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Applications of wet analysis – A review

Farhath unnisa*, Nuzhath Hafsa khan, Qizra vaseem, Raheela, Ramsha Fatima, Reba Mariya

Department of Pharmaceutical Analysis, Shadan Women's College of Pharmacy, Khairatabad, Hyderabad.

Corresponding author: Farhath unnisa

ABSTRACT

Wet chemistry is a term used to refer to chemistry generally done in the liquid phase. It is also known as bench chemistry because many of the tests performed are done at a lab bench. Before the age of theoretical and computational chemistry it was the predominant form of scientific discovery in the chemical field. This is why it is sometimes referred to as classic chemistry or classical chemistry. Because of the high volume of wet chemistry that must be done in today's society and quality control requirements, many wet chemistry methods have been automated and computerized for streamlined analysis. The main goal of this review is to provide overview on the qualitative analysis to identify the elements and the quantitative analysis to determine the quantity. The wet chemical analysis uses the procedure to decompose a sample with a reagent such as acids to dissolve in a solvent and identifies and quantifies the targeted elements using various measurement methods. Separation and isolation of the sample is performed if needed. The wet chemical analysis utilizes the stoichiometric method such as the gravimetric method and the volumetric method ensuring the precise and accurate (quantitative) chemical analysis of the sample. This method is widely used in determining the major components with high accuracy and precision and in checking the accuracy of standard specimens and reagents for instrument analysis.

Keywords: Wet chemistry, qualitative analysis, quantitative analysis, Volumetric Analysis

INTRODUCTION

Wet Analysis is a form of analytical chemistry that uses classical methods such as observation to analyze materials. It is called wet chemistry since most analyzing is done in the liquid phase. Wet chemistry is also called bench chemistry since many tests are performed at lab benches.

Wet chemistry commonly uses laboratory glassware such as beakers and graduated cylinders to prevent materials from being contaminated or interfered with by unintended sources. Gasoline, Bunsen burners, and

crucibles may also be used to evaporate and isolate substances in their dry forms. Wet chemistry is not performed with any advanced instruments since most automatically scan substances. Although, simple instruments such as scales are used to measure the weight of a substance before and after a change occurs. Many high school and college laboratories teach students basic wet chemistry methods.

Qualitative Methods: Qualitative methods use changes in information that cannot be quantified to detect a change. This can include a change in color, smell, texture, etc.

Chemical Tests: When burned, lead produces a bright white flame. Chemical tests use reagents to indicate the presence of a specific chemical in an unknown solution. The reagents cause a unique reaction to occur based on the chemical it reacts with, allowing one to know what chemical is in the solution. An example is Heller's test where a test tube containing proteins has strong acids added to it. A cloudy ring forms where the substances meet, indicating the acids are denaturing the proteins. The cloud is a sign that proteins are present in a liquid. The method is used to detect proteins in a person's urine.

Flame Test: The flame test is a more well known version of the chemical test. It is only used on metallic ions. The metal powder is burned, causing an emission of colors based on what metal was burned. For example, Calcium (Ca) will burn orange and Copper (Cu) will burn blue. Their color emissions are used to produce bright colors in fireworks.

Quantitative Methods: Quantitative methods use information that can be measured and quantified to indicate a change. This can include changes in volume, concentration, weight, etc. Solids are filtered out of the liquid, which is collected in the beaker.

Gravimetric Analysis: Gravimetric analysis measures the weight or concentration of a solid that has either formed from a precipitate or dissolved in a liquid. The mass of the liquid is recorded before undergoing the reaction. For the precipitate, a reagent is added until the precipitate stops forming. The precipitate is then dried and weighed to determine the chemicals concentration in the liquid. For a dissolved substance, the liquid can be filtered until the solids are removed or boiled until all the liquid evaporates. The solids are left alone until completely dried and then weighed to determine its concentration. Evaporating all the liquid is the more common approach.

Volumetric Analysis: Titration is called volumetric analysis since it relies on volume measurements to determine the quantity of a chemical. A reagent with a known volume and concentration is added to a solution with an unknown substance and concentration. The amount of reagent required for a change to occur is proportional to the amount of the unknown substances. This reveals the amount of the unknown substance present. If no visible change is present, an indicator is added to the solution. The indicator changes color based on the pH of the solution. The exact point where the color change occurs is called the endpoint. Since the color change can occur very suddenly, it is important to be extremely precise with all measurements.

Colorimetry: Colorimetry is a unique method since it has both qualitative and quantitative properties. Its qualitative analysis involves recording color changes to indicate a change has occurred. This can be a change in shading of the color or a change into a completely different color. The quantitative aspect involves sensory equipment that can measure the wavelength of colors. Changes in wavelengths can be precisely measured and help indicate changes.

ABSORPTION MAXIMA: Emission and absorption spectrometry is based on comparing the amount of radiation released and absorbed by a sample. It is a relatively inexpensive and easy to use method as it does not require extra primary radiation. The sensitivity of higher flame temperatures and other more efficient methods of excitation can, however, be improved. The perfect solvent for flame Spectrometry creates neutral atoms which interferes least with the processes of emission or absorption. For absorption, organic solvents such as flame retardants can often be used alone or combined with water.

For emission, the perfect solvent may be water. The ideal solvent for this reason is a diluted solution of hydrochloric acid. Introduce the water or the blank solution into a generator of atomic vapour. Calibrate the instrument and change the readings to zero for emission spectrometers or the optimum transmission for the spectrometer ingested. Implement the more concentrated regular solution in the flame for pollution calculations. Change the sensitivity to completely deflect the acid anion. Shoot it after each introduction if the generator is a furnace. The solution to be checked three times in the instrument. Calculate the linear equation of the graph by using the minimal fit and obtain from it the element concentration calculated in the test solution. Methanol and water grades were extracted from analyses. The research approach proposed is straightforward, reliable and replicable. The T limit at 243 is paracetamol. The dilution amount up to 100ml was modified to make the experiment more reproducible.

COLORIMETRY: Potential practicality of the procedure will inevitably depend on the preliminary care needed to eliminate creatinine, uric acid and other products that could be significantly decreased in intensity. The protocol that we have eventually implemented is incredibly basic, and we have been persuaded that it satisfies all realistic criteria. The first remedy is to shake your urine with the distilled whole earth "Lloyd's alkaloid reagent" This reagent eliminates most of the colouring agents in combination with uric Acid, creatine and creatinine. It doesn't eliminate sugar as any or most powerful charcoals. It is not appropriate to eliminate any residue of creatinines because comparatively large concentrations do not influence Folin and Wu's sugar method. Remove the water tube after approximately 5 minutes, allow to cool, add 10ml of water then blend. Clean the glass tube with water and

ensure zero absorption with thinner. Take sample solution in a glass tube and first hold in a blue source and concurrently record absorbance from an available light source.

UV SPECTROSCOPY: Spectra were collected and treated using an IBM computer with Thermo Spectronic software and 1 cm quartz cells. National Institute for Drug Quality Control offered the kindness of paracetamol, PA (99.5%) and ibuprofen, IB (100.0%) (Vietnam) Pharmaceuticals were used to solubilize all medicaments for spectrophotometric measures. Zero-order spectras were reported at Intellyscan for signal-to-noise ratios of the absorption peaks without an extended scan time of 30 – 150 nm/min in a wavelength of 200–325 nm against a white (phosphate buffer pH 7.2). The spectrum was separated and smoothed with Savitsky-Golay filters for derivative approach.

ASSAY OF PARACETAMOL: A spectrophotometer UV-visible is an important instrument in all laboratories for quality monitoring. It is useful for raw material, active ingredients and finished goods in the manufacture of identity, purity and quantitative analyses. The wavelength and peaks/valleys feature in the Thermo Science VISIONcollect programme. Functions for absorption and relationship provide evidence that these elements are pure and quantified. A test result was rendered in the same manner as the regular acetaminophen.

The amount and percent measure for acetamine is used as an amount and per cent measure for the product. The USP test for acetaminope states that the test sample "must contain not more than 101.0% of the C₈H₉NO₂ anhydrous-based calculation".

FLUORIMETRY: Fluorescence spectroscopy is a perfect method for testing and analysis applications of chemistry. It is used to help classify proteins, organic compounds, oils and dyes and to monitor the atmosphere and laser-induced fluorescence in chlorophyll. Ocean Optics provides several choices for fluorometry applications able to be used for multiple resolutions, shelf settings and time-control options. These measurements are conducted using a QE65000 (Grating #HC1, 200mm split, spectrum 349.2nm – 1143.5nm, optical resolution 6.4 Nm, light source PX-2, breakout box HR4-BREAKOUT, monochromator MonoScan2000 and programme of SpectraSuite. Relative irradiance measures were made on the same unit, but an LS-1 tungsten halogen light source was added, which was used as a black body reference. The peak positions differed considerably from the recorded 450 nm peak for quinine sulphate (more so in the Scope Mode) Calibration curves for two different stages were measured. The narrower concentration spectrum under 1 ug/mL is the most linear component of the calibration curve (or 1 ppm or 1000 ppb)

FLUORESCENCE: Fluorescence is the absorption of light (or phosphorescence if the excited state is a triplet state, see below) It can be observed even from single molecules with very high sensitivity and is used in many chemical and biochemical applications. The emitted light is normally longer than the hard light used for arousal, and can therefore be eliminated by filters or monochromators. In recent years there have been a number of organic dyes tested as sensitizers for phthalocyanine, tri-phenyl methane, xanthene, coumarins and porphyrins. Eosin has been collected and used as such from Sigma and is a xan-thene colouring class. Researchers used a continuous state fluorescence quenching technique.

Samples were formed by dissolving eosin and administration of dyes in doubly distilled water. They were then degassed with pure nitrogen oxide for 15 minutes. The maximum form and strip of absorption and fluorescent spectrum remain unchanged. No new eosine emission band has been observed. The reduction potential in dyes with electrolyte KCl (0.1 M) in water was calculated. The related reduction ability for dyes is shown by both CV and DPV processes.

FLAME PHOTOMETRY: In order to calculate low levels of sodium and potassium in a solution, Barnes, Richardson, Berry and Hood have created a flame Photometer. A description of its application to biological material analysis is mentioned in this article. Sodium and potassium tests in such materials with the flame photometer have been contrasted with the chemical precise research methods mentioned earlier. The basic sodium calculation with the assistance of a Flame Photometer in various biological fluids is defined including interference and dilution, interference and calibration curves. Read the concentration corresponding to this reading from the previous sodium calibration curve.

Multiply this dilution factor to receive mg Na/100ml of urine. Aspirate deionized spray, which would otherwise obstruct the nebuliser to capture all traces of sample.

NEPHELO TURBIDIMETRY: Chloride, since it imparts a salty smell to water, is an aesthetic contaminant. The chloride concentration of water depends on the chemical composition of the water. In waste water, owing to manufacturing practises and dietary sodium chloride, which move through the digestive tract unchanged, the C concentration may be very high. Automated chloride determination systems have been developed using a technique for the study of flow injections that have major advantages in terms of sample reagent consumption relative to traditional approaches. A less polluting method was suggested based on a silver nitrate testimony of silver chloride formation.

The results were published in the scientific journal Chemical and Engineering Toxicology and Toxicology. Sodium chloride solution was filled with 50ml of silver nitrate and titrated to the first colour

$$N = \frac{W}{(0.05844) V}$$

Where:

N = normality of the silver nitrate solution

W = mass of sodium chloride used for the titration, g

V = volume of silver nitrate used for the titration, mL.

Chloride ion content: Pipetted into a beaker of 200ml tall-form 50ml of the diluted sample. pH may be changed to 8–9 by adding nitric acid or diluting sodium hydroxide. The chromate indicator is then included in the sample of 11 drops.

Calculations:

$$\text{ppm Chloride} = \frac{3.5433 \text{ NVA } (10,000)}{S}$$

Where:

N = normality of silver nitrate (AgNO_3)

V = volume of AgNO_3 , mL

A = aliquot factor

S = sample weight, g.

PAPER CHROMATOGRAPHY:

Chromatography is a simple and efficient tool for mixture isolation and product detection. The procedure was particularly useful to distinguish closely related compounds. There are several different cell types, but we can demonstrate the process by paper chromatography with the isolation of amino acids in this experiment.

Paper chromatography is the process of separating compounds from each other by placing them in a solution on a strip of absorbent paper. The ratio of distance that the spot travels to the overall distance the solvent fronts travel is called the R_f value. The R_f values will be determined for known and unknown elements for your amino acid solutions and used to classify amino acid solution components. The use of UV light in order to identify fluorescent compounds and the use of a Geiger counter for the identification of radioactive substances are two ways to detect colourless products in a chromatogram.

THIN LAYER CHROMATOGRAPHY:

Thin layer chromatography is an important tool for research because of its low cost, facilitated and rapidity. The goal of this thesis was to adapt a separation, identification and approximation system of various sugars to liquors, thick storage juice and beet storage

samples. In quantitative analyses, the intensity of the spots can be measured by transmission densitometry if more precision is required. The combination of the double pattern and silica gel surfaces provides a minimal to no saccharose tail and an increased sugar resolution. The accurate half-quantitative knowledge offered a clear visual contrast with the established criteria. The best way to detect several carbohydrates present in beet and factory juices is through this process.

COLUMN CHROMATOGRAPHY:

Chromatography of columns is a method used for the isolation of certain complex mixtures. The effectiveness of a chromatographic separation is determined by the collection of the mobile and stationary phases. The motorised method is a non-polar solvent such as petroleum and benzene. Polar groups such as hydroxyl-(OH) in water and ethanol can induce desorption in a variety of situations, such as alumina and silica gel such as the adsorbent. You also learned paper and chromatography of thin layers in the last chapters. The green plant leaves have many pigments, including chlorophyll-a, chlorophyll-b, xanthophylls and carotenes. In column chromatography, three major interactions must be considered. The adsorbent behaviour, the polar comportement of the part and the eluting solvent polarity

are all important. The green region at the top of the column, a 3-4 mm green region is formed. This is called the sample loading. The uppermost small, green layer is chlorophyll-b, beneath is xanthophyll-a, next orange-yellow area, and in the bottom, orange region there are carotenes. There are various colour stripes observed on the panel. The developer (benzene) to the column and position it in the column packaging to observe different strips. This test is based on the observations of the founder of the chromatography process.

CONCLUSION

Wet chemistry is a sort of analytical chemistry using traditional techniques like observation to study materials. Wet chemistry is sometimes termed bench

chemistry, since many experiments are done at laboratory benches. No sophisticated tools are needed as most chemicals are scanned automatically. Chemical tests utilize reagents to identify a particular chemical in an unknown solution. Many wet chemistry processes have been mechanized and digitized for simplified analysis due to the enormous amount of wet chemistry in today's culture.

Wet Analysis happens largely in institutions and is taught in high-school and college labs. The procedure is utilized in the urine of a person to identify protein in a liquid. Flame Test: Burns metal powder, generating Color emission dependent on what metal was burnt. Quantitative approaches employ information measurable and quantifiable to demonstrate a change. Gravimetric analyzes the weight or concentration of a solid generated from a precipitate or dissolved in a liquid.

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