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i. BACKGROUND ABOUT SAUDI ARAMCO:

Over the past decade, Saudi ARAMCO has grown from mainly an oil and gas producing company to an integrated company with substantial shipping and refining assets. Saudi ARAMCO today is the world's largest oil producer and sixth in refining capacity. The Company has operations in exploration, production, refining, marketing and international shipping. Building on a legacy that dates back nearly 70 years, Saudi ARAMCO today leads the world in crude oil production and exports sit the top exporter of natural gas liquids and are major natural gas producer.

Established by Royal Decree in 1988, Saudi ARAMCO assumed the responsibilities of its predecessor, the Arabian American Oil Company (ARAMCO), whose origins date back to the original 1933 oil concession granted by King 'Abbd al-'Aziz ibn Sa'ud. The ARAMCO consortium was made up of four major oil companies: Chevron, Exxon, Texaco and Mobil. During the 1970's the Saudi Government purchased ARAMCO in stages from its four original owners, acquiring 100% of the assets by 1980.

The Company has discovered, and is repairable for, about one-quarter of the world's oil reserves. Since it fist found crude oil in commercial quantities in Saudi Arabia's Easter Province in 1938, the company has discovered about 90 oil and gas fields throughout the Kingdom and in its offshore waters. More than one-fourth of the discoveries have been made since 1989. Saudi ARAMCO's sustainable crude oil production capacity is 10 million barrels per day. The company manufactures and markets a wide range of petroleum products from oil and gas, both domestically and internationally.

Saudi ARAMCO's five domestic refineries are at Ras Tanura, Riyadh, Jaddah, Rabigh and Yanbu'. Its refining and marketing partnership in Saudi Arabia are Saudi ARAMCO Mobil Refinery Co., Ltd. (SAMREF) in Yanbu' and Saudi ARAMCO Shell Refinery Company (SASREF) in Jubail. Its international joint ventures are Motiva Enterprises LLC (wit Shell) in the United States, S-Oil Corporation in the Republic of Korea, Petron Corporation in the Philippines and Motor Oil (Hellas) Corinth Refineries S.A. (with retailing affiliate Avinoil) in Greece.

Saudi ARAMCO owns and operates the Kingdom's nationwide petroleum product distribution network. The company also holds controlling interests in two main lubricants companies (in partnership with Exxon Mobil): Saudi ARAMCO Lubrication Oil Refining Company (Luberef) and Saudi Arabian Lubricating Oil Company (Petrolube).

ii. FIELD OF WORK

Last summer, I had eight weeks summer training at Northern Area Oil Operations Department of Aramco and specifically at Northern Area Laboratory Unit (NALU) at Tanajib – 250 km away of Dhahran -.

The objective of NALU is to provide information about oil, and gas analysis, and other materials that are associated with them, which support the production engineering. It has five subdivisions: oil, gas, water, biological analysis, and elemental analysis subdivisions.

I have worked at the water subdivision, and I was assigned to work in the geochemical analysis tests of water. These tests include pH, chloride, sulfate, conductivity, specific gravity, TDS, and other tests which will be mentioned later in some details.

iii. Oil Field Waters:

Three basic types of water are encountered in oil field operations which are produced water, water used to process crude, injection water. Each type of water requires treatment for use and disposal.

Oil and gas are seldom produced from a reservoir by themselves. Water, known as produced water, and other impurities like salt and sediment are also produced with the hydrocarbons. Once on the surface, the produced water and impurities, called basic sediment and water (BS&W), must be separated from the oil and gas before further processing. The produced water is usually very high in salinity. Due to its high salinity and minor amounts of oil and other impurities, produced water

has little or no value. The BS&W has to be disposed of properly. Often, it is injected into disposal wells or back into a reservoir where it can assist in improving the yield of oil.

After passing through production traps where some water may be separated from crude, the remaining BS&W is removed from the crude in a desalting train. In this process, wash water, which is usually from shallow wells, is injected into the crude to aid in the removal of BS&W. This water also requires proper treatment.

Injection water is that is injected (pumped) into the ground in order to pressurize oil reserves. It assists in increasing the yield of oil from the field. Water injected at the outer edges of a reservoir will push oil towards the producing wells within the reservoir. Seawater is the primary source of injection water in Saudi Aramco. Other sources that may also be used are produced water, and well water from other subsurface zones or shallow aquifers. Injection water must be of high quality to allow trouble free injection over a long period of time. It must be free of matter that would cause plugging of the formation.

Oil field water must be treated for some important reasons. Preventing scale formation, mitigating microbiological fouling and corrosion, preventing corrosion, and removing suspended solids are the most important ones.

iv. Water Geochemistry of Oil Field:

Water geochemistry provides a series of powerful tools for solving various oil field development and production problems. Specifically, naturally occurring chemical "tracers" in water can be used to identify the origin and track the movement of water in oil fields, as well as predict the precipitation of scales. These naturally occurring tracers include the absolute and relative abundance of the various dissolved salts (anions and cations) as well as the isotopic composition of certain cations (e.g., $^{86}\text{Sr}/^{87}\text{Sr}$) and the hydrogen and oxygen stable isotopic composition of the water itself.

Which formation is responsible for water moving behind casing can be determined by comparing formation water geochemistry data with data from produced

waters. Similarly, the progression of water floods can be monitored, as can the relative progression of water that is flooding a group of discrete sands. Additionally, water geochemistry can be used to diagnose the cause of precipitation of mineral scales (e.g., barite, calcite, silica, iron oxide, halite) in flow-lines, valves, gauges and other surface equipment by identifying the mixing of geochemically incompatible formation fluids at surface facilities.

Meanwhile petroleum engineers and geologists had learned that waters associated with petroleum could be identified with regard to the reservoir in which they occurred by a knowledge of their chemical characteristics. Commonly the waters from different strata differ considerably in their dissolved chemical constituents, making the identification of water from particular strata easy. However, in some areas the concentrations of dissolved constituents in waters from different strata do not differ significantly, and the identification of such waters is difficult or impossible.

In the early days, the water was dumped on the ground where it seeped below the land surface. Until about 1930, the oilfield waters were disposed into local drainage, frequently killing fish and oven surface vegetation. After 1930, it became common practice to evaporate the water in earthen pits or to inject it into the producing sand or another deep aquifer. The primary concern in such disposal practice is to remove all oil and basic sediment from the waters before pumping them into injection wells, to prevent clogging of the pore spaces in the formation receiving the waste water. Chemical compatibility of waste water and host aquifer water must also be assured.

Waters produced with petroleum are growing in importance. In years past, these waters were considered waste and had to be disposed of in some manner. Injection of these waters into the petroleum reservoir rock serves three purposes: (1) it produces additional petroleum (secondary recovery); (2) it utilizes a potential pollutant; and (3) in some areas it controls land subsidence.

To inject these waters into reservoir rocks, suspended solids and oil must be removed from the waters to prevent plugging of the porous formations. Water injection systems require separators, filters, and, and in some areas, deoxygenating

equipment utilizing chemical and physical control methods to minimize corrosion and plugging in the injection system.

In waterflooding most petroleum reservoirs, the volume of produced water is not sufficient to efficiently recover the additional petroleum. Therefore, supplemental water must be added to the petroleum reservoir. The use of waters from other sources requires that the blending of the produced water with supplemental water must yield a chemically stable mixture so that plugging solids will not be formed. For example, produced water containing considerable calcium should not be mixed with a water containing considerable carbonate because calcium carbonate may precipitate and prevent injection of the flood water. The design and successful operation of a secondary recovery waterflood requires a thorough knowledge of the composition of the waters used.

Chemical analyses of waters (geochemical analysis) of waters produced with oil are useful in oil production problems, such as identifying the source of intrusive water, planning waterflood and salt-water disposal projects, and treating to prevent corrosion problems in primary and secondary recover. Electrical well-log interpretation requires knowledge of the dissolved solids concentration and composition of the interstitial water. Such information also is useful in correlation of stratigraphic units and of the aquifers within these units, and in studies of the movement of subsurface waters. It is impossible to understand the processes that accumulate petroleum or other minerals without insight into the nature of these waters. (1)

v. Water Problems in Petroleum Industry:

Problems involved with the use of water are caused by the dissolved constituents. For example, pure water is not very corrosive to steel. Corrosion will proceed until the corrosion products stifle the reaction. The addition of salt to water increases conductivity and corrosion. Dissolved gases such as oxygen and carbon dioxide increase the corrosivity of the water. Corrosion, then, is a problem with certain waters. (3)

Corrosion is undesirable for several reasons. Foremost, of course, is that corrosion represents destruction of equipment and replacement costs. All types of oilfield equipment exposed to water are subject to corrosion. Corrosion can cause not only a shutdown in production operations, but also causes a safety hazard by weakening high pressure equipment. Leaks in flow lines or pipelines can also result in costly damages to a farmer's property.

Corrosion products removed by turbulent water flow can deposit in processing equipment or reduce permeability in water injection wells. Damage caused by corrosion can, therefore, decrease the operational efficiency of a system.

Chemical reactions sometimes occur between some constituents dissolved in water to produce insoluble compounds. These insoluble compounds deposited by the water are called scale. Scale formation is a major water problem. It not only occurs in production tubing and flow lines, but in heater treaters, radiators, cooling towers, and every other piece of oilfield or plant equipment that handles water.

Scale buildup in tubing or flow lines reduces the pipe diameter and, consequently, the flow. In heat exchangers, scale acts as insulation, decreasing their effectiveness. Prevention of scale formation often requires treatment of the water to remove one of the constituents. Softening water is an example of treatment to prevent scale deposition. Certain chemical compounds which act to prevent scale formation by complexing one of the ions in the scale forming reaction are called scale inhibitors. When practicable, these are added to scale forming water to prevent scale deposition.

Another water problem that is becoming more serious as our population and industrial capacity grows is water pollution. In the early days of oil production, produced salt water could be dumped into creeks and rivers. This sometimes resulted in fish kills and making the water unfit for animal or human consumption. Today, states and governments have laws regulating the disposal of waste brines in bodies of fresh water. Now the field engineer must carefully consider the disposal of brine to avoid conflicts with pollution laws.

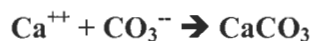
Disposal of brines or other wastes such as cooling tower blow-down water is a serious economic problem. The revenue is several dollars for a barrel of oil. Expense in producing this barrel of oil is justified, but a barrel of waste water produces no revenue; the cost involved in its disposal must be deducted from the profit made in oil production. Disposal costs must, therefore, be held to a minimum. Operators have sometimes been forced to haul waste water, when any form of surface disposal would constitute pollution and underground disposal was not available. (3)

a. Scales:

1. Calcium Carbonate Scale:

Calcium carbonate, or calcite, scale is frequently encountered in oilfield operations. Calcium carbonate crystals are large, but when the scale is found with impurities in the form of finely divided crystals, the scale appears uniform. Carbonate scale can be qualitatively identified by the addition of a few drops of mineral acid. The evolution of an odorless gas indicates that carbonate is present. This does not identify the scale as calcium carbonate, since additional tests are required to identify calcium.

Deposition of CaCO_3 scale or sludge results from precipitation of calcium carbonate according to the following equation:

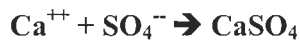


Solubility of calcium carbonate in distilled water at 25 C (77 F), with a carbon dioxide partial pressure of 3.2×10^{-4} atm, is 0.053 g/1000 g of water. This is a very low solubility. However, solubility of calcium carbonate is greatly influenced by partial pressure of carbon dioxide, temperature, and concentration of other salts in the solution. (3)

2. Calcium Sulfate Deposits:

Calcium sulfate, or gypsum, is another solid frequently deposited by oilfield waters. Calcium sulfate usually precipitates directly on the metal surfaces of flow lines, boilers, heat exchanger tubes, etc., and consequently forms a scale rather than sludge. The crystals of calcium sulfate are smaller than those of calcium carbonate, so the scale is generally harder and denser than carbonate scales. Sulfate scales do not effervesce when treated with acid and cannot successfully be removed by acidizing at normal temperatures. Calcium sulfate scale is more difficult to remove than calcium carbonate scale.

The precipitation of calcium sulfate from water can be expressed as:



and the solubility product is given by:

$$(\text{Ca}^{++})(\text{SO}_4^{-}) = K_{sp}$$

(3)

b. Corrosion:

1. Influence of Dissolved Salts:

Salts dissolved in water have a marked influence on the corrosivity of the water. At extremely low concentrations of dissolved salts, different anions and cations show varying degrees of influence on the corrosivity of the water.

The influence of the anion on corrosivity also depends upon the metal in question. Waters containing sulfate ion would not seriously corrode lead because of the formation of lead sulfate on the surface of the lead. The corrosion rate of stainless steel is greater in 0.1 mole potassium chloride than in 0.1 mole potassium sulfate because of the greater penetration of the protective oxygen or oxide coating by the

chloride ion. The order of decreasing penetrating power of anions has been given as: chloride > bromide > iodide > fluoride > sulfate > nitrate monohydrogen phosphate.

Water solutions containing equal concentrations of salts of the same anion but different cations show different degrees of corrosivity to mild steel. With alkali metal chlorides, the corrosion rate is greatest in potassium chloride solution, less in sodium chloride solutions, and lowest in lithium chloride solutions. The order of decreasing corrosiveness of cations has been given as: ferric > chromic > ammonium > aluminum > potassium > sodium > lithium > barium > strontium > calcium > manganese > cadmium > magnesium. (3)

Generally, the corrosivity of waters containing dissolved salts increases with increasing salt concentration until a maximum is reached, and then the corrosivity decreases. This may be attributed to increased electroconductivity because of the increased salt content, until the salt concentration is great enough to cause an appreciable decrease in the oxygen solubility, resulting in a decreased rate of depolarization. The dissolved salts may also decrease the protective of any corrosion products which form, and thus increase corrosion. (3)

2. Influence of pH on Corrosion Rate:

The chemical nature of the electrolyte is an important external factor governing the rate of corrosion, and the pH is an important characteristic of the electrolyte. The influence of pH on the rate of corrosion of water solutions containing oxygen from the air is dependent upon the metal corroded.

In the pH range 4 to 9.5, the iron surface is in contact with an alkaline saturated solution of hydrated ferrous oxide, and corrosion progresses as oxygen diffuses through this barrier. The rate at which this layer of hydrated ferrous oxide is formed depends upon the dissolved oxygen content. If the acidity is due to a highly dissociated acid, hydrogen evolution will occur in the corrosion of iron at pH 4 or less. The hydrated ferrous oxide will be dissolved at this low pH, resulting in direct contact between acid and iron. Carbonic acid solutions react with iron at pH 6 or less, resulting in hydrogen evolution. Since hydrogen evolution is probably the product of

direct attack on the iron by the acidity of the solution and since carbonic acid is a weakly dissociated acid, it appears that total acidity is as important a factor as pH.

A relatively dilute alkaline solution affords corrosion protection to iron, but a highly alkaline solution does not. In a water solution of 4% sodium hydroxide, the corrosion rate of iron is very low, and the potential of the iron on the hydrogen scale is approximately 0.1 volt. At extremely high concentrations of sodium hydroxide, the potential drops to an active value, and iron corrodes, forming soluble sodium ferrite (NaFeO_2). (3)

vi. Geochemical Analysis of Oilfield Waters:

Geochemical analysis are used by the petroleum industry in studies related of subsurface formation identification, pollution problems, water compatibilities, corrosion, water-quality control, waterflooding, and exploration.

Here, I will try to give the most important tests of geochemical analysis that I have worked in during the summer training in Tanajeb Lab.

a. pH Measurements:

pH is a numerical expression of the relative acidity or alkalinity of an aqueous system. It refers to the concentration of H^+ and OH^- , and is defined as the negative logarithm of the hydrogen ion activity. (2)

The pH of the water can be determined with a pH meter which utilizes the principle of measuring the electrical potential between an indicator electrode and a reference electrode. pH meters measure the electrical potential between two suitable electrodes immersed in the solution to be tested. The reference electrode assumes a constant potential, and the indicating electrode assumes a potential dependent on the pH of the solution. Electrode potential is the difference in potential between the electrode and the solution in which it is immersed. The pH meter used should be

calibrated using at least two pH buffer solutions. These standard buffer solutions should cover the range of pH.

An idea of the effect of temperature on pH may be obtained by observing temperature versus pH of various buffers. Theoretically, the potential response of the electrode system changes 0.20 mV per pH unit per degree Celsius. (1)

The pH value is a fundamental property which has an important bearing on the mobility of elements. Among the many possible examples, it is sufficient to recall that during the oxidation of sulfide minerals, low pH (high acidity) values are generated, and in this environment many metals are mobile, but mobility is decreased as the pH becomes higher.

The solubility of most elements and the stability of their compounds is extremely sensitive to the pH of the aqueous environment. Most metallic elements are soluble only in acidic solution, and tend to precipitate as hydroxides with increasing pH. (2)

pH measurements can give a quick indication of any change that has happened to the well. Because each well in Aramco has its history of pH and other measurements, any change in the pH of the routine samples of well's water can be detected. For example, in the water injection process, the injected water can migrate with the water associated with oil and that can be detected quickly by the use of the pH values because, as mentioned above, the water used usually in the injection is seawater which has a different salinity, and pH value.

Procedure:

1. The pH meter should be calibrated with three buffer solutions which have pH values of 4, 7, and 11.
2. The electrodes are washed with fresh distilled water and the tips are dried with a soft tissue.
3. The sample is placed in a clean beaker, and the electrodes are immersed in it.
4. The sample is agitated with magnetic stirring to provide homogeneity.
5. The temperature of the sample is measured, and the meter is set for temperature compensation.

The pH and temperature is noted and recorded when the pH meter reading has stabilized

b. Conductivity:

Conductivity is the measurement of a solution's ability to conduct an electrical current. For horticultural applications, the unit of measure is often expressed as milliohms. Absolutely pure water is actually a poor electrical conductor. It is the substances (or salts) dissolved in the water which determine how conductive the solution will be. Therefore, conductivity can be an excellent indicator of:

- Water quality
- Soil salinity
- Fertilizer concentration

TDS or Total Dissolved Solids is a measure of the total ions in solution. EC is actually a measure of the ionic activity of a solution in term of its capacity to transmit current. In dilute solution TDS and EC are reasonably comparable and the TDS of a water sample based on the measured EC value can be calculated using the following equation:

$$\text{TDS (mg/l)} = 0.5 \times \text{EC (dS/m or mmho/cm)} \quad \text{or} \quad = 0.5 * 1000 \times \text{EC (mS/cm)}$$

The above relationship can also be used to check the acceptability of water chemical analyses. It does not apply to raw wastewater or high-strength industrial wastewater.

As the solution become more concentrated (TDS > 1000 mg/l, EC > 2000 ms/cm), the proximity of the solution ions to each other depresses their activity and consequently their ability to transmit current, although the physical amount of dissolved solids is not affected. At high TDS values, the ratio TDS/EC increases and the relationship tends toward TDS = 0.9 x EC.

In these cases the above-mentioned relationship should not be used and each sample should be characterized separately.

Procedure:

1. The conductivity cell is rinsed several times with fresh distilled water.
2. The cell is rinsed two times with the clean filtered sample cooled to 25oC
3. Sufficient quantity of sample is transferred into the container and the cell is immersed.
4. The temperature is adjusted to 25 0.1 oC
5. The conductance is measured when the temperature is steady.



Calculation

$$\text{Conductivity} = \text{Dial reading} \times \text{Multiplying Factor} \times \text{Cell Constant}$$

c. Specific Gravity:

Specific gravity is the ratio of the weight of a given volume of material to the weight of an equal volume of some other material used as a standard, and pure water is the usual standard for liquids and solids. Depending upon the accuracy desired, the specific gravity of petroleum-associated water can be determined with a pycnometer, specific gravity balance, or hydrometer. Because any oil in or on the sample will interfere with the specific gravity determination, the sample should be filtered.

Knowledge of the specific gravity of the sample is necessary to convert the analytical data determined for the sample from milligrams per liter to parts per million. In addition, the specific gravity will give an indication of the amount of dissolve solids present in the sample.

Procedure:

1. A clean, dry, calibrated pycnometer with cap and thermometer is weighed to the nearest 0.1 mg and record the weight (W1).
2. The stopper and thermometer are removed and the pycnometer is filled up to the neck with the clean and fresh filtered sample, which has been brought to room temperature (20-30 °C)
3. The thermometer is inserted gently and the outside of the pycnometer is wiped with a dry tissue.
4. The temperature (t1) is noted and the side arm of the pycnometer is capped after removing the excess water from the tip.
5. The weigh (W2) of the pycnometer and the sample are found.
6. The weight of the sample is calculated (W2-W1)



Calculations:

Specific Gravity at t1 (Co) = (W2-W1) x F

Specific Gravity at t2 (15.5 oC) = (W1 x W2) x F+T

Where, W2 – W1 = weight of sample

F = Calibration Factor of the Pycnometer

T = Temperature correction factor

t1= Test Temperature

t2= 60oF or 15.5oF

The specific gravity can be related to the salinity of the water. Table below

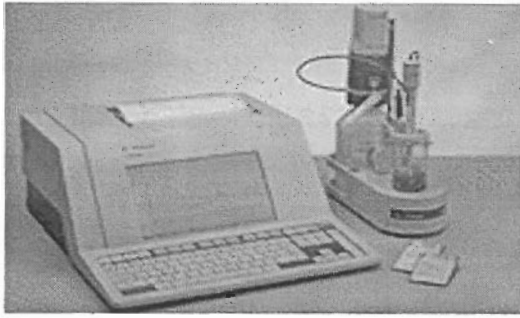
Specific gravity/salinity at 15C(59F)	
Specific gravity	Salinity (gm/litre:ppm)
1.015	20.6
1.016	22.0
1.017	23.3
1.018	24.6
1.019	25.9
1.020	27.2
1.021	28.5
1.022	29.8
1.023	31.1
1.024	32.4
1.025	33.7
1.026	35.0
1.027	36.3
1.028	37.6
1.029	38.9
1.030	40.2

d. Chloride Measurements:

Because of its major effect in decreasing the pH which will increase the rate of corrosion of metals, it is very important to determine chloride concentration in oil field water.

The most effective method to determine any base is to titrate it with an acid, and by finding the equivalence point of the titration, the concentration of chloride can be determined. As the chloride concentration is high in oil field waters, it is necessary to dilute the sample before titration. In addition, the specific gravity of the sample can be used to estimate the correct aliquot size. The most chemical used in the titration of chloride waters' samples is silver nitrate with an indicator.

In Aramco Tanajeb Lab, the chloride concentration in water sample is determined using a titroprocessor apparatus. Using this titroprocessor, the sample of water is titrated using silver nitrate solutions with two different concentrations, the lower one is used when the amount of chloride concentration is low, and that can be estimating by the pH value of the sample, on the other hand, the other one is used when the amount is too high.



e. Total Dissolved Salts (TDS) Determinations:

Dissolved solids refer to any minerals, salts, metals, cations or anions dissolved in water. Total dissolved solids (TDS) comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and some small amounts of organic matter that are dissolved in water.

In general, the total dissolved solids concentration is the sum of the cations (positively charged) and anions (negatively charged) ions in the water. Therefore, the total dissolved solids test provides an qualitative measure of the amount of dissolved ions, but does not tell us the nature or ion relationships. In addition, the test does not provide us insight into the specific water quality issues, such as: Elevated Hardness, Salty Taste, or Corrosiveness. Therefore, the total dissolved solids test is used as an indicator test to determine the general quality of the water, and in determining the source of salts in the produced water which may come from injected waters. The sources of total dissolved solids can include all of the dissolved cations and anions, but the following table can be used as a generalization of the relationship of TDS to water quality problems.

Cations combined with Carbonates CaCO ₃ , MgCO ₃ etc	Associated with hardness, scale formation, bitter taste
Cations combined with Chloride NaCl, KCl	Salty or brackish taste, increase corrosivity

TDS can be determined easily. In Tanajeb Lab, TDS in oil field waters is determined by two different methods. One method is used one the TDS is low, and the other one is used when the TDS is high.

The first method uses conductivity concept to relate it with TDS, because, as it is mentioned above, the conductivity is related to the salts dissolved in an electrolyte. Moreover, as the concentration of ions increases the conductivity increases. The TDS can be determined, then, by using a TDS meter.

The second method is by simple evaporation of the water sample, then, TDS can be determined by weighing the remaining salts and record the result in ppm.



f. Sulfate Determinations:

Sulfate ion is determined in oilfield waters mainly to detect and predict scale formation that can be formed, as mentioned above.

In Aramco Tanajeb Lab, sulfate ion in water sample is determined by photometric endpoint determination using a photometer.

Photometric or spectrophotometric measurements can be employed to advantage in locating the equivalence point of a titration, provided the analyte, the reagent, or the titration product absorbs radiation. Alternatively, an absorbing indicator can provide the absorbance change necessary for location of equivalence. (4)

Photometric titrations are ordinarily performed with a photometer that has been modified to permit insertion of the titration vessel in the light path. Alternatively, a probe-type cell can be employed. After the zero adjustment of the meter scale has been made, radiation is allowed to pass through the solution of the

analyte, and the instrument is adjusted by varying the source intensity or the detector sensitivity until a convenient absorbance reading is obtained. Ordinarily, no attempt is made to measure the true absorbance, since relative values are perfectly adequate for the purpose of end-point detection. (4)



Conclusion:

In my conclusion, I want to say that summer training has given me a good experience not only in the field that I have worked in but also in other skills. Summer training has showed me the difference between being a student and being an employee. It is good to study and to learn but I think it is more important to apply what you have studied. Finally, summer training is one of the most important courses that should be continued, and improved in such a way that can provide experienced graduate students.

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