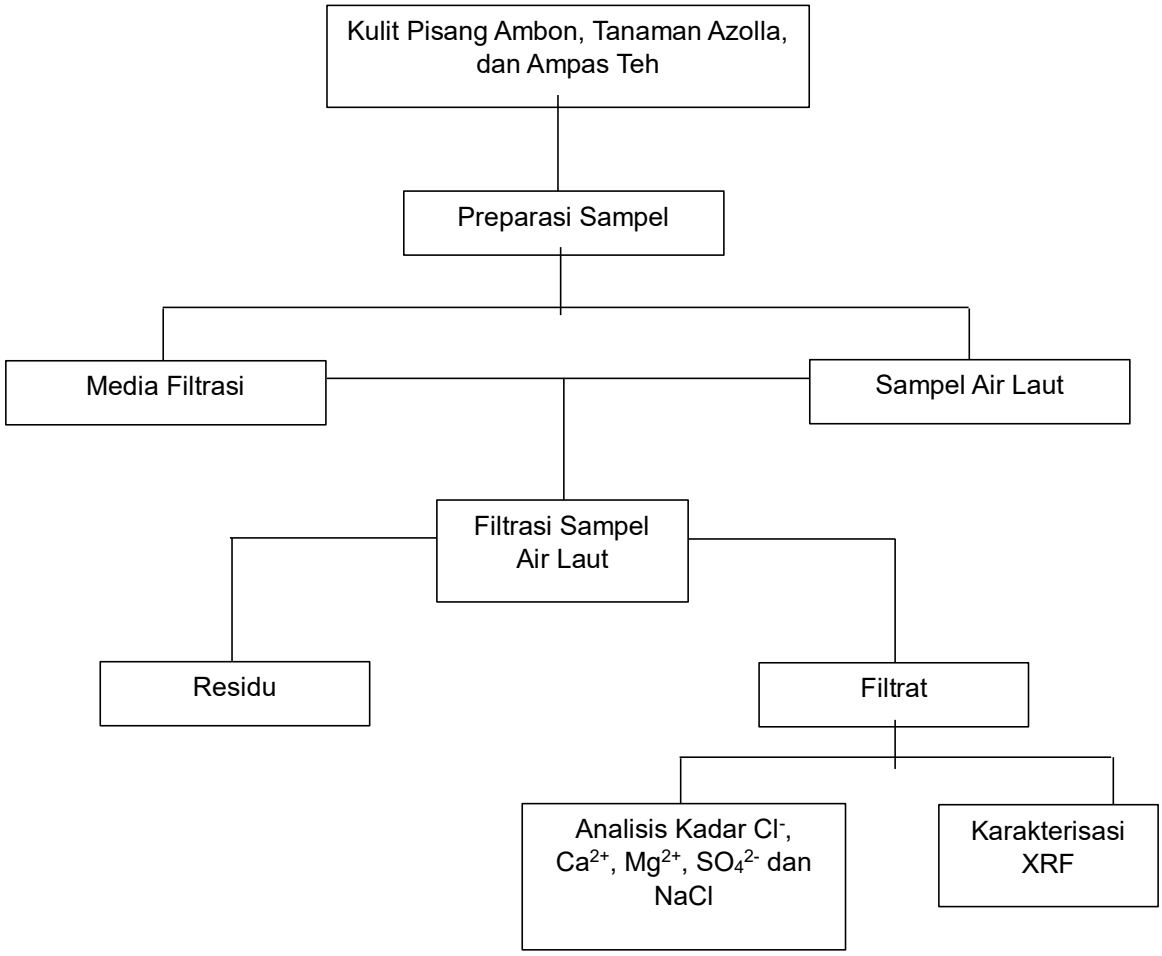
Lampiran 1. Skema kerja

1. Bahan Filter



Catatan: dilakukan hal yang sama untuk bahan filter 2 dan 3.

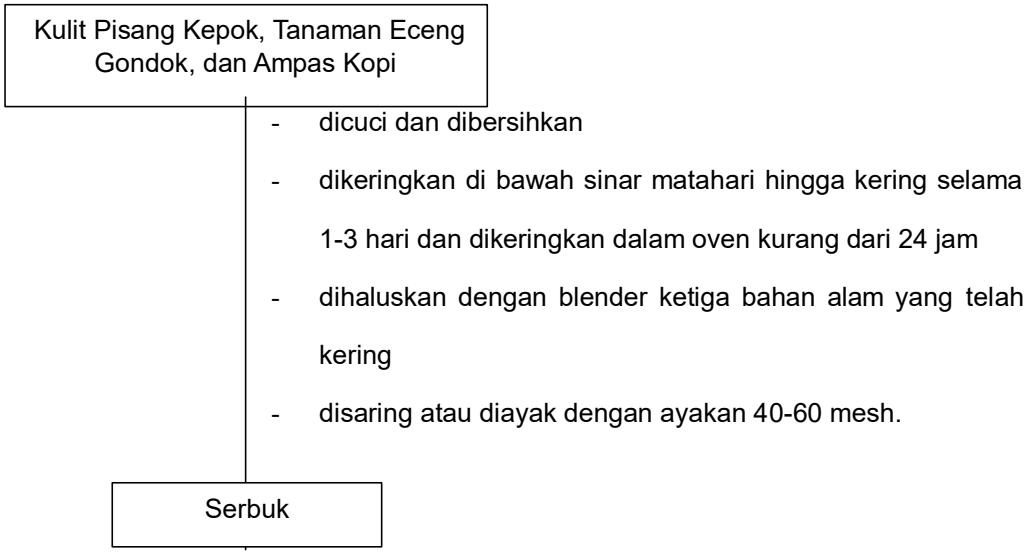
2. Variasi Susunan Bahan Filter



Catatan: dilakukan hal yang sama untuk variasi 2,3,4,5 dan 6.

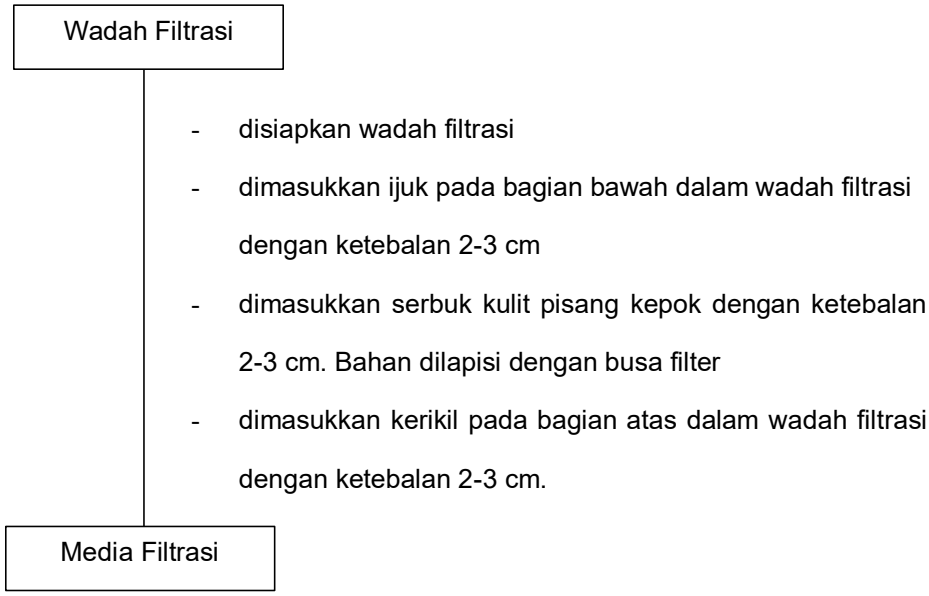
Lampiran 2. Bagan kerja

1. Preparasi Bahan Alam



2. Pembuatan Media Filtrasi Bahan Alam

a. Bahan Filter



Catatan: dilakukan hal yang sama untuk bahan filter 2 dan 3.

b. Variasi Susunan Bahan Filter

Wadah Filtrasi

- disiapkan wadah filtrasi
- dimasukkan ijuk pada bagian bawah dalam wadah filtrasi dengan ketebalan 2-3 cm
- dimasukkan serbuk ampas kopi, serbuk tanaman eceng gondok, dan serbuk kulit pisang kepok dengan ketebalan 2-3 cm, disusun sesuai dengan variasi 1. Semua bahan dilapisi dengan busa filter
- dimasukkan kerikil pada bagian atas dalam wadah filtrasi dengan ketebalan 2-3 cm

Media Filtrasi

Catatan: dilakukan hal yang sama untuk variasi 2,3,4,5 dan 6.

3. Proses Filtrasi dengan Media Filtrasi

Sampel Air Laut

- dialirkan pada media filtrasi dengan kecepatan alir 10 mL/menit
- hasil filtrasi disaring dengan kertas saring
- filtrat dianalisis komposisinya yang meliputi kadar Cl^-, Ca^{2+}, dan Mg^{2+} dengan metode titrasi, kadar air dan SO_4^{2-} dengan gravimetri. Selain itu, kandungan dalam NaCl juga dianalisis dengan menggunakan *X-Ray Fluorescence* (XRF).

Hasil

4. Penentuan Kadar Cl^-, Ca^{2+} dan Mg^{2+} dengan Metode Titrasi

a. Analisis Kadar Cl^- (Basset dkk., 1985)

Sampel Air Laut

- diuapkan atau dipanaskan hingga membentuk kristal

Garam

- ditimbang sebanyak 0,0585 gram
- dilarutkan dengan akuades ke dalam labu ukur 100 mL

Larutan Sampel

- dipipet 10 mL
- dimasukkan ke dalam erlenmeyer 250 mL
- ditambahkan indikator K_2CrO_4 5% 2-3 tetes
- dititrasi dengan $AgNO_3$ 0,01 N
- dicatat volume $AgNO_3$ yang digunakan
- diulangi titrasi secara duplo.

Hasil

b. Analisis Kadar Ca^{2+} (Basset dkk., 1985)

Sampel Air Laut

- diuapkan atau dipanaskan hingga membentuk kristal

Garam

- ditimbang sebanyak 0,585 gram
- dilarutkan dengan akuades ke dalam labu ukur 100 mL

Larutan Sampel

- dipipet 10 mL
- dimasukkan ke dalam erlenmeyer 250 mL
- ditambahkan 1 mL NaOH 1 M hingga pH 12
- ditambahkan indikator mureksid
- dititrasi dengan EDTA 0,01 N
- dicatat volume EDTA yang digunakan
- diulangi titrasi secara duplo.

Hasil

c. Analisis Kadar Mg^{2+} (Basset dkk., 1985)

Sampel Air Laut

- diuapkan atau dipanaskan hingga membentuk kristal

Garam

- ditimbang sebanyak 0,585 gram
- dilarutkan dengan akuades ke dalam labu ukur 100 mL

Larutan Sampel

- dipipet 10 mL
- dimasukkan ke dalam erlenmeyer 250 mL
- ditambahkan 2 mL buffer pH 10
- ditambahkan indikator EBT
- dititrasi dengan EDTA 0,01 N
- dicatat volume EDTA yang digunakan
- diulangi titrasi secara duplo.

Hasil

5. Analisis Kadar Air dengan Gravimetri (Sudarmadji dkk., 1997)

Sampel Air Laut

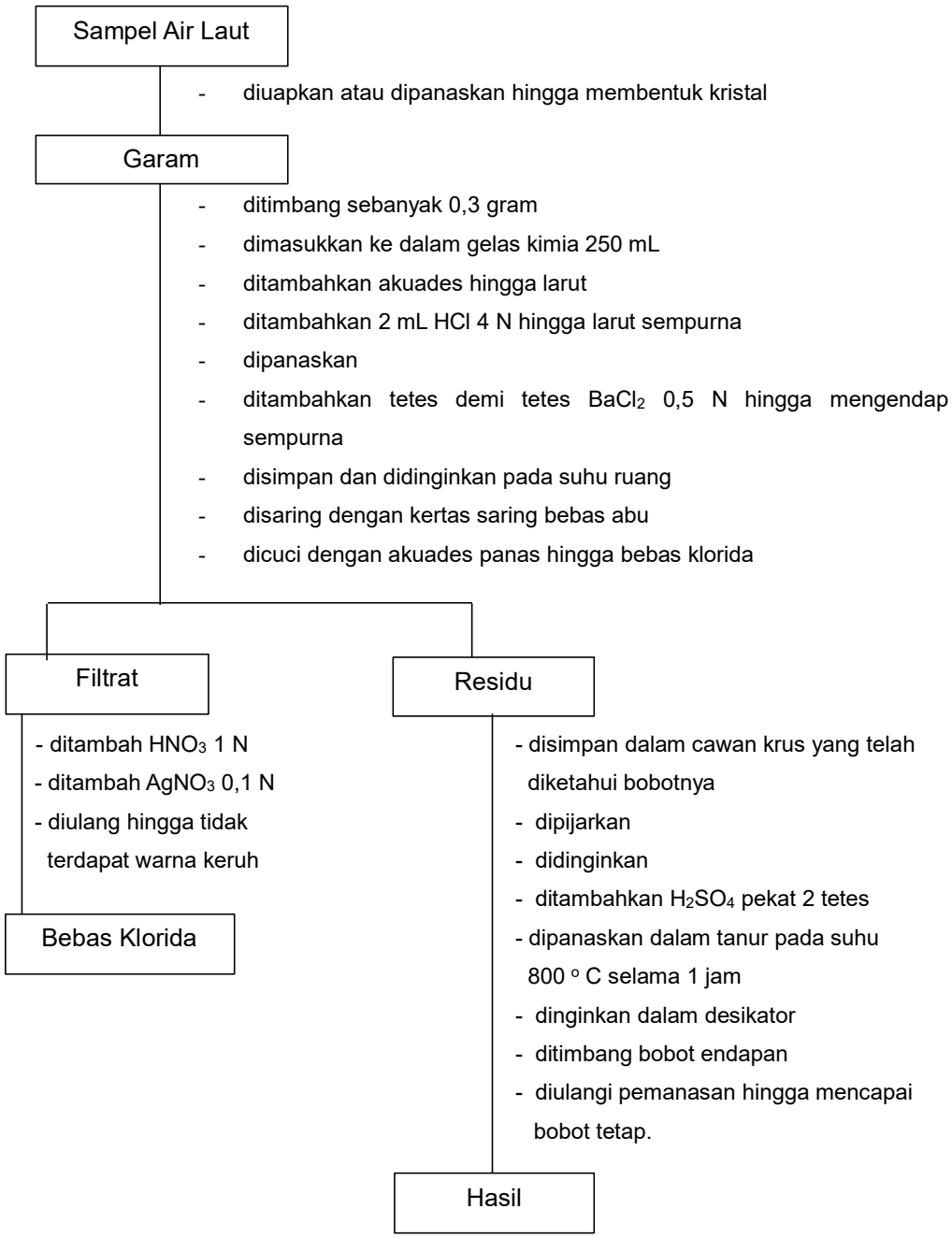
- diuapkan atau dipanaskan hingga membentuk kristal

Garam

- ditimbang sebanyak 1-2 gram
- dimasukkan ke dalam cawan yang telah diketahui beratnya
- dikeringkan dalam oven pada suhu 105 ºC selama 2 jam
- didinginkan dalam desikator dan ditimbang
- dipanaskan kembali dalam oven pada suhu 105 ºC selama 30 menit
- didinginkan dalam desikator dan ditimbang
- diulangi perlakuan yang sama hingga mencapai bobot tetap.

Hasil

6. Analisis Kadar SO_4^{2-} dengan Gravimetri (Basset dkk., 1985)



7. Analisis Logam dengan *X-Ray Fluorescence* (XRF)

XRF

- dikeringkan sampel garam dalam oven pada suhu 70 ºC selama 2 jam
- diayak sampel garam dengan ukuran 40-60 mesh lalu dimasukkan ke dalam *sampel holder*
- dilakukan analisis dengan menggunakan XRF.

Hasil

Lampiran 3. Dokumentasi penelitian

Pengambilan sampel air laut

Sampel air laut

Kulit pisang kepok

Serbuk kulit pisang kepok

Eceng gondok

Serbuk eceng gondok

Ampas kopi

Serbuk ampas kopi

Ijuk

Batu kerikil/koral putih

Busa

Botol filtrasi

Selang infus

Proses pengaliran sampel filtrasi

Proses pengayakan

Proses penyaringan vakum

Susunan filtrasi kulit pisang kepok

Susunan filtrasi eceng gondok

Susunan filtrasi ampas kopi

Susunan filtrasi variasi 1

Susunan filtrasi variasi 2

Susunan filtrasi variasi 3

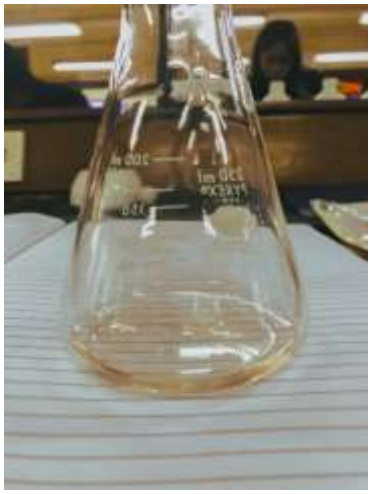
Susunan filtrasi variasi 4

Susunan filtrasi variasi 5

Susunan filtrasi variasi 6

Hasil Filtrasi


Hasil titrasi argentometri (analisis kadar klorida)




Hasil titrasi kompleksometri (analisis kadar kalsium)

Hasil titrasi kompleksometri (analisis kadar magnesium)

Hasil gravimetri pengujian kadar air

Hasil gravimetri pengujian kadar sulfat

Lampiran 4. Perhitungan

1. Penentuan Kadar Cl^- dengan Metode Titrasi Argentometri

a. Standarisasi $AgNO_3$

- Bobot Timbang NaCl : 0,0585 g
- Konsentrasi NaCl : 0,01 N
- Volume NaCl : 25 mL
- V $AgNO_3$: $\frac{25\ mL + 25{,}3\ mL}{2}$ = 25,15 mL
- V $AgNO_3$ x N $AgNO_3$ = V NaCl x N NaCl

$$N\ AgNO_3 = \frac{V\ NaCl \times N\ NaCl}{V\ AgNO_3}$$

$$N\ AgNO_3 = \frac{25\ mL \times 0{,}01\ N}{25{,}15\ mL}$$

$$N\ AgNO_3 = 0{,}0099\ N$$

b. Sampel Awal (tanpa filtrasi)

- V $AgNO_3$ = $\frac{6{,}7\ mL + 7\ mL}{2}$ = 6,85 mL
- Kadar Cl^- = $\frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 6{,}85\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 48{,}14\%$$

c. Sampel Bahan filter 1 (kulit pisang kepok)

- V $AgNO_3$ = $\frac{8{,}2\ mL + 8{,}3\ mL}{2}$ = 8,25 mL
- Kadar Cl^- = $\frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}25\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 57{,}98\%$$

d. Sampel Bahan filter 2 (eceng gondok)

- $V\ AgNO_3 = \frac{8{,}2\ mL + 8{,}3\ mL}{2} = 8{,}25\ mL$
- $Kadar\ Cl^- = \frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}25\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 57{,}98\%$$

e. Sampel Bahan filter 3 (ampas kopi)

- $V\ AgNO_3 = \frac{8{,}5\ mL + 8{,}4\ mL}{2} = 8{,}45\ mL$
- $Kadar\ Cl^- = \frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}45\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 59{,}39\%$$

f. Sampel Variasi 1 (kulit pisang kepok, eceng gondok, ampas kopi)

- $V\ AgNO_3 = \frac{8{,}4\ mL + 8{,}3\ mL}{2} = 8{,}35\ mL$
- $Kadar\ Cl^- = \frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}35\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 58{,}69\%$$

g. Sampel Variasi 2 (kulit pisang kepok, ampas kopi, eceng gondok)

- $V\ AgNO_3 = \frac{8{,}2\ mL + 8{,}3\ mL}{2} = 8{,}25\ mL$
- $Kadar\ Cl^- = \frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}25\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 57{,}98\%$$

h. Sampel Variasi 3 (eceng gondok, kulit pisang kepok, ampas kopi)

- $V\ AgNO_3 = \frac{8{,}5\ mL + 8{,}5\ mL}{2} = 8{,}5\ mL$
- $Kadar\ Cl^- = \frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}5\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 59{,}74\%$$

i. Sampel Variasi 4 (eceng gondok, ampas kopi, kulit pisang kepok)

- $V\ AgNO_3 = \frac{8{,}5\ mL + 8{,}6\ mL}{2} = 8{,}55\ mL$
- $Kadar\ Cl^- = \frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}55\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 60{,}09\%$$

j. Sampel Variasi 5 (ampas kopi, kulit pisang kepok, eceng gondok)

- $V\ AgNO_3 = \frac{8{,}5\ mL + 8{,}4\ mL}{2} = 8{,}45\ mL$
- $Kadar\ Cl^- = \frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}45\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 59{,}39\%$$

k. Sampel Variasi 6 (ampas kopi, eceng gondok, kulit pisang kepok)

- $V\ AgNO_3 = \frac{8{,}6\ mL + 8{,}5\ mL}{2} = 8{,}55\ mL$
- $Kadar\ Cl^- = \frac{fp \times V\ AgNO3 \times N\ AgNO3 \times BE\ Cl}{m\ sampel} \times 100\%$

$$= \frac{10 \times 8{,}55\ mL \times 0{,}0099\ meq/mL \times 35{,}5\ mg/meq}{50\ mg} \times 100\%$$

$$= 60{,}09\%$$

2. Penentuan Kadar Ca^{2+} dan Mg^{2+} dengan Metode Titrasi Kompleksometri

a. Standarisasi EDTA

- Bobot Timbang $CaCO_3$: 0,1 g
- Konsentrasi $CaCO_3$: 0,01 N = $\frac{0,01}{\text{valensi } CaCO_3} = \frac{0,01}{2}$ = 0,0050 N
- V EDTA : $\frac{9,8 \text{ mL} + 9,6 \text{ mL}}{2}$ = 9,7 mL
- V EDTA x N EDTA = V $CaCO_3$ x N $CaCO_3$

$$\text{N EDTA} = \frac{\text{V } CaCO_3 \times \text{N } CaCO_3}{\text{V EDTA}}$$

$$\text{N EDTA} = \frac{10 \text{ mL} \times 0,0050 \text{ N}}{9,7 \text{ mL}}$$

$$\text{N EDTA} = 0,00515 \text{ N}$$

b. Sampel Awal (tanpa filtrasi)

- V EDTA II (titrasi Mureksid) = $\frac{1,3 \text{ mL} + 1,1 \text{ mL}}{2}$ = 1,2 mL
- Kadar Ca^{2+} = $\frac{\text{fp} \times \text{V EDTA II} \times \text{N EDTA} \times \text{BE Ca}}{\text{m sampel}} \times 100\%$

  = $\frac{10 \times 1,2 \text{ mL} \times 0,00515 \text{ meq/mL} \times 20 \text{ mg/meq}}{500 \text{ mg}} \times 100\%$

  = 0,24%

- V EDTA I (titrasi EBT) = $\frac{0,5 \text{ mL} + 0,5 \text{ mL}}{2}$ = 0,5 mL
- Kadar Mg^{2+} = $\frac{\text{fp} \times \text{V EDTA II} \times \text{N EDTA} \times \text{BE Ca}}{\text{m sampel}} \times 100\%$

  = $\frac{10 \times (0,5 - 1,2) \text{ mL} \times 0,00515 \text{ meq/mL} \times 20 \text{ mg/meq}}{500 \text{ mg}} \times 100\%$

  = -0,08%

c. Sampel Bahan filter 1 (kulit pisang kepok)

- V EDTA II (titrasi Mureksid) = $\frac{0,5 \text{ mL} + 0,7 \text{ mL}}{2}$ = 0,6 mL
- Kadar Ca^{2+} = $\frac{\text{fp} \times \text{V EDTA II} \times \text{N EDTA} \times \text{BE Ca}}{\text{m sampel}} \times 100\%$

  = $\frac{10 \times 0,6 \text{ mL} \times 0,00515 \text{ meq/mL} \times 20 \text{ mg/meq}}{500 \text{ mg}} \times 100\%$

  = 0,12%

- V EDTA I (titrasi EBT) $= \frac{1{,}2\ \text{mL} + 1{,}0\ \text{mL}}{2} = 1{,}1\ \text{mL}$
- Kadar $Mg^{2+} = \frac{\text{fp} \times (\text{V EDTA I} - \text{V EDTA II}) \times \text{N EDTA} \times \text{BE Mg}}{\text{m sampel}} \times 100\%$

$= \frac{10 \times (1{,}1 - 0{,}6)\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 12\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

$= 0{,}06\%$

d. Sampel Bahan filter 2 (eceng gondok)

- V EDTA II (titrasi Mureksid) $= \frac{0{,}6\ \text{mL} + 0{,}6\ \text{mL}}{2} = 0{,}6\ \text{mL}$
- Kadar $Ca^{2+} = \frac{\text{fp} \times \text{V EDTA II} \times \text{N EDTA} \times \text{BE Ca}}{\text{m sampel}} \times 100\%$

$= \frac{10 \times 0{,}6\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 20\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

$= 0{,}12\%$

- V EDTA I (titrasi EBT) $= \frac{0{,}6\ \text{mL} + 0{,}8\ \text{mL}}{2} = 0{,}7\ \text{mL}$
- Kadar $Mg^{2+} = \frac{\text{fp} \times (\text{V EDTA I} - \text{V EDTA II}) \times \text{N EDTA} \times \text{BE Mg}}{\text{m sampel}} \times 100\%$

$= \frac{10 \times (0{,}7 - 0{,}6)\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 12\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

$= 0{,}01\%$

e. Sampel Bahan filter 3 (ampas kopi)

- V EDTA II (titrasi Mureksid) $= \frac{0{,}4\ \text{mL} + 0{,}6\ \text{mL}}{2} = 0{,}5\ \text{mL}$
- Kadar $Ca^{2+} = \frac{\text{fp} \times \text{V EDTA II} \times \text{N EDTA} \times \text{BE Ca}}{\text{m sampel}} \times 100\%$

$= \frac{10 \times 0{,}5\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 20\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

$= 0{,}1\%$

- V EDTA I (titrasi EBT) $= \frac{1{,}2\ \text{mL} + 1{,}1\ \text{mL}}{2} = 0{,}15\ \text{mL}$
- Kadar $Mg^{2+} = \frac{\text{fp} \times (\text{V EDTA I} - \text{V EDTA II}) \times \text{N EDTA} \times \text{BE Mg}}{\text{m sampel}} \times 100\%$

$= \frac{10 \times (0{,}15 - 0{,}5)\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 12\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

$= -0{,}04\%$

f. Sampel Variasi 1 (kulit pisang kepok, eceng gondok, ampas kopi)

- V EDTA II (titrasi Mureksid) $= \frac{0{,}5\ \text{mL} + 0{,}7\ \text{mL}}{2} = 0{,}6\ \text{mL}$
- Kadar $Ca^{2+} = \frac{\text{fp} \times \text{V EDTA II} \times \text{N EDTA} \times \text{BE Ca}}{\text{m sampel}} \times 100\%$

  $= \frac{10 \times 0{,}6\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 20\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

  $= 0{,}12\%$

- V EDTA I (titrasi EBT) $= \frac{0{,}6\ \text{mL} + 0{,}8\ \text{mL}}{2} = 0{,}7\ \text{mL}$

  Kadar $Mg^{2+} = \frac{\text{fp} \times (\text{V EDTA I} - \text{V EDTA II}) \times \text{N EDTA} \times \text{BE Mg}}{\text{m sampel}} \times 100\%$

  $= \frac{10 \times (0{,}7 - 0{,}6)\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 12\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

  $= 0{,}01\%$

g. Sampel Variasi 2 (kulit pisang kepok, ampas kopi, eceng gondok)

- V EDTA II (titrasi Mureksid) $= \frac{0{,}7\ \text{mL} + 0{,}7\ \text{mL}}{2} = 0{,}7\ \text{mL}$
- Kadar $Ca^{2+} = \frac{\text{fp} \times \text{V EDTA II} \times \text{N EDTA} \times \text{BE Ca}}{\text{m sampel}} \times 100\%$

  $= \frac{10 \times 0{,}7\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 20\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

  $= 0{,}14\%$

- V EDTA I (titrasi EBT) $= \frac{1{,}3\ \text{mL} + 0{,}9\ \text{mL}}{2} = 1{,}1\ \text{mL}$

  Kadar $Mg^{2+} = \frac{\text{fp} \times (\text{V EDTA I} - \text{V EDTA II}) \times \text{N EDTA} \times \text{BE Mg}}{\text{m sampel}} \times 100\%$

  $= \frac{10 \times (1{,}1 - 0{,}7)\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 12\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

  $= 0{,}04\%$

h. Sampel Variasi 3 (eceng gondok, kulit pisang kepok, ampas kopi)

- V EDTA II (titrasi Mureksid) $= \frac{0{,}4\ \text{mL} + 0{,}6\ \text{mL}}{2} = 0{,}5\ \text{mL}$
- Kadar $Ca^{2+} = \frac{\text{fp} \times \text{V EDTA II} \times \text{N EDTA} \times \text{BE Ca}}{\text{m sampel}} \times 100\%$

  $= \frac{10 \times 0{,}5\ \text{mL} \times 0{,}00515\ \text{meq/mL} \times 20\ \text{mg/meq}}{500\ \text{mg}} \times 100\%$

  $= 0{,}1\%$

- V EDTA I (titrasi EBT) $= \frac{0,9\ mL + 0,8\ mL}{2} = 0,85\ mL$

  Kadar $Mg^{2+} = \frac{fp \times (V\ EDTA\ I - V\ EDTA\ II) \times N\ EDTA \times BE\ Mg}{m\ sampel} \times 100\%$

  $= \frac{10 \times (0,85 - 0,5)\ mL \times 0,00515\ meq/mL \times 12\ mg/meq}{500\ mg} \times 100\%$

  $= 0,04\%$

i. Sampel Variasi 4 (eceng gondok, ampas kopi, kulit pisang kepok)

- V EDTA II (titrasi Mureksid) $= \frac{0,4\ mL + 0,6\ mL}{2} = 0,5\ mL$
- Kadar $Ca^{2+} = \frac{fp \times V\ EDTA\ II \times N\ EDTA \times BE\ Ca}{m\ sampel} \times 100\%$

  $= \frac{10 \times 0,5\ mL \times 0,00515\ meq/mL \times 20\ mg/meq}{500\ mg} \times 100\%$

  $= 0,1\%$

- V EDTA I (titrasi EBT) $= \frac{0,8\ mL + 0,9\ mL}{2} = 0,85\ mL$

  Kadar $Mg^{2+} = \frac{fp \times (V\ EDTA\ I - V\ EDTA\ II) \times N\ EDTA \times BE\ Mg}{m\ sampel} \times 100\%$

  $= \frac{10 \times (0,85 - 0,5)\ mL \times 0,00515\ meq/mL \times 12\ mg/meq}{500\ mg} \times 100\%$

  $= 0,04\%$

j. Sampel Variasi 5 (ampas kopi, kulit pisang kepok, eceng gondok)

- V EDTA II (titrasi Mureksid) $= \frac{0,4\ mL + 0,5\ mL}{2} = 0,45\ mL$
- Kadar $Ca^{2+} = \frac{fp \times V\ EDTA\ II \times N\ EDTA \times BE\ Ca}{m\ sampel} \times 100\%$

  $= \frac{10 \times 0,45\ mL \times 0,00515\ meq/mL \times 20\ mg/meq}{500\ mg} \times 100\%$

  $= 0,09\%$

- V EDTA I (titrasi EBT) $= \frac{0,8\ mL + 0,7\ mL}{2} = 0,75\ mL$

  Kadar $Mg^{2+} = \frac{fp \times (V\ EDTA\ I - V\ EDTA\ II) \times N\ EDTA \times BE\ Mg}{m\ sampel} \times 100\%$

  $= \frac{10 \times (0,75 - 0,45)\ mL \times 0,00515\ meq/mL \times 12\ mg/meq}{500\ mg} \times 100\%$

  $= 0,03\%$

k. Sampel Variasi 6 (ampas kopi, eceng gondok, kulit pisang kepok)

- V EDTA II (titrasi Mureksid) $= \frac{0,3\ mL + 0,4\ mL}{2} = 0,35\ mL$

- Kadar $Ca^{2+} = \frac{fp \times V\ EDTA\ II \times N\ EDTA \times BE\ Ca}{m\ sampel} \times 100\%$

$= \frac{10 \times 0{,}35\ mL \times 0{,}00515\ meq/mL \times 20\ mg/meq}{500\ mg} \times 100\%$

$= 0{,}07\%$

- V EDTA I (titrasi EBT) $= \frac{0{,}6\ mL + 0{,}6\ mL}{2} = 0{,}6\ mL$

Kadar $Mg^{2+} = \frac{fp \times (V\ EDTA\ I - V\ EDTA\ II) \times N\ EDTA \times BE\ Mg}{m\ sampel} \times 100\%$

$= \frac{10 \times (0{,}6 - 0{,}35)\ mL \times 0{,}00515\ meq/mL \times 12\ mg/meq}{500\ mg} \times 100\%$

$= 0{,}03\%$

3. Penentuan Kadar H_2O dengan Metode Gravimetri

a. Sampel Awal (tanpa filtrasi)

- Bobot kosong cawan : 47,2090 g
- Bobot cawan + sampel : 49,5435 g
- Bobot kering cawan + sampel : 48,6568 g
- Bobot sampel : 49,5435 – 47,2090 = 2,3345 g
- Bobot kering sampel : 48,6568 – 47,2090 = 1,4478 g
- Kadar Air $= \frac{berat\ awal - berat\ kering}{berat\ awal} \times 100\%$

$= \frac{2{,}3345\ g - 1{,}4478\ g}{2{,}3345\ g} \times 100\%$

$= 37{,}98\%$

b. Sampel Bahan filter 1 (kulit pisang kepok)

- Bobot kosong cawan : 40,6631 g
- Bobot cawan + sampel : 43,1778 g
- Bobot kering cawan + sampel : 42,3319 g
- Bobot sampel : 43,1778 – 40,6631 = 2,5147 g
- Bobot kering sampel : 42,3319 – 40,6631 = 1,6688 g
- Kadar Air $= \frac{berat\ awal - berat\ kering}{berat\ awal} \times 100\%$

$= \frac{2{,}5147\ g - 1{,}6688\ g}{2{,}5147\ g} \times 100\%$

$= 33{,}63\%$

c. Sampel Bahan filter 2 (eceng gondok)

- Bobot kosong cawan : 48,2147 g

- Bobot cawan + sampel : 50,2081 g
- Bobot kering cawan + sampel : 49,6212 g
- Bobot sampel : 50,2081 – 48,2147 = 1,9934 g
- Bobot kering sampel : 49,6212 – 48,2147 = 1,4065 g
- Kadar Air $= \frac{\text{berat awal - berat kering}}{\text{berat awal}} \times 100\%$

  $= \frac{1,9934\text{ g} - 1,4065\text{ g}}{1,9934\text{ g}} \times 100\%$

  $= 29,44\%$

d. Sampel Bahan filter 3 (ampas kopi)

- Bobot kosong cawan : 48,5346 g
- Bobot cawan + sampel : 51,0313 g
- Bobot kering cawan + sampel : 50,2065 g
- Bobot sampel : 51,0313 – 48,5346 = 2,4967 g
- Bobot kering sampel : 50,2065 – 48,5346 = 1,6719 g
- Kadar Air $= \frac{\text{berat awal - berat kering}}{\text{berat awal}} \times 100\%$

  $= \frac{2,4967\text{ g} - 1,6719\text{ g}}{2,4967\text{ g}} \times 100\%$

  $= 33,03\%$

e. Sampel Variasi 1 (kulit pisang kepok, eceng gondok, ampas kopi)

- Bobot kosong cawan : 46,7913 g
- Bobot cawan + sampel : 48,7854 g
- Bobot kering cawan + sampel : 48,1766 g
- Bobot sampel : 48,7854 – 46,7913 = 1,9941 g
- Bobot kering sampel : 48,1766 – 46,7913 = 1,3853 g
- Kadar Air $= \frac{\text{berat awal - berat kering}}{\text{berat awal}} \times 100\%$

  $= \frac{1,9941\text{ g} - 1,3853\text{ g}}{1,9941\text{ g}} \times 100\%$

  $= 30,53\%$

f. Sampel Variasi 2 (kulit pisang kepok, ampas kopi, eceng gondok)

- Bobot kosong cawan : 40,4203 g
- Bobot cawan + sampel : 42,6074 g
- Bobot kering cawan + sampel : 41,9219 g
- Bobot sampel : 42,6074 – 40,4203 = 2,1871 g
- Bobot kering sampel : 41,9219 – 40,4203 = 1,5016 g
- Kadar Air $= \frac{\text{berat awal - berat kering}}{\text{berat awal}} \times 100\%$

$$= \frac{2{,}1871\ g - 1{,}5016\ g}{2{,}1871\ g} \times 100\%$$
$$= 31{,}34\%$$

g. Sampel Variasi 3 (eceng gondok, kulit pisang kepok, ampas kopi)

- Bobot kosong cawan : 46,4771 g
- Bobot cawan + sampel : 48,6915 g
- Bobot kering cawan + sampel : 48,0206 g
- Bobot sampel : 48,6915 – 46,4771 = 2,2144 g
- Bobot kering sampel : 48,0206 – 46,4771 = 1,5435 g
- Kadar Air $= \frac{\text{berat awal - berat kering}}{\text{berat awal}} \times 100\%$

$$= \frac{2{,}2144\ g - 1{,}5435\ g}{2{,}2144\ g} \times 100\%$$
$$= 30{,}29\%$$

h. Sampel Variasi 4 (eceng gondok, ampas kopi, kulit pisang kepok)

- Bobot kosong cawan : 46,7371 g
- Bobot cawan + sampel : 48,9119 g
- Bobot kering cawan + sampel : 48,3560 g
- Bobot sampel : 48,9119 – 46,7371 = 2,1748 g
- Bobot kering sampel : 48,3560 – 46,7371 = 1,6189 g
- Kadar Air $= \frac{\text{berat awal - berat kering}}{\text{berat awal}} \times 100\%$

$$= \frac{2{,}1748\ g - 1{,}6189\ g}{2{,}1748\ g} \times 100\%$$
$$= 25{,}56\%$$

i. Sampel Variasi 5 (ampas kopi, kulit pisang kepok, eceng gondok)

- Bobot kosong cawan : 39,5878 g
- Bobot cawan + sampel : 41,0162 g
- Bobot kering cawan + sampel : 40,6128 g
- Bobot sampel : 41,0162 – 39,5878 = 1,4284 g
- Bobot kering sampel : 40,6128 – 39,5878 = 1,0250 g
- Kadar Air $= \frac{\text{berat awal - berat kering}}{\text{berat awal}} \times 100\%$

$$= \frac{1{,}4284\ g - 1{,}0250\ g}{1{,}4284\ g} \times 100\%$$
$$= 28{,}31\%$$

j. Sampel Variasi 6 (ampas kopi, eceng gondok, kulit pisang kepok)

- Bobot kosong cawan : 45,6920 g
- Bobot cawan + sampel : 47,0568 g

- Bobot kering cawan + sampel : 46,7558 g
- Bobot sampel : 47,0568 – 45,6920 = 1,3648 g
- Bobot kering sampel : 46,7558 – 45,6920 = 1,0638 g
- Kadar Air $= \frac{\text{berat awal - berat kering}}{\text{berat awal}} \times 100\%$

$= \frac{1{,}3648\text{ g} - 1{,}0638\text{ g}}{1{,}3648\text{ g}} \times 100\%$

$= 22{,}05\ \%$

4. Penentuan Kadar SO_4^{2-} dengan Metode Gravimetri

a. Sampel Awal (tanpa filtrasi)

- Bobot sampel : 1,7288 g
- Bobot cawan kosong : 19,9847 g
- Bobot sisa pijar : 19,9941 – 19,9847 = 0,0094 g
- $FG = \frac{Mr\ SO4}{Mr\ BaSO4} = \frac{96\text{ g/mol}}{233\text{ g/mol}} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar x FG}}{\text{m sampel}} \times 100\%$

$= \frac{0{,}0094\text{ g x }0{,}4120}{1{,}7288\text{ g}} \times 100\%$

$= 0{,}22\%$

b. Sampel Bahan filter 1 (kulit pisang kepok)

- Bobot sampel : 1,7702 g
- Bobot cawan kosong : 24,9879 g
- Bobot sisa pijar : 24,9896 – 24,9879 = 0,0017 g
- $FG = \frac{Mr\ SO4}{Mr\ BaSO4} = \frac{96\text{ g/mol}}{233\text{ g/mol}} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar x FG}}{\text{m sampel}} \times 100\%$

$= \frac{0{,}0017\text{ g x }0{,}4120}{1{,}8416\text{ g}} \times 100\%$

$= 0{,}03\%$

c. Sampel Bahan filter 2 (eceng gondok)

- Bobot sampel : 1,7935 g
- Bobot cawan kosong : 18,0716 g
- Bobot sisa pijar : 18,0824 – 18,0716 = 0,0108 g
- $FG = \frac{Mr\ SO4}{Mr\ BaSO4} = \frac{96\text{ g/mol}}{233\text{ g/mol}} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar x FG}}{\text{m sampel}} \times 100\%$

$$= \frac{0{,}0108 \text{ g} \times 0{,}4120}{1{,}7935 \text{ g}} \times 100\%$$
$$= 0{,}24\%$$

d. Sampel Bahan filter 3 (ampas kopi)

- Bobot sampel : 1,8416 g
- Bobot cawan kosong : 16,6591 g
- Bobot sisa pijar : 16,6672 – 16,6591 = 0,0081 g
- $FG = \frac{Mr\ SO4}{Mr\ BaSO4} = \frac{96\ g/mol}{233\ g/mol} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar} \times FG}{\text{m sampel}} \times 100\%$

$$= \frac{0{,}0057 \text{ g} \times 0{,}4120}{1{,}8416 \text{ g}} \times 100\%$$
$$= 0{,}18\%$$

e. Sampel Variasi 1 (kulit pisang kepok, eceng gondok, ampas kopi)

- Bobot sampel : 1,7064 g
- Bobot cawan kosong : 16,6591 g
- Bobot sisa pijar : 16,6672 – 16,6591 = 0,0081 g
- $FG = \frac{Mr\ SO4}{Mr\ BaSO4} = \frac{96\ g/mol}{233\ g/mol} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar} \times FG}{\text{m sampel}} \times 100\%$

$$= \frac{0{,}0081 \text{ g} \times 0{,}4120}{1{,}7064 \text{ g}} \times 100\%$$
$$= 0{,}19\%$$

f. Sampel Variasi 2 (kulit pisang kepok, ampas kopi, eceng gondok)

- Bobot sampel : 1,7319 g
- Bobot cawan kosong : 18,0716 g
- Bobot sisa pijar : 18,0732 – 18,0716 = 0,0016 g
- $FG = \frac{Mr\ SO4}{Mr\ BaSO4} = \frac{96\ g/mol}{233\ g/mol} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar} \times FG}{\text{m sampel}} \times 100\%$

$$= \frac{0{,}0016 \text{ g} \times 0{,}4120}{1{,}7319 \text{ g}} \times 100\%$$
$$= 0{,}03\%$$

g. Sampel Variasi 3 (eceng gondok, kulit pisang kepok, ampas kopi)

- Bobot sampel : 1,0005 g
- Bobot cawan kosong : 19,9851 g

- Bobot sisa pijar : 19,9878 - 19,9851 = 0,0027 g
- FG = $\frac{\text{Mr SO4}}{\text{Mr BaSO4}} = \frac{96\ \text{g/mol}}{233\ \text{g/mol}} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar x FG}}{\text{m sampel}} \times 100\%$

  $= \frac{0{,}0027\ \text{g} \times 0{,}4120}{1{,}0005\ \text{g}} \times 100\%$

  $= 0{,}11\%$

h. Sampel Variasi 4 (eceng gondok, ampas kopi, kulit pisang kepok)

- Bobot sampel : 0,9093 g
- Bobot cawan kosong : 15,5287 g
- Bobot sisa pijar : 15,5310 - 15,5287 = 0,0023 g
- FG = $\frac{\text{Mr SO4}}{\text{Mr BaSO4}} = \frac{96\ \text{g/mol}}{233\ \text{g/mol}} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar x FG}}{\text{m sampel}} \times 100\%$

  $= \frac{0{,}0023\ \text{g} \times 0{,}4120}{0{,}9093\ \text{g}} \times 100\%$

  $= 0{,}10\%$

i. Sampel Variasi 5 (ampas kopi, kulit pisang kepok, eceng gondok)

- Bobot sampel : 1,7448 g
- Bobot cawan kosong : 16,6553 g
- Bobot sisa pijar : 16,6591 – 16,6553 = 0,0038 g
- FG = $\frac{\text{Mr SO4}}{\text{Mr BaSO4}} = \frac{96\ \text{g/mol}}{233\ \text{g/mol}} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar x FG}}{\text{m sampel}} \times 100\%$

  $= \frac{0{,}0038\ \text{g} \times 0{,}4120}{1{,}7448\ \text{g}} \times 100\%$

  $= 0{,}08\%$

j. Sampel Variasi 6 (ampas kopi, eceng gondok, kulit pisang kepok)

- Bobot sampel : 1,8364 g
- Bobot cawan kosong : 18,0683 g
- Bobot sisa pijar : 18,0716 - 18,0683 = 0,0033 g
- FG = $\frac{\text{Mr SO4}}{\text{Mr BaSO4}} = \frac{96\ \text{g/mol}}{233\ \text{g/mol}} = 0{,}4120$
- Kadar $SO_4^{2-} = \frac{\text{berat sisa pijar x FG}}{\text{m sampel}} \times 100\%$

  $= \frac{0{,}0033\ \text{g} \times 0{,}4120}{1{,}8364\ \text{g}} \times 100\%$

= 0,07%

5. Penentuan Kadar NaCl dalam Garam

a. Sampel Awal (tanpa filtrasi)

- Kadar SO_4^{2-} = 0,22%
- Kadar Cl^- = 48,14%
- Kadar Ca^{2+} = 0,24%
- Kadar Mg^{2+} = -0,08%
- Kadar $CaSO_4$ $= \frac{\text{Mr } CaSO_4}{\text{Mr } SO_4} \times \text{Kadar } SO_4^{2-}$
  $= \frac{136 \text{ g/mol}}{96 \text{ g/mol}} \times 0{,}22\%$
  = 0,31%
- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{\text{Ar Ca}}{\text{Mr } CaSO_4} \times \text{Kadar } CaSO_4$
  $= \frac{40 \text{ g/mol}}{136 \text{ g/mol}} \times 0{,}31\%$
  = 0,09%
- Kadar Ca^{2+} sisa = Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$
  = 0,24% - 0,09%
  = 0,15%
- Kadar $CaCl_2$ $= \frac{\text{Mr } CaCl_2}{\text{Ar Ca}} \times \text{Kadar } Ca^{2+} \text{ sisa}$
  $= \frac{111 \text{ g/mol}}{40 \text{ g/mol}} \times 0{,}15\%$
  = 0,41%
- Kadar Cl^- dalam $CaCl_2$ $= \frac{2 \text{ x Ar Cl}}{\text{Mr } CaCl_2} \times \text{Kadar } CaCl_2$
  $= \frac{71 \text{ g/mol}}{111 \text{ g/mol}} \times 0{,}41\%$
  = 0,26%
- Kadar $MgCl_2$ $= \frac{\text{Mr MgCl2}}{\text{Ar Mg}} \times \text{Kadar } Mg^{2+}$
  $= \frac{95 \text{ g/mol}}{24 \text{ g/mol}} \times -0{,}08\%$
  = -0,31% (dianggap 0% karena nilainya negatif)
- Kadar Cl^- dalam $MgCl_2$ = 0%
- Kadar Cl^- sisa = Cl^- total – Cl^- dalam $CaCl_2$ – Cl^- dalam $MgCl_2$
  = 48,14% - 0,26% - 0%
  = 47,88%
- Kadar NaCl $= \frac{\text{Mr NaCl}}{\text{Ar Cl}} \times \text{Kadar } Cl^- \text{ sisa}$
  $= \frac{58{,}5 \text{ g/mol}}{35{,}5 \text{ g/mol}} \times 47{,}88\%$

= 78,90%

b. Sampel Bahan filter 1 (kulit pisang kepok)

- Kadar SO_4^{2-} = 0,03%
- Kadar Cl^- = 57,98%
- Kadar Ca^{2+} = 0,12%
- Kadar Mg^{2+} = 0,6%
- Kadar $CaSO_4$ $= \frac{\text{Mr CaSO4}}{\text{Mr SO4}} \times \text{Kadar } SO_4^{2-}$
  $= \frac{136 \text{ g/mol}}{96 \text{ g/mol}} \times 0{,}03\%$
  = 0,04%
- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{\text{Ar Ca}}{\text{Mr CaSO4}} \times \text{Kadar } CaSO_4$
  $= \frac{40 \text{ g/mol}}{136 \text{ g/mol}} \times 0{,}04\%$
  = 0,01%
- Kadar Ca^{2+} sisa = Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$
  = 0,12% - 0,01%
  = 0,11%
- Kadar $CaCl_2 = \frac{\text{Mr CaCl2}}{\text{Ar Ca}} \times \text{Kadar } Ca^{2+} \text{ sisa}$
  $= \frac{111 \text{ g/mol}}{40 \text{ g/mol}} \times 0{,}11\%$
  = 0,30%
- Kadar Cl^- dalam $CaCl_2$ $= \frac{\text{2 x Ar Cl}}{\text{Mr CaCl2}} \times \text{Kadar } CaCl_2$
  $= \frac{71 \text{ g/mol}}{111 \text{ g/mol}} \times 0{,}30\%$
  = 0,19%
- Kadar $MgCl_2 = \frac{\text{Mr MgCl2}}{\text{Ar Mg}} \times \text{Kadar } Mg^{2+}$
  $= \frac{95 \text{ g/mol}}{24 \text{ g/mol}} \times 0{,}08\%$
  = 0,31%
- Kadar Cl^- dalam $MgCl_2$ $= \frac{\text{2 x Ar Cl}}{\text{Mr CaCl2}} \times \text{Kadar } MgCl_2$
  $= \frac{71 \text{ g/mol}}{95 \text{ g/mol}} \times 0{,}31\%$
  = 0,23%
- Kadar Cl^- sisa = Cl^- total – Cl^- dalam $CaCl_2$ – Cl^- dalam $MgCl_2$
  = 57,98% - 0.19% - 0.31%
  = 57,48%
- Kadar NaCl $= \frac{\text{Mr NaCl}}{\text{Ar Cl}} \times \text{Kadar } Cl^- \text{ sisa}$
  $= \frac{58{,}5 \text{ g/mol}}{35{,}5 \text{ g/mol}} \times 57{,}48\%$
  = 94,72%

c. Sampel Bahan filter 2 (Eceng Gondok)

- Kadar SO_4^{2-} = 0,24%
- Kadar Cl^- = 57,98%
- Kadar Ca^{2+} = 0,12%
- Kadar Mg^{2+} = 0,01%
- Kadar $CaSO_4$ $= \frac{\text{Mr CaSO4}}{\text{Mr SO4}} \times \text{Kadar } SO_4^{2-}$
  $= \frac{136 \text{ g/mol}}{96 \text{ g/mol}} \times 0{,}24\%$
  $= 0{,}34\%$
- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{\text{Ar Ca}}{\text{Mr CaSO4}} \times \text{Kadar } CaSO_4$
  $= \frac{40 \text{ g/mol}}{136 \text{ g/mol}} \times 0{,}34\%$
  $= 0{,}1\%$
- Kadar Ca^{2+} sisa = Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$
  $= 0{,}12\% - 0{,}1\%$
  $= 0{,}11\%$
- Kadar $CaCl_2 = \frac{\text{Mr CaCl2}}{\text{Ar Ca}} \times \text{Kadar } Ca^{2+} \text{ sisa}$
  $= \frac{111 \text{ g/mol}}{40 \text{ g/mol}} \times 0{,}11\%$
  $= 0{,}30\%$
- Kadar Cl^- dalam $CaCl_2$ $= \frac{2 \text{ x Ar Cl}}{\text{Mr CaCl2}} \times \text{Kadar } CaCl_2$
  $= \frac{71 \text{ g/mol}}{111 \text{ g/mol}} \times 0{,}30\%$
  $= 0{,}19\%$
- Kadar $MgCl_2 = \frac{\text{Mr MgCl2}}{\text{Ar Mg}} \times \text{Kadar } Mg^{2+}$
  $= \frac{95 \text{ g/mol}}{24 \text{ g/mol}} \times 0{,}06\%$
  $= 0{,}23\%$
- Kadar Cl^- dalam $MgCl_2$ $= \frac{2 \text{ x Ar Cl}}{\text{Mr CaCl2}} \times \text{Kadar } MgCl_2$
  $= \frac{71 \text{ g/mol}}{95 \text{ g/mol}} \times 0{,}23\%$
  $= 0{,}17\%$
- Kadar Cl^- sisa = Cl^- total – Cl^- dalam $CaCl_2$ – Cl^- dalam $MgCl_2$
  $= 57{,}98\% - 0{,}19\% - 0{,}17\%$
  $= 57{,}62\%$
- Kadar NaCl $= \frac{\text{Mr NaCl}}{\text{Ar Cl}} \times \text{Kadar } Cl^- \text{ sisa}$
  $= \frac{58{,}5 \text{ g/mol}}{35{,}5 \text{ g/mol}} \times 57{,}62\%$
  $= 94{,}95\%$

d. **Sampel bahan filter 3 (Ampas kopi)**

- Kadar SO_4^{2-} = 0,18%
- Kadar Cl^- = 59,39%
- Kadar Ca^{2+} = 0,1%
- Kadar Mg^{2+} = -0,04%

- Kadar $CaSO_4$ $= \frac{\text{Mr CaSO4}}{\text{Mr SO4}} \times \text{Kadar } SO_4^{2-}$
  $= \frac{136 \text{ g/mol}}{96 \text{ g/mol}} \times 0{,}18\%$
  $= 0{,}25\%$
- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{\text{Ar Ca}}{\text{Mr CaSO4}} \times \text{Kadar } CaSO_4$
  $= \frac{40 \text{ g/mol}}{136 \text{ g/mol}} \times 0{,}25\%$
  $= 0{,}07\%$
- Kadar Ca^{2+} sisa $=$ Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$
  $= 0{,}1\% - 0{,}07\%$
  $= 0{,}03\%$
- Kadar $CaCl_2 = \frac{\text{Mr CaCl2}}{\text{Ar Ca}} \times$ Kadar Ca^{2+} sisa
  $= \frac{111 \text{ g/mol}}{40 \text{ g/mol}} \times 0{,}03\%$
  $= 0{,}08\%$
- Kadar Cl^- dalam $CaCl_2$ $= \frac{\text{2 x Ar Cl}}{\text{Mr CaCl2}} \times \text{Kadar } CaCl_2$
  $= \frac{71 \text{ g/mol}}{111 \text{ g/mol}} \times 0{,}08\%$
  $= 0{,}05\%$
- Kadar $MgCl_2 = \frac{\text{Mr MgCl2}}{\text{Ar Mg}} \times \text{Kadar } Mg^{2+}$
  $= \frac{95 \text{ g/mol}}{24 \text{ g/mol}} \times -0{,}04\%$
  $= -0{,}15\%$ (dianggap 0% karena nilainya negatif)
- Kadar Cl^- dalam $MgCl_2$ $= 0\%$
- Kadar Cl^- sisa $=$ Cl^- total – Cl^- dalam $CaCl_2$ – Cl^- dalam $MgCl_2$
  $= 59{,}39\% - 0{,}05\% - 0\%$
  $= 59{,}34\%$
- Kadar NaCl $= \frac{\text{Mr NaCl}}{\text{Ar Cl}} \times$ Kadar Cl^- sisa
  $= \frac{58{,}5 \text{ g/mol}}{35{,}5 \text{ g/mol}} \times 59{,}34\%$
  $= 97{,}78\%$

e. **Sampel bahan Variasi 1**

- Kadar SO_4^{2-} $= 0{,}19\%$
- Kadar Cl^- $= 58{,}69\%$
- Kadar Ca^{2+} $= 0{,}12\%$
- Kadar Mg^{2+} $= 0{,}01\%$
- Kadar $CaSO_4$ $= \frac{\text{Mr CaSO4}}{\text{Mr SO4}} \times \text{Kadar } SO_4^{2-}$
  $= \frac{136 \text{ g/mol}}{96 \text{ g/mol}} \times 0{,}19\%$
  $= 0{,}26\%$
- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{\text{Ar Ca}}{\text{Mr CaSO4}} \times \text{Kadar } CaSO_4$
  $= \frac{40 \text{ g/mol}}{136 \text{ g/mol}} \times 0{,}26\%$
  $= 0{,}07\%$

- Kadar Ca^{2+} sisa = Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$
  = 0,12% - 0,07%
  = 0,05%
- Kadar $CaCl_2 = \frac{\text{Mr CaCl2}}{\text{Ar Ca}} \times$ Kadar Ca^{2+} sisa
  $= \frac{111\ g/mol}{40\ g/mol} \times 0,05\%$
  = 0,13%
- Kadar Cl^- dalam $CaCl_2 = \frac{2 \times \text{Ar Cl}}{\text{Mr CaCl2}} \times$ Kadar $CaCl_2$
  $= \frac{71\ g/mol}{111\ g/mol} \times 0,13\%$
  = 0,08%
- Kadar $MgCl_2 = \frac{\text{Mr MgCl2}}{\text{Ar Mg}} \times$ Kadar Mg^{2+}
  $= \frac{95\ g/mol}{24\ g/mol} \times 0,01\%$
  = 0,03%
- Kadar Cl^- dalam $MgCl_2 = \frac{2 \times \text{Ar Cl}}{\text{Mr CaCl2}} \times$ Kadar $MgCl_2$
  $= \frac{71\ g/mol}{95\ g/mol} \times 0,03\%$
  = 0,02%
- Kadar Cl^- sisa = Cl^- total – Cl^- dalam $CaCl_2$ – Cl^- dalam $MgCl_2$
  = 58,69% - 0,08% - 0,02%
  = 58,59%
- Kadar NaCl $= \frac{\text{Mr NaCl}}{\text{Ar Cl}} \times$ Kadar Cl^- sisa
  $= \frac{58,5\ g/mol}{35,5\ g/mol} \times 58,59\%$
  = 96,54%

f. **Sampel bahan variasi 2**

- Kadar SO_4^{2-} = 0,03%
- Kadar Cl^- = 57,98%
- Kadar Ca^{2+} = 0,14%
- Kadar Mg^{2+} = 0,04%
- Kadar $CaSO_4 = \frac{\text{Mr CaSO4}}{\text{Mr SO4}} \times$ Kadar SO_4^{2-}
  $= \frac{136\ g/mol}{96\ g/mol} \times 0,03\%$
  = 0,04%
- Kadar Ca^{2+} dalam $CaSO_4 = \frac{\text{Ar Ca}}{\text{Mr CaSO4}} \times$ Kadar $CaSO_4$
  $= \frac{40\ g/mol}{136\ g/mol} \times 0,04\%$
  = 0,01%
- Kadar Ca^{2+} sisa = Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$
  = 0,14% - 0,01%
  = 0,13%
- Kadar $CaCl_2 = \frac{\text{Mr CaCl2}}{\text{Ar Ca}} \times$ Kadar Ca^{2+} sisa

$= \frac{111\ g/mol}{40\ g/mol} \times 0{,}13\%$
$= 0{,}36\%$

- Kadar Cl^- dalam $CaCl_2$ $= \frac{2 \times Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $CaCl_2$
  $= \frac{71\ g/mol}{111\ g/mol} \times 0{,}36\%$
  $= 0{,}23\%$
- Kadar $MgCl_2 = \frac{Mr\ MgCl2}{Ar\ Mg} \times$ Kadar Mg^{2+}
  $= \frac{95\ g/mol}{24\ g/mol} \times 0{,}04\%$
  $= 0{,}15\%$
- Kadar Cl^- dalam $MgCl_2$ $= \frac{2 \times Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $MgCl_2$
  $= \frac{71\ g/mol}{95\ g/mol} \times 0{,}15\%$
  $= 0{,}11\%$
- Kadar Cl^- sisa $= Cl^-$ total $- Cl^-$ dalam $CaCl_2 - Cl^-$ dalam $MgCl_2$
  $= 57{,}98\% - 0{,}23\% - 0{,}11\%$
  $= 57{,}64\%$
- Kadar NaCl $= \frac{Mr\ NaCl}{Ar\ Cl} \times$ Kadar Cl^- sisa
  $= \frac{58{,}5\ g/mol}{35{,}5\ g/mol} \times 57{,}64\%$
  $= 92{,}38\%$

g. **Sampel bahan Variasi 3**

- Kadar SO_4^{2-} $= 0{,}11\%$
- Kadar Cl^- $= 59{,}74\%$
- Kadar Ca^{2+} $= 0{,}1\%$
- Kadar Mg^{2+} $= 0{,}04\%$
- Kadar $CaSO_4$ $= \frac{Mr\ CaSO4}{Mr\ SO4} \times$ Kadar SO_4^{2-}
  $= \frac{136\ g/mol}{96\ g/mol} \times 0{,}11\%$
  $= 0{,}15\%$
- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{Ar\ Ca}{Mr\ CaSO4} \times$ Kadar $CaSO_4$
  $= \frac{40\ g/mol}{136\ g/mol} \times 0{,}15\%$
  $= 0{,}04\%$
- Kadar Ca^{2+} sisa $=$ Kadar Ca^{2+} total $-$ kadar Ca^{2+} dalam $CaSO_4$
  $= 0{,}1\% - 0{,}04\%$
  $= 0{,}06\%$
- Kadar $CaCl_2 = \frac{Mr\ CaCl2}{Ar\ Ca} \times$ Kadar Ca^{2+} sisa
  $= \frac{111\ g/mol}{40\ g/mol} \times 0{,}06\%$
  $= 0{,}16\%$
- Kadar Cl^- dalam $CaCl_2$ $= \frac{2 \times Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $CaCl_2$

$= \frac{71\ g/mol}{111\ g/mol} \times 0{,}16\%$

$= 0{,}1\%$

- Kadar $MgCl_2 = \frac{Mr\ MgCl2}{Ar\ Mg} \times$ Kadar Mg^{2+}

  $= \frac{95\ g/mol}{24\ g/mol} \times 0{,}04\%$

  $= 0{,}15\%$

- Kadar Cl^- dalam $MgCl_2$ $= \frac{2\ x\ Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $MgCl_2$

  $= \frac{71\ g/mol}{95\ g/mol} \times 0{,}15\%$

  $= 0{,}11\%$

- Kadar Cl^- sisa $= Cl^-$ total $- Cl^-$ dalam $CaCl_2 - Cl^-$ dalam $MgCl_2$

  $= 59{,}74\% - 0{,}1\% - 0{,}11\%$

  $= 59{,}53\%$

- Kadar NaCl $= \frac{Mr\ NaCl}{Ar\ Cl} \times$ Kadar Cl^- sisa

  $= \frac{58{,}5\ g/mol}{35{,}5\ g/mol} \times 59{,}53\%$

  $= 98{,}09\%$

h. **Sampel bahan variasi 4**

- Kadar SO_4^{2-} $= 0{,}1\%$
- Kadar Cl^- $= 60{,}09\%$
- Kadar Ca^{2+} $= 0{,}1\%$
- Kadar Mg^{2+} $= 0{,}04\%$
- Kadar $CaSO_4$ $= \frac{Mr\ CaSO4}{Mr\ SO4} \times$ Kadar SO_4^{2-}

  $= \frac{136\ g/mol}{96\ g/mol} \times 0{,}1\%$

  $= 0{,}14\%$

- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{Ar\ Ca}{Mr\ CaSO4} \times$ Kadar $CaSO_4$

  $= \frac{40\ g/mol}{136\ g/mol} \times 0{,}14\%$

  $= 0{,}04\%$

- Kadar Ca^{2+} sisa $=$ Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$

  $= 0{,}1\% - 0{,}04\%$

  $= 0{,}06\%$

- Kadar $CaCl_2 = \frac{Mr\ CaCl2}{Ar\ Ca} \times$ Kadar Ca^{2+} sisa

  $= \frac{111\ g/mol}{40\ g/mol} \times 0{,}06\%$

  $= 0{,}16\%$

- Kadar Cl^- dalam $CaCl_2$ $= \frac{2\ x\ Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $CaCl_2$

  $= \frac{71\ g/mol}{111\ g/mol} \times 0{,}16\%$

  $= 0{,}1\%$

- Kadar $MgCl_2 = \frac{Mr\ MgCl2}{Ar\ Mg} \times$ Kadar Mg^{2+}

$= \frac{95\ g/mol}{24\ g/mol} \times 0{,}04\%$

$= 0{,}15\%$

- Kadar Cl^- dalam $MgCl_2$ $= \frac{2 \times Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $MgCl_2$

  $= \frac{71\ g/mol}{95\ g/mol} \times 0{,}15\%$

  $= 0{,}11\%$
- Kadar Cl^- sisa $= Cl^-$ total $- Cl^-$ dalam $CaCl_2 - Cl^-$ dalam $MgCl_2$

  $= 60{,}09\% - 0{,}1\% - 0{,}11\%$

  $= 59{,}88\%$
- Kadar NaCl $= \frac{Mr\ NaCl}{Ar\ Cl} \times$ Kadar Cl^- sisa

  $= \frac{58{,}5\ g/mol}{35{,}5\ g/mol} \times 59{,}88\%$

  $= 98{,}67\%$

i. **Bahan sampel variasi 5**

- Kadar SO_4^{2-} $= 0{,}08\%$
- Kadar Cl^- $= 59{,}39\%$
- Kadar Ca^{2+} $= 0{,}09\%$
- Kadar Mg^{2+} $= 0{,}03\%$
- Kadar $CaSO_4$ $= \frac{Mr\ CaSO4}{Mr\ SO4} \times$ Kadar SO_4^{2-}

  $= \frac{136\ g/mol}{96\ g/mol} \times 0{,}08\%$

  $= 0{,}11\%$
- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{Ar\ Ca}{Mr\ CaSO4} \times$ Kadar $CaSO_4$

  $= \frac{40\ g/mol}{136\ g/mol} \times 0{,}11\%$

  $= 0{,}03\%$
- Kadar Ca^{2+} sisa $=$ Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$

  $= 0{,}09\% - 0{,}03\%$

  $= 0{,}06\%$
- Kadar $CaCl_2 = \frac{Mr\ CaCl2}{Ar\ Ca} \times$ Kadar Ca^{2+} sisa

  $= \frac{111\ g/mol}{40\ g/mol} \times 0{,}06\%$

  $= 0{,}16\%$
- Kadar Cl^- dalam $CaCl_2$ $= \frac{2 \times Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $CaCl_2$

  $= \frac{71\ g/mol}{111\ g/mol} \times 0{,}16\%$

  $= 0{,}1\%$
- Kadar $MgCl_2 = \frac{Mr\ MgCl2}{Ar\ Mg} \times$ Kadar Mg^{2+}

  $= \frac{95\ g/mol}{24\ g/mol} \times 0{,}03\%$

  $= 0{,}11\%$
- Kadar Cl^- dalam $MgCl_2$ $= \frac{2 \times Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $MgCl_2$

$= \frac{71\ g/mol}{95\ g/mol} \times 0{,}11\%$

$= 0{,}08\%$

- Kadar Cl^- sisa $= Cl^-$ total – Cl^- dalam $CaCl_2$ – Cl^- dalam $MgCl_2$
  $= 59{,}39\% - 0{,}1\% - 0{,}08\%$
  $= 59{,}21\%$
- Kadar NaCl $= \frac{Mr\ NaCl}{Ar\ Cl} \times$ Kadar Cl^- sisa
  $= \frac{58{,}5\ g/mol}{35{,}5\ g/mol} \times 59{,}21\%$
  $= 97{,}57\%$

j. **Bahan sampel variasi 6**

- Kadar SO_4^{2-} = 0,07%
- Kadar Cl^- = 60,09%
- Kadar Ca^{2+} = 0,07%
- Kadar Mg^{2+} = 0,03%
- Kadar $CaSO_4$ $= \frac{Mr\ CaSO4}{Mr\ SO4} \times$ Kadar SO_4^{2-}
  $= \frac{136\ g/mol}{96\ g/mol} \times 0{,}07\%$
  $= 0{,}09\%$
- Kadar Ca^{2+} dalam $CaSO_4$ $= \frac{Ar\ Ca}{Mr\ CaSO4} \times$ Kadar $CaSO_4$
  $= \frac{40\ g/mol}{136\ g/mol} \times 0{,}09\%$
  $= 0{,}02\%$
- Kadar Ca^{2+} sisa = Kadar Ca^{2+} total – kadar Ca^{2+} dalam $CaSO_4$
  $= 0{,}07\% - 0{,}02\%$
  $= 0{,}05\%$
- Kadar $CaCl_2 = \frac{Mr\ CaCl2}{Ar\ Ca} \times$ Kadar Ca^{2+} sisa
  $= \frac{111\ g/mol}{40\ g/mol} \times 0{,}05\%$
  $= 0{,}13\%$
- Kadar Cl^- dalam $CaCl_2$ $= \frac{2\ x\ Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $CaCl_2$
  $= \frac{71\ g/mol}{111\ g/mol} \times 0{,}13\%$
  $= 0{,}08\%$
- Kadar $MgCl_2 = \frac{Mr\ MgCl2}{Ar\ Mg} \times$ Kadar Mg^{2+}
  $= \frac{95\ g/mol}{24\ g/mol} \times 0{,}03\%$
  $= 0{,}11\%$
- Kadar Cl^- dalam $MgCl_2$ $= \frac{2\ x\ Ar\ Cl}{Mr\ CaCl2} \times$ Kadar $MgCl_2$
  $= \frac{71\ g/mol}{95\ g/mol} \times 0{,}11\%$
  $= 0{,}08\%$
- Kadar Cl^- sisa = Cl^- total – Cl^- dalam $CaCl_2$ – Cl^- dalam $MgCl_2$
  $= 60{,}09\% - 0{,}08\% - 0{,}08\%$

$= 59{,}93\%$

- Kadar NaCl $= \frac{\text{Mr NaCl}}{\text{Ar Cl}} \times \text{Kadar } Cl^- \text{ sisa}$

$= \frac{58{,}5 \text{ g/mol}}{35{,}5 \text{ g/mol}} \times 59{,}93\%$

$= 98{,}75\%$

Lampiran 5. Hasil XRF

06-Apr-2024 13:34:10

Hasil Sampel

Application	LOSSES POWDER - GEOSTAT
Sequence	1 of 1
Position	9
Measurement time	04-Apr-2024 16:28:37

Minimum He Flow (l/min)	0,62

Sample ident
TANPA FILTRASI

Compound	**Na**	**Mg**	**Al**	**P**	**S**	**K**
Conc	8,9396	2,8493	2,5096	0,0383	0,5569	1,5949
Unit	%	%	%	%	%	%

Ca	**Cr**	**Fe**	**Co**	**Ni**	**Cu**
0,4944 %	23,5998 ppm	0,0661 %	186,458 ppm	0,0003 %	118,1524 ppm

Zn	**Bi**	**Zr**	**Ti**
39,4293 ppm	99,8253 ppm	191,8555 ppm	0,232 %

06-Apr-2024 13:32:10

Hasil Sampel

Application	LOSSES POWDER - GEOSTAT
Sequence	1 of 1
Position	5
Measurement time	04-Apr-2024 15:50:31

Minimum He Flow (l/min)	0,62

Sample ident
K.P.KEPOK

Compound	Na	Mg	Al	P	S	K
Conc	10,9492	1,9598	1,3437	0,0247	0,5244	0,4287
Unit	%	%	%	%	%	%

Ca	Cr	Fe	Co	Ni	Cu
0,5486 %	21,8022 ppm	0,0632 %	184,642 ppm	0,0003 %	118,1265 ppm

Zn	Bi	Zr	Ti
38,9785 ppm	69,7716 ppm	174,0041 ppm	0,230 %

06-Apr-2024 13:33:48

Hasil Sampel

Application	LOSSES POWDER - GEOSTAT
Sequence	1 of 1
Position	6
Measurement time	04-Apr-2024 15:57:16

Minimum He Flow (l/min)	0,62

Sample ident

ECENG GONDOK

Compound	Na	Mg	Al	P	S	K
Conc	13,5712	1,9114	1,2921	0,0260	0,5652	0,1797
Unit	%	%	%	%	%	%

Ca	Cr	Fe	Co	Ni	Cu
0,6342 %	22,8001 ppm	0,0660 %	186,503 ppm	0,0004 %	117,5556 ppm

Zn	Bi	Zr	Ti
38,0354 ppm	33,2994 ppm	189,9110 ppm	0,228 %

06-Apr-2024 13:34:03

Hasil Sampel

Application	LOSSES POWDER - GEOSTAT
Sequence	1 of 1
Position	8
Measurement time	04-Apr-2024 16:22:19

Minimum He Flow (l/min)	0,62

Sample ident

AMPAS KOPI

Compound	Na	Mg	Al	P	S	K
Conc	14,4804	0,9116	0,0359	0,0223	0,3728	0,1293
Unit	%	%	%	%	%	%

Ca	Cr	Fe	Co	Ni	Cu
0,4857 %	23,8252 ppm	0,0674 %	186,509 ppm	0,0002 %	117,9290 ppm

Zn	Bi	Zr	Ti
39,2764 ppm	26,5580 ppm	160,8710 ppm	0,231 %

06-Apr-2024 13:31:51

Hasil Sampel

Application	LOSSES POWDER - GEOSTAT
Sequence	1 of 1
Position	4
Measurement time	04-Apr-2024 15:43:46

Minimum He Flow (l/min)	0,62

Sample ident

VARIASI 6

Compound	Na	Mg	Al	P	S	K
Conc	7,7884	0,950	1,5232	0,0267	0,3966	0,8730
Unit	%	%	%	%	%	%

Ca	Cr	Fe	Co	Ni	Cu
0,3353 %	23,5476 ppm	0,0664 %	186,314 ppm	0,0002 %	122,3224 ppm

Zn	Bi	Zr	Ti
47,5492 ppm	69,8208 ppm	177,8798 ppm	0,235 %