



# *Manual Chemical analysis*

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## نصيحه مقتبسه

العبره زي الشاطر مش هو مكتوب ايه في الكارنيه ولا البطاقه  
العبره ماذا تقدم؟ بتعمل ايه؟ بتقول ايه؟ بتفكر ازاي ليك اسهام ولا مكش  
ولا عايش علي الهامش اوعي تعيش علي الهامش لانك لو عشت علي  
الهامش هتفضل طول عمرك علي الهامش والعيال في المستقبل هتبقى  
علي الهامش  
عايز يبق ليك بصمه زي الشاطر بدليل انك لما تغيب يوم يقولك ده  
مجاش النهارده اركن بقا لما يجي استني لما يجي.. ليماذا؟؟؟ عشان  
ليك بصمه .. يعني اي بصمه؟ يعني القراءه. التفكير  
ايه هو راس مالك ... هي الكيمياء

كلمات استاذي ومعلمي الفاضل رحمه الله عليه

أ.د/ علي الديب

# Manual Chemical Analysis



🔧 Determination of “ Total , Free Chlorine “ , Total Iron , Sulphate , Potassium , Manganese , Silica by Using **device DR3900** ?

## 🔧 Determination of Total , Free Chlorine:-

- Take 10 mL of The sample and put it in Cuvette .
- Push Zero The device DR3900 .
- Remove Cuvette and Put **PDP Reagent** for ( Total or Free Chlorine ) ,  
DPD = N,N-Diethyl-P-Phenylenediamine .
- Start a time for 3 minutes .
- Push Read , Record the results of ( Total or Free Chlorine ) .

We have Two Reagent ( DPD Free Chlorine , DPD Total Chlorine ) .

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## 🔧 Determination of Total Iron:-

- Take 10 mL of The sample and put it in Cuvette .
  - Push Zero The device DR3900 .
  - Remove Cuvette and Put **Ferover Iron Reagent** for ( Total Iron ) .
  - Start a time for 3 minutes .
  - Push Read , Record the results of ( Total Iron ) .
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## 🔧 Determination of Sulphate:-

- Take 10 mL of The sample and put it in Cuvette .
  - Push Zero The device DR3900 .
  - Remove Cuvette and Put **Sulfaver 4 sulfate Reagent** for ( Sulphate ) .
  - Start a time for 5 minutes .
  - Push Read , Record the results of ( Sulphate ) .
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### Determination of Potassium:-

- Take 25 mL of The sample and put it in Cylinder .
  - Put Potassium 1 Reagent ( Powder )
  - Put potassium 2 Reagent ( Solution )
  - Put Potassium 3 Reagent ( Powder )
  - Take 10 mL from Mixing and put it in Cuvette.
  - Push Zero The device DR3900 By another Cuvette But this cuvette contain 10 mL of pure sample .
  - Put the cuvette which contain 10 ML from Mixing.
  - Start a time for 10 minutes.
  - Push Read , Record the Results of ( Potassium ) .
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### Determination of Silica:-

In this experience we have Two range ( **High range** it happens on **Feed water** but **Low range** it happens on **Product water** ) .

#### **HIGH RANGE :-**

- Take 10 mL of The sample and put it in Cuvette .
  - Push Zero The device DR3900 .
  - Remove Cuvette and Put **Molybdate Reagent ( Powder )** for ( Silica \_HR ).
  - Start a time for 10 minutes
  - Remove Cuvette and Put **Acid Reagent ( Powder )** And **Citric Acid Reagent ( Powder )** for ( Silica \_HR ).
  - Start a time for 2 minutes .
  - Push Read , Record the Results of ( Silica \_HR ) .
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#### **LOW RANGE :-**

- Take 10 mL of The sample and put it in Cuvette .
  - Push Zero The device DR3900 .
  - Remove Cuvette and Put **14 Point Molybdate Reagent ( Solution )** for ( Silica \_LR ).
  - Start a time for 4 minutes
  - Remove Cuvette and Put **Citric Acid Reagent ( Powder )** for ( Silica \_LR ).
  - Start a time for 1 minutes
  - Remove Cuvette and Put **Amino Acid Reagent ( Powder )** for ( Silica \_LR ).
  - Start a time for 2 minutes
  - Push Read , Record the Results of ( Silica \_LR ) .
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### Determination of Manganese:-

In this experience we have Two range ( **High range** it happens on **Feed water** but **Low range** it happens on **Product water** ) .

#### **HIGH RANGE :-**

- Take 10 mL of The sample and put it in Cuvette .
  - Push Zero The device DR3900 .
  - Remove Cuvette and Put **Buffer Powder Citrate** and Put **Sodium Periodate ( Powder )** for ( Manganese \_HR ) .
  - Start a time for 2 minutes .
  - Push Read , Record the Results of ( Silica \_HR ) .
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#### **LOW RANGE :-**

- Take 10 mL of The sample and put it in Cuvette .
  - Push Zero The device DR3900 .
  - Remove Cuvette and Put **Ascorbic acid Reagent ( Powder )**
  - **Put Alkaline Cyanide Reagent ( Solution )**
  - **Put Di-solution Reagent ( Solution )** for ( Manganese \_LR ) .
  - Start a time for 2 minutes
  - Push Read , Record the Results of ( Manganese \_LR ) .
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## **Titration Methods**

 Determination of “ Total Hardness , Total Alkalinity , Calcium , Magnesium , Chloride by Using **Titration Methods** ?

### Determination of Total Hardness:-

- ❖ Take 50 mL of the sample to Conical Flask .
- ❖ Add 2 drop from **EBT Indicator**.    EBT = Eriochrom Black I
- ❖ Add 5 drop from **ammonical Buffer** until Violet color .
- ❖ Titrat against **EDTA ( 0.01 M )** until till Blue color.
- ❖ Record the Volume of EDTA ( V )
- ❖ Calculate Total Hardness from equation :-

$$\text{Total Hardness (ppm)} = 20 * v$$

### Determination of Total Alkalinity:-

- ❖ Take 50 mL of the sample to Conical Flask .
- ❖ Add 2 drop from **Methyl orange Indicator** until bill orange
- ❖ Titrat against **H<sub>2</sub>SO<sub>4</sub> ( 0.02 N )** until till Red orange.
- ❖ Record the Volume of **H<sub>2</sub>SO<sub>4</sub> ( V )**
- ❖ Calculate Total Hardness from equation :-

$$\text{Total Alkalinity (ppm)} = 20 * v$$

### Determination of Calcium:-

- ❖ Take 50 mL of the sample to Conical Flask .
- ❖ Add 2 drop from **Muroxide Indicator** .
- ❖ Add 1 drop from **NaOH ( 4M )** Until pink color.
- ❖ Titrat against **EDTA ( 0.01 M )** until till Violet color.
- ❖ Record the Volume of EDTA ( V )
- ❖ Calculate Total Hardness from equation :-

$$\text{Calcium(ppm)} = 8.016 * v$$

### **WE CAN CALCULATED MAGNESIUM BY USING THIS IS EQUATION :-**

$$\text{Magnesium (ppm)} = 0.243 * \{ \text{Total Hardness} - ( 2.5 * \text{Calcium} ) \}$$

### Determination of Chloride:-

In This experience we want to know the Normality of Sliver Nitrat

- ❖ Take 50 mL of NaCl ( 0.028 N ) to Conical Flask .
- ❖ Add 10 drop from **Potassium Chromate Indicator** the color become yellow.
- ❖ Titrat against **AgNO<sub>3</sub> ( 0.1 M )** until till Red brown.
- ❖ Record the Volume of AgNO<sub>3</sub> ( V<sub>1</sub> )
- ❖ Calculate:-

$$\text{Normality of AgNo3} = \frac{1.4}{v1 - 0.2}$$

- ❖ Take 50 mL of the sample to Conical Flask .
- ❖ Add 10 drop from **Potassium Chromate Indicator** the color become yellow.
- ❖ Titrat against **AgNO<sub>3</sub>** until till Red brown.
- ❖ Record the Volume of AgNO<sub>3</sub> ( V<sub>2</sub> )
- ❖ Calculate:-

$$\text{Chloride (ppm)} = \text{Norm.} * ( V2 - 0.2 ) * 710$$

### Notes:-

- ❖ **IN CASE OF PRODUCT WATER** we make all test as it as.
- ❖ **IN CASE OF FEED WATER:-**

The sample is diluted 40 times in case of Total Hardness , Chloride and Calcium .

But in case of Total Alkalinity we make test as it as.

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## Molality

 How to prepare ( 1.0 M ) from NaOH in 250 mL ?

*In case of Solid Substance:-*

$$gm = M * M. wt * V(L)$$

Which :-

gm = the weight of Substance in grams.

M = Molality required.

M.wt = Molecular weight of Substance.

V(L) = Volume per Liter.

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*In case of Liquid Substance:-*

 How to prepare ( 1.0 M ) from HCL in 250 mL ?

$$V = \frac{M.wt * M * v(L) * 100}{D * c}$$

Which:-

V = the Volume of Liquid Substance .

M = Molality required.

M.wt = Molecular weight of Substance.

V(L) = Volume per Liter.

D = Density of Liquid substance.

C = Concetration of Liquid substance.

# Normality

🚦 How to prepare ( 1.0 N ) from HCL in 250 mL ?

In case of Liquid Substance:-

$$\text{Normality} = \frac{C * D * 10}{eq. wt}$$

Which

D = Density of Liquid substance.

C = Concentration of Liquid substance.

❖ How to Calculate Equivalent weight ?

In Case of Acid

$$eq. wt = \frac{M. wt \text{ of substance}}{\text{number of Hydrogen replaced}}$$

In case of Basic

$$eq. wt = \frac{M. wt \text{ of substance}}{\text{number of Hydroxide replaced}}$$

In case of Salt

$$eq. wt = \frac{M. wt \text{ of salt}}{\text{valence one of salt} * \text{Number of repetitions}}$$

Then we used this equation

$$(N * V) \text{ berfor} = (N * V) \text{ after}$$

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In case of Solid Substance:-

$$gm = \frac{N * eq. wt * V(L)}{1000}$$



### Chemical Water Analysis Report (Product Water)

Parameters	Measuring units	Ref. Range WHO	Results
Conductivity	$\mu\text{S} / \text{cm}$	—	
TDS	Mg/L	1000	
pH	—	6.5 - 8.5	
Calcium $\text{Ca}^{++}$	Mg/L	< 120	
Magnesium $\text{Mg}^{++}$	Mg/L	< 50	
Sodium $\text{Na}^{+}$	Mg/L	< 200	
Potassium $\text{K}^{+}$	Mg/L	< 10	
Chloride $\text{Cl}^{-}$	Mg/L	< 250	
Sulfate $\text{SO}_4^{--}$	Mg/L	< 250	
Silicate $\text{SiO}_2^{--}$	Mg/L	—	
Iron Fe	Mg/L	< 0.3	
Manganese Mn	Mg/L	< 0.4	
Total Hardness ( $\text{CaCO}_3$ )	Mg/L	< 500	
Total Alkalinity( $\text{CaCO}_3$ )	Mg/L	—	
Bicarbonate Alkalinity ( $\text{HCO}_3$ )	Mg/L	—	
Hydroxide Alkalinity ( $\text{OH}$ )	Mg/L	—	
Total Chlorine	Mg/L	< 5	
Free Chlorine	Mg/L	< 5	

### Chemical Water Analysis Report (Feed Water)

Parameters	Measuring units	Ref. Range WHO	Results
Conductivity	µs / cm	-	
TDS	Mg/L	-	
pH	—	-	
Calcium Ca <sup>++</sup>	Mg/L	-	
Magnesium Mg <sup>++</sup>	Mg/L	-	
Sodium Na <sup>+</sup>	Mg/L	-	
Potassium K <sup>+</sup>	Mg/L	-	
Chloride Cl <sup>-</sup>	Mg/L	-	
Sulfate SO <sub>4</sub> <sup>--</sup>	Mg/L	-	
Silicate SiO <sub>2</sub> <sup>--</sup>	Mg/L	-	
Iron Fe	Mg/L	-	
Manganese Mn	Mg/L	-	
Total Hardness ( CaCO <sub>3</sub> )	Mg/L	-	
Total Alkalinity( CaCO <sub>3</sub> )	Mg/L	-	
Bicarbonate Alkalinity (HCO <sub>3</sub> )	Mg/L	-	
Hydroxide Alkalinity (OH)	Mg/L	-	
Total Chlorine	Mg/L	-	
Free Chlorine	Mg/L	-	