Occurrence of Analytical Techniques Recommended by B.P. for Certain Formulation

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Declaration

It is hereby declared that

1. The thesis submitted is my/our own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

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Approval

The project titled -"Occurrence of Analytical Techniques Recommended by B.P. for Certain Formulation" Submitted by Shaulina Jahan Maliha (18346084) in Spring, 2023 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Pharmacy (Hons.) on May 2023.

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Ethics Statement:

This study does not involve any human or animal trials.

Abstract

This study reviews the most common analytical methods that have been recommended in the B.P. 2013. We discuss the frequency of analytical methods that have been recommended in the monograph of BP 2013. This study also highlights the usefulness & limitations of a variety of analytical methods such as titrimetric, chromatographic, spectroscopic, immunological and gravimetric.

Keywords: British Pharmacopeia, Analytical techniques, Monograph, Assay

Dedication

Dedicated To My Parents

Acknowledgment

To start with, I would like to thank Almighty Allah, The most merciful and benefactor, for granting me life with infinite blessings. All praises to him for giving me patience and strength to continue my journey to complete this project.

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List of Acronyms

BP	Bitish Pharmacopeia
TLC	Thin Layer Chromatography
HPLC	High-Performance Liquid Chromatography
UV	UV-visible Spectroscopy
RP-HPLC	Reverse-Phase HPLC
NP-HPLC	Normal-Phase HPLC
USP	United State Pharmacopeia

Chapter 1

Introduction

1.1 Background

The British Pharmacopoeia (BP) is the United Kingdom's official pharmacopeia. It is a collection of UK pharmaceutical quality requirements for products that are used by both individuals as well as organizations involved in pharmaceutical research, development, production and testing. Further, it has shown how, in the first decades of the twentieth century, the British Pharmacopeia served an aim by defining standards and establishing formulations. Every year in August, BP is released and officially becomes effective on January 1 of the year by combining all monographs (Munirathnam & Radhakrishnan, 2023). Since 1864, the British Pharmacopoeia has established acceptable regulatory standards for therapeutic drugs and pharmaceutical components (BP, 2013). BP 2013 follows the pattern set by past decades (BP, 2013).

The monographs serve as recommendations for developing national formularies and are intended to encourage worldwide standardization in the quality assurance and usage of herbal treatments. Moreover, the tests described in the monograph section are used to evaluate the product's quality characteristics. Most importantly, the monographs are a valuable scientific reference for the general public and for health authorities, scientists, and pharmacists.

However, who's monographs are compilations of information about active pharmaceutical ingredients (APIs) with their associated identification tests, assay methods, impurity profiles, tests for impurities, solubility, etc.

Pharmacopeia recommends various analytical test methods -

Spectroscopic Techniques are recommended in the BP. The study of spectroscopy involves examining how various types of radiation, electromagnetic radiation, interact with materials to provide information about their properties. Further, this technique is subdivided into two types such as - atomic and UV-VIS spectroscopy. In addition, a photoelectric transducer (electronic device) is used to detect the intensity of radiation in spectrometry and spectrometric procedures (*Introduction*, n.d.).

One of the first instrumental analytical methods, UV-VIS spectroscopy identifies two types of analytes such as the micro- amounts of analyte and semi-micro-amounts of analytes in a sample. Basically, it measures the effects of electromagnetic radiation interactions with molecules, ions, and atoms in the UV-Visible region. Consequently, the presence of atoms, bonds, functional groups, basic nuclei, molecular formulas, and atomic weights of atoms, and molecules are determined (Hussain, 2019). However, the Beer-Lambert law predicts a linear relationship between absorbance, absorber concentration in the solution, and route length.

By measuring a relationship between the quantity of light absorption and the concentration of the analyte used in traditional techniques. Mainly, atomic absorption spectroscopy allows one

to detect unknown amounts. In essence, an atomic absorption spectrometer is a device used to apply these fundamental ideas to everyday problems in quantitative analysis. Atomic absorption is the process by which a ground-state atom raises its energy level by absorbing light at a certain wavelength.(Benneth, P.A. and Rothery, n.d.).

The process of using a light beam to excite the electrons in the molecules of particular compounds and cause them to emit light is known as fluorescence spectroscopy. This light is focused onto a detector and through a filter to measure and identify the molecule or changes in the molecule.

Chromatography is a technique where the analytical substance is added in a liquid or gaseous mobile phase, which is pumped through a stationary phase. Additionally, each of the components of the analyte reacts differently. They interact with the stationary phase for a longer or shorter duration of time based on their polarity and causes them to be more or less retarded. As a result, components are separated that are present in the sample. A chromatogram is used so that signals can be recorded and plotted when components pass through the detector (Blakely, C. R. and Vestal, M. L. 1983).

The stationary phase also known as the chromatography media which is solid in nature and various components of the liquid mobile phase interact with each other to variable degrees as they move over the column in column liquid chromatography. Basically, molecules are separated based on their distinct chemical and physical interactions with the stationary and mobile phases.

HPLC separation principle is depend on the distribution of an analyte between a stationary phase and a mobile phase (Hashim, 2018). The molecules travel through the stationary phase more slowly based on the chemical composition of the analyte. The exact interactions between the molecules of the sample and the packing material shows how long a sample spends "on-column." As a result, different types of sample components elute at different times. Finally, the components of the sample have been successfully separated. (Hashim, 2018).

The combination of a polar stationary phase and a nonpolar mobile phase is called normal-phase chromatography. In addition, the increased polarity of the mobile phase reduces solute retention. A column is packaged by inorganic adsorbent such as silica or (less often) alumina. In addition, selected phases in NPC have stronger polarities than mobile phases. Thus, the sample retention enhances on more polar stationary phases which is opposite to RPC.

In this chromatography technique, the more common form is Reverse phase HPLC where the stationary phase is nonpolar and the mobile phase is polar. Basically, hydrophobic molecules are covalently linked to the stationary phase particles in reverse-phase chromatography to produce a hydrophobic stationary phase that has a greater attraction for hydrophobic or less polar substances. For reversed-phase chromatography, any inert polar material with sufficient packing can be applied. In RP chromatography, a stationary phase made of silica is utilized. An octadecyl carbon chain (C18) made of bonded silica is the most frequently used column.

In Gas Chromatography, the group of analytical separation techniques used to evaluate volatile compounds in the gas phase is referred to as gas chromatography. In gas chromatography, the

stationary phase is a microscopic layer of viscous liquid on a surface of solid particles on an inert solid support and an inert gas such as helium, argon, nitrogen, or hydrogen, typically makes up the mobile phase. Usually, the components of a sample are dissolved in a solvent and vaporized to separate analytes. Analyte molecules are transported through the heated column by the mobile phase.

Ion exchange chromatography (IEC) is based on the concept that opposites attract. A chargeable solute interacts with an oppositely charged, solid stationary phase during ion exchange chromatography, which is used for the separation of charged analytes. Any solute that can pick up a charge in solution can be subjected to ion exchange chromatography. Positive analytes will interact with the stationary phase's negative charge. As a result, movement of the analyte become slow.

The TLC procedure's separation techniques are based on the given compound's respective affinities for the mobile and stationary phases. Here, the process starts by moving the mobile phase across the stationary phase's surface. In contrast to the lower affinity molecules, the higher affinity compounds move more slowly during this movement.

In order to perform titrimetric analysis, the standard solution is often added to the long-calibrated tube known as the burette. The procedure of titrating involves gradually adding the standard solution into a solution with an unknown concentration up until the reaction is finished. The equivalency point, sometimes referred to as the theoretical or stoichiometric end point, is the point at which a reaction is finished (Michałowska-Kaczmarczyk et al., 2017).

The primary difference between aqueous and non-aqueous titrations is that- an analytical substance dissolve in water is called aqueous titrations and an analytical substance dissolved in organic solvent is called non-aqueous titrations.

Analyte substance can dissolve in a solvent lacking of water is known as non-aqueous titration. This technique is essential for pharmacopeial tests. Here, Water is capable of functioning both as a weak base and an acid, requiring an approach of non-aqueous titration.

Redox titrations are oxidation-reduction reactions in which a reducing agent and an oxidizing agent interact to allow us to quantify the concentration of the target molecule in a sample. We need to dissolve the sample in water, that's why it is in an aqueous form.

Precipitation titration's basic principle is that the total quantity of precipitant must correlate with the amount of the substance being precipitated. The resulting solid is referred to as a precipitate this is why precipitation is knowns as a process of a solid forming in a solution. However, the precipitate itself is ionic because the cation originates from one solution and the anion from another. Thus, the analyte and titrant in this titration mix to create an insoluble material, and the procedure is repeated until all of the analytes have been utilized up. When the first drop of excess titrant reacts with an indicator, the color will alter, signaling the titration's ending.

Complex ion is formed from a simple ion in this techniques and an equivalent point can be determined using metal indicators or electrometrically. This technique has also been referred

to by a number of other names, including EDTA titrations, chilatometric titrations, chilometric titrations, and chilometry. The usage of EDTA (Ethylene diamine tetra acetic acid) and other chemicals has led to the creation of all these classifications, which all relate to the same analytical procedure (Hussain, 2019).

RIA is an immunoassay method for the radioisotope-based detection of the antigen-antibody combination. An immunoassay method called ELISA uses enzymes to detect antigen-antibody complexes. Therefore, this is the primary distinction between RIA and ELISA. In addition, while the antibody is labeled in ELISA, the antigen is labeled in the RIA approach. Additionally, labeling molecules in the RIA technique are radioisotopes, whereas labeling molecules in the ELISA technique are enzyme.

In gravimetric analysis, the mass of a solid is used to find out the amount of an analyte. The main purpose of gravimetric analysis is that it is possible to determine the mass of compound.

1.2 Literature Review

British Pharmacopeia's guarantee the safety, efficacy, and appropriate quality of medications and the chemicals used to make them. Most importantly, British Pharmacopeia assure that–"N-Nitroso dimethylamine (NDMA) and N-Nitroso diethylamine (NDEA) are which are classified as probable human carcinogens and the manufacture must make sure that their manufacturing process does not generate such impurities". Again. the standards meet the requirements of

pharmaceutical products and ingredients that will be sold on the market. Moreover, it also provides quality control methods (Munirathnam & Radhakrishnan, 2023). Therefore, we can say that BP is reliable to manufacture medicinal products.

Assay tests in IP are carried out using a titrimetric method (by visual identification), which has a lower degree of precision than the LC method. Additionally, because the assay limits are stricter than those for USP due to the titrimetric method. By using the HPLC technique, related substances in IP are limited to three recognized contaminants. Two known contaminants are specified in accordance with BP, and their amounts are calculated using impurity standards (Munirathnam & Radhakrishnan, 2023)According to IP, there are no known impurities stated; however, BP and USP list known impurities, and their limits for total impurities are stronger than IP's as well. Again, BP is more reliable compare to IP.

According to USP, the Organic Impurities Test was not officially recognized as of January 11, 2021, and Related Substances Tests are not mentioned in IP. BP have Related Substances Test.. For the efficacy and safety of the patient's health, the related substances test are necessary. In addition, a test for related substances' main purpose is to manage degrading impurities. We found that related substances tests are not listed in some of the monograph processes However, Related Substances Test have a role to minimize impurities produced during the synthesis of the active pharmaceutical ingredient (API). So, without a related substance test, the method cannot be reliable. That’s why, BP is more reliable than the USP and IP pharmacopeia.

1.3 Aim and Objective

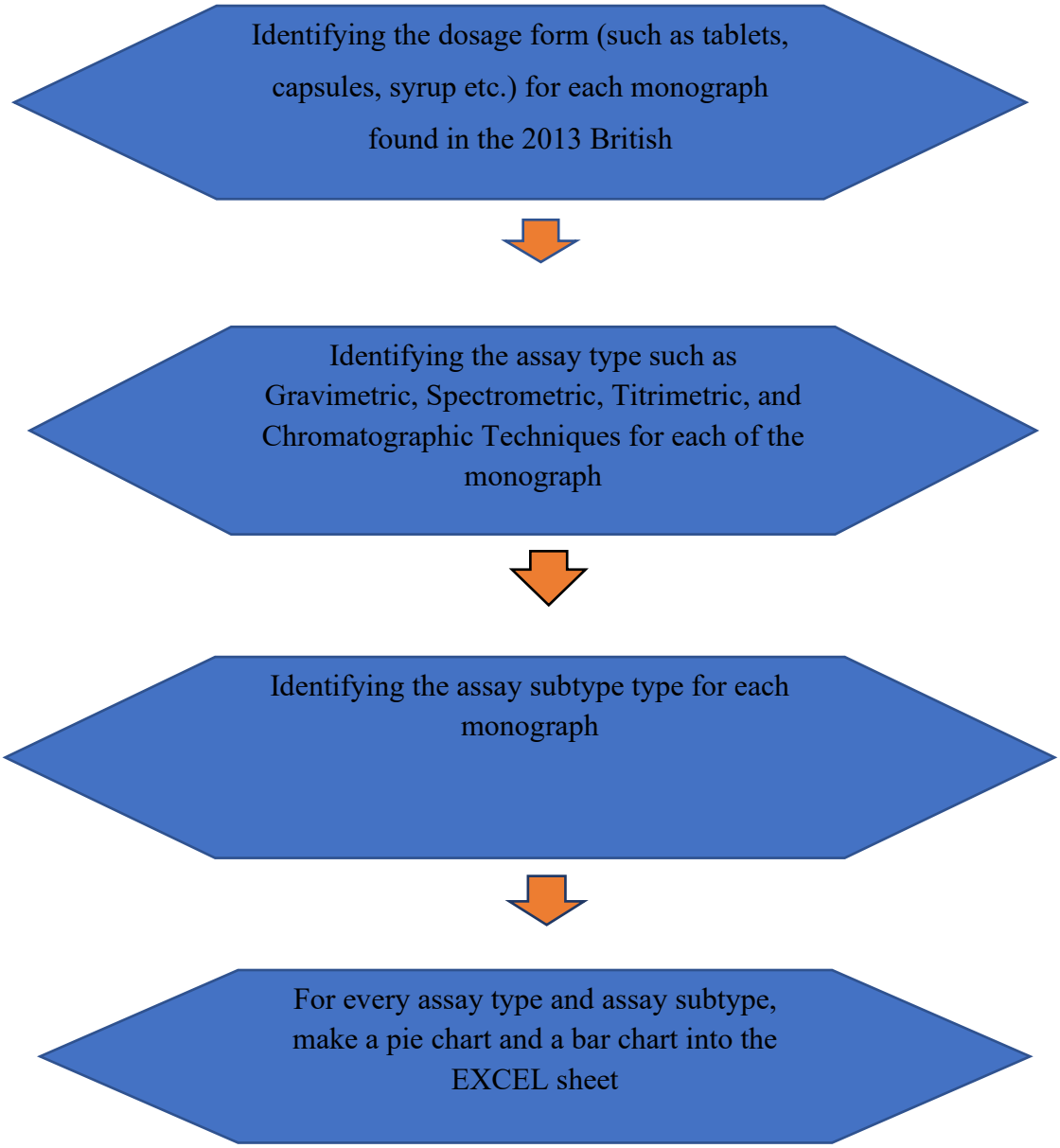
The aim of this study is to give an idea about frequency of the analytical techniques in BP 2013.

This review is aimed at focusing on the role of various analytical techniques in the assay of formulations and giving an overall review of how frequently analytical techniques used in British Pharmacopoeia analysis. The review also highlights the comparison and advances of each of the techniques which is used by British Pharmacopoeia.

Chapter 2

Method

This data analysis was carried out by reviewing the monographs of the British Pharmacopeia (BP) 2013.At first, the dosage form was identified from each of the formulation. Further, by reading the assay and related substance part of all the pharmaceutical products, the analytical techniques type and sub-type were identified. Below, I've outlined here how I evaluate a technique-


Identifying the dosage form (such as tablets, capsules, syrup etc.) for each monograph found in the 2013 British
Identifying the assay type such as Gravimetric, Spectrometric, Titrimetric, and Chromatographic Techniques for each of the monograph
Identifying the assay subtype type for each monograph
For every assay type and assay subtype, make a pie chart and a bar chart into the EXCEL sheet

Chapter 3

Result & Discussion

Among 1247 formulated preparation in specific monographs of BP 2013, monographs were studied 110. We can observe assay type from Figure 1 and Figure 2 which shows the frequency of chromatographic techniques mostly recommended which is 40%. Then, the percentage of spectroscopic techniques recommends 30% in the formulations which is less compared to chromatographic techniques. Further, the titrimetric techniques percentage is 27%. Finally, we can see the BP recommends gravimetric and immunological less frequently, at 1% and 2%, Immunoassays produce results that are either quantitative (ELISA) or RIA assay. Due to the high sensitivity of the antibodies and their potential to interact, this type of assay is not widely used. This immunoassay method is therefore limited to a specific raw material (Zheng et al., 2006). Each of the strategies discussed above has benefits and drawbacks: While immunoassay tests are a quick, simple, and inexpensive method that can only be applicable for specific raw materials but are not always very accurate. On the other hand, chromatography techniques provide reliable and complete contamination profiles but are expensive analysis.

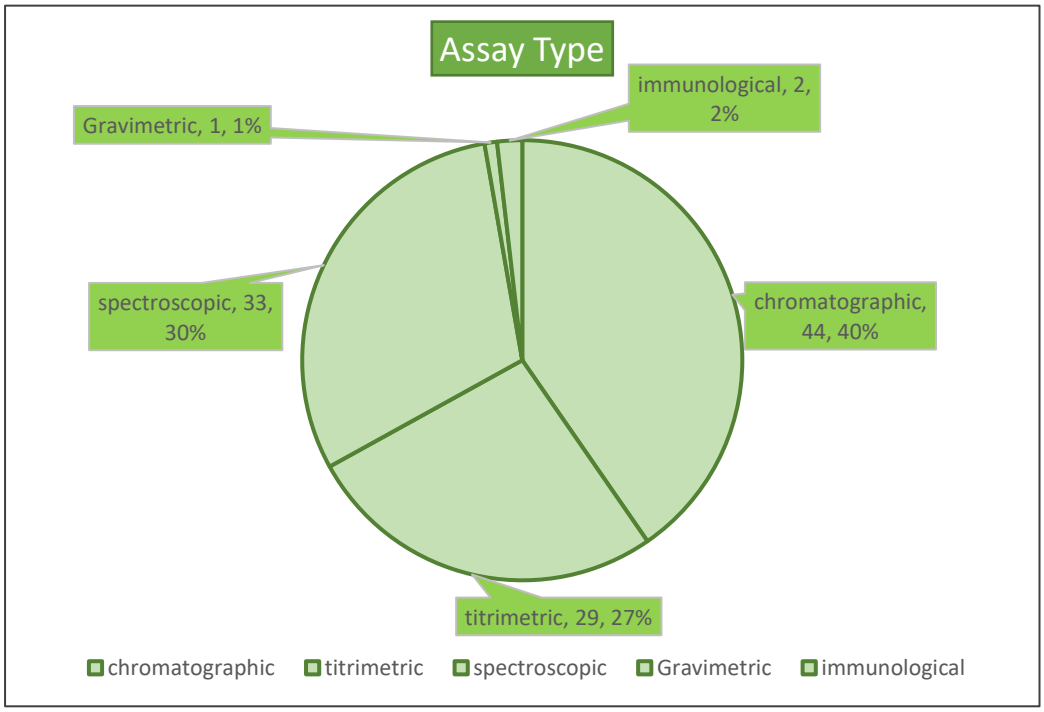


Figure 1:Assay type

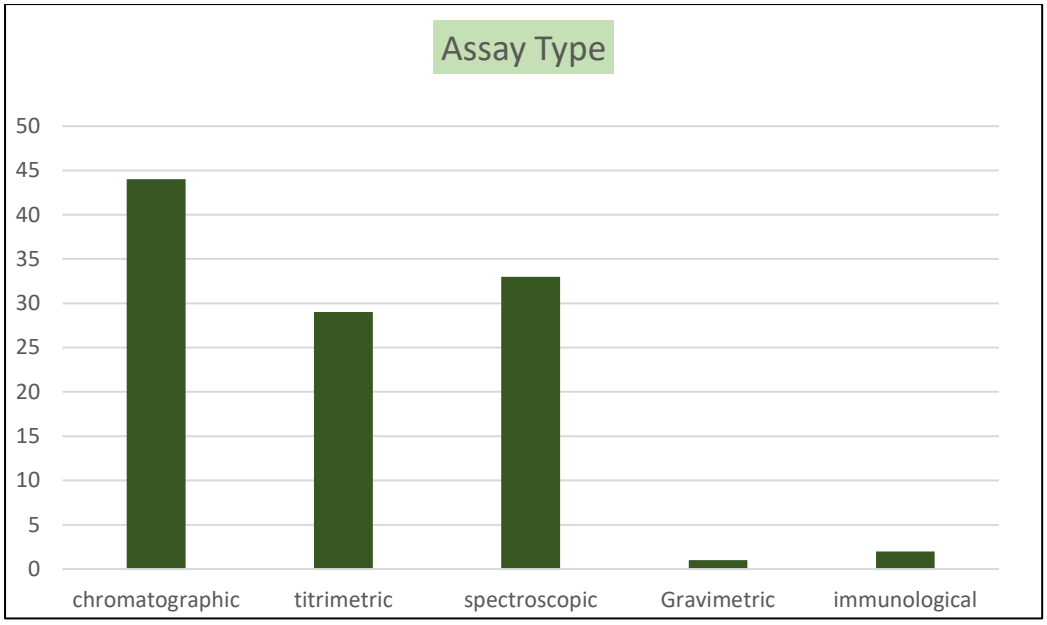


Figure 2:Assay type

Out of 110 reviewed formulations, the frequency of Uv-visible spectroscopic methods is most commonly recommended and it is almost 94% observed in Figures 3 (Pie chart) and 4 (Bar chart). On the other hand, atomic absorption spectroscopic methods are recommended very rarely. In a short time, a UV–Vis spectrophotometer can examine a large number of samples. On the contrary, atomic Absorption spectrophotometers can only analyze metals, making it impossible for organic compounds. In that situation, analyzing metals requires more time than analyzing organic ones.

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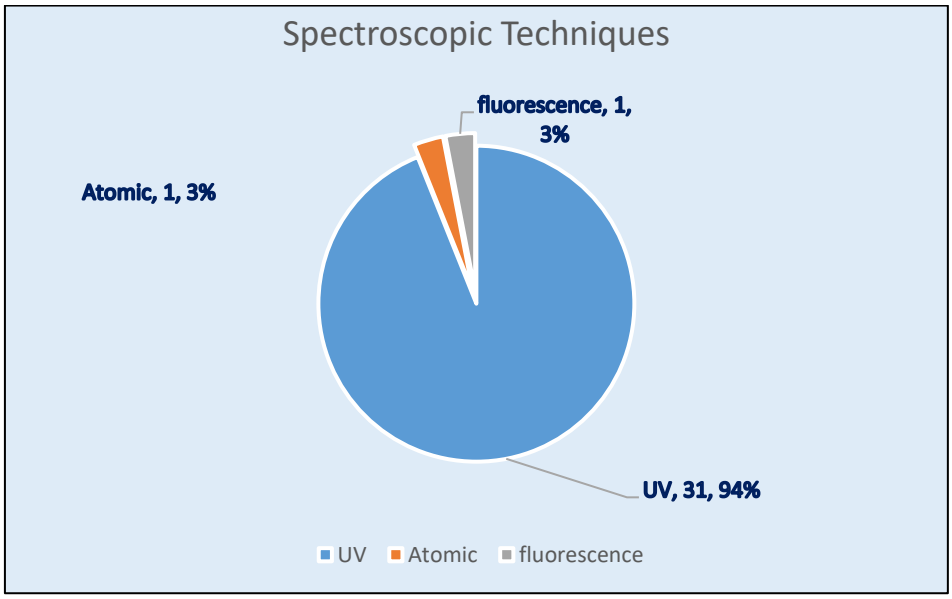

Figure 3:Pie chart For Spectroscopic Techniques

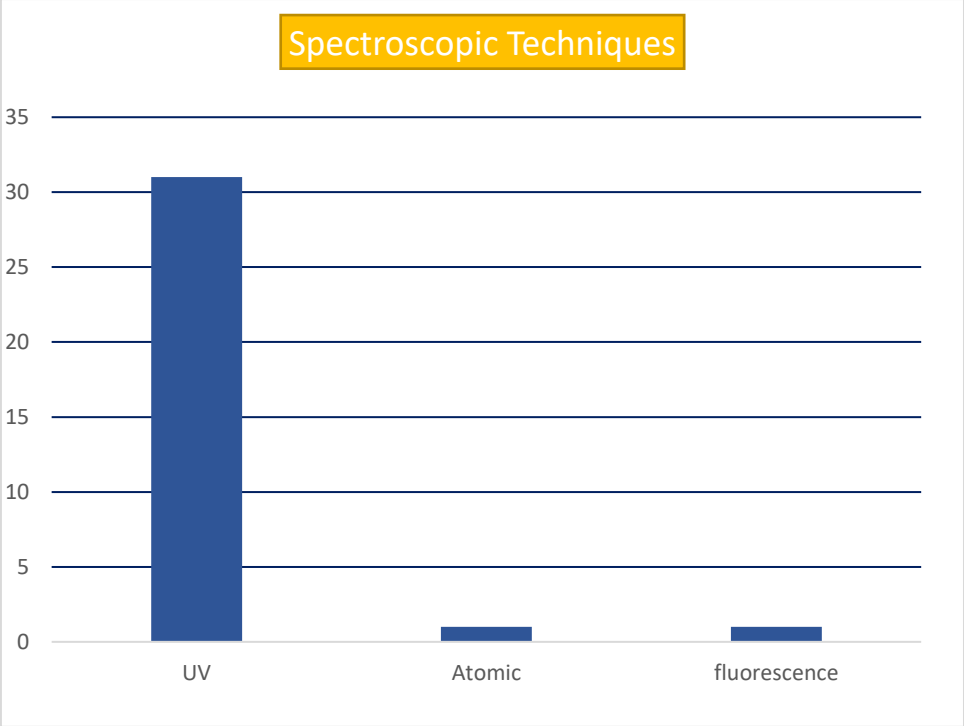

Figure 4:Bar Chart for Spectroscopic techniques

According to Figure 5 (a pie chart), which shows the frequency of Reverse Phase HPLC is most frequently recommended, it is about 91% out of the 110 formulations studied. But the TLC technique is not recommended in that formulation. Since, there are different types of detector alternatives present with HPLC, including UV, fluorescence, and mass selectivity detectors. Again, the application of photodiode array detection technology also allows for simultaneous detection. In the case of TLC separations do not have such expansive and

sensitive detection options this is why TLC techniques may not be used in the formulation preparation.

Similar to GC, chromatograms can be stored permanently as hard or soft copies. Nevertheless, due to the degradation of the spots over time, TLC plates cannot be stored.

In this case, Ion-exchange chromatography has the following drawbacks - the main drawback of ion-exchange chromatography is the need for buffers. Since the buffer is applied for component separation, it has a high working cost. Only charged molecules can be isolated using this technique which is the reason Ion exchange chromatography used only 7%.

Further, reversed-phase HPLC has a number of benefits over normal-phase HPLC in separations. The use of reversed-phase chromatography removes solubility problems that are frequently present in non-polar normal phase solvents, uses less hazardous solvents than those connected with normal phase, and allows quick sample recovery (Claus, 2009). So, this is the possible reason for using reverse phase HPLC more than the normal phase HPLC techniques.

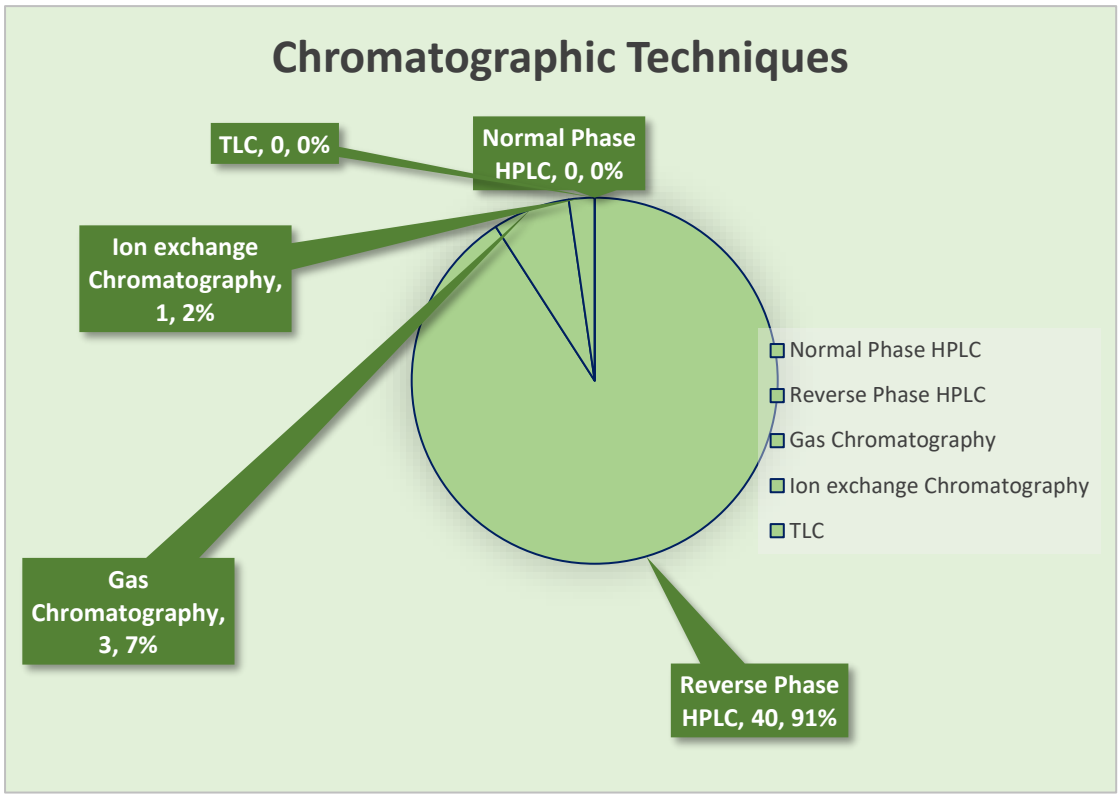

Figure 5:Chromatographic techniques

Figures 6 (a pie chart) show that out of the 110 formulations that were reviewed, Aqueous acid-base titration was used in mostly 45% of the formulation.

The main advantages of acid-base titration is- it doesn't require specialized or expensive chemicals as well as acid-base titration techniques are typically reliable compared to other approaches. In addition, this method is cost-effective. Again, it does not need for a high level of skill and has an easy operating process. Most importantly, analysis of this techniques

provide for extremely accurate and exact outcomes. The primary benefit of complexometric titrations is their usefulness in identifying combinations of various metal ions in solution.

Since this is an open system, variables like humidity, pH, and temperature may have an impact on the outcomes. So, Aqueous acid-base titration is preferable to complexometric titration in this case.

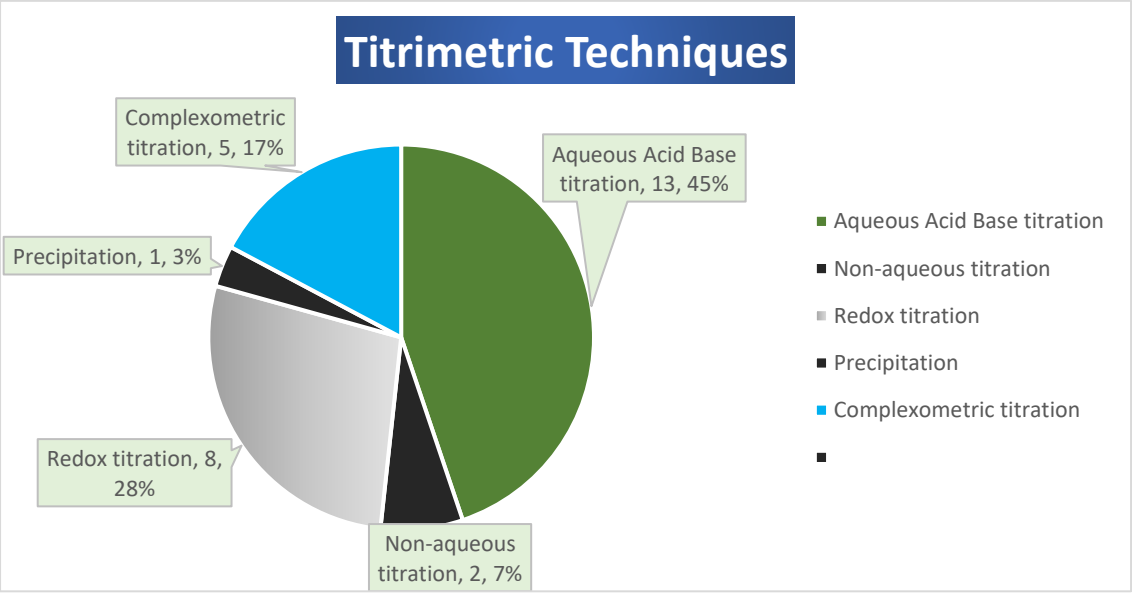

Figure 6:Titrimetric techniques

Chapter 4

Conclusion

In the present study, we examine how frequency of analytical techniques used. Now a day, chromatography is accepted as an extremely sensitive and effective separation method. In terms of scientific advances, chromatography is considered to be one of the major innovations in the past few days. The practice of HPLC is limited to analyzers but is now widely used by students, chemists, biologists, production workers, and other research and quality control laboratories. The spectroscopy techniques for the quantitative and qualitative analysis of drugs have included the various methods UV-Visible spectroscopy, Nuclear magnetic resonance Fluorimetry. Mass Spectroscopy and Infrared Spectroscopy. This review focuses on the principle, classifications, instrumentation, advantages, disadvantages, and application of chromatographic spectroscopy techniques, and titrimetric techniques. Chromatographic techniques enhance chemical and instrumentation productivity, robustness, resolution, speed and sensitivity by giving more information about a sample. The time spent refining new methods can be significantly reduced.

References

1.Benneth, P.A. and Rothery, E. (n.d.). Atomic Absorption Analysis. *Varian*, *January 1997*, 1–40.

Claus, J. E. (2009). Advantages of Reversed-Phase for Preparative Chiral Separations prep-compatible reversed-phase mode. *Reporter, SIGMA ALDRICH*, *27.5*, 14. sigma-aldrich.com/thereporter

Desbandu College. (2021). *Π* (Pi Star) Orbital*. https://www.deshbandhucollege.ac.in/pdf/resources/1585214485_PHY(H)-VI-NANO_MATERIAL-13-AJAYPRATAP.pdf

Hashim, H. O. (2018). chromatography and HPLC principles Chromatography and HPLC principles By : Dr Hayder Obayes Hashim Chromatography : *Technical Report*, *January*, 1–15. https://doi.org/10.13140/RG.2.2.33635.25126

Hussain, A. F. (2019). *UV-VISIBLE SPECTROMETRY*. *December*.

Michałowska-Kaczmarczyk, A. M., Spórna-Kucab, A., & Michałowski, T. (2017). Principles of Titrimetric Analyses According to Generalized Approach to Electrolytic Systems (GATES). *Advances in Titration Techniques*, *September 2017*. https://doi.org/10.5772/intechopen.69248

Munirathnam, J., & Radhakrishnan, G. (2023). *Comparison of Monographs of Indian Pharmacopeia with BP and USP Pharmacopeia*. *11*(1), 6–14. https://doi.org/10.22270/ijdra.v11i1.572

Appendix A.

Sl.	Drug	Dosage form	Assay type	Assay subtype
1	**Acebutolol Capsules**	**Capsule**	**spectroscopic**	**UV**
2	**Acebutolol Tablets**	**tablet**	**spectroscopic**	**UV**
3	**Acenocoumarol Tablets**	**tablet**	**spectroscopic**	**UV**
4	**Acetazolamide Oral Suspension**	**suspension**	**chromatographic**	**reverse phase HPLC**
5	**Acetazolamide Tablets**	**tablet**	**titrimetric**	**non aqueous titration**
6	**Acetylcysteine Eye Drops**	**eye drops**	**chromatographic**	**reverse phase HPLC**
7	**Acetylcysteine injection**	**injection/infusion**	**titrimetric**	**redox titration**
8	**Aciclovir cream**	**cream**	**spectroscopic**	**UV**
9	**Aciclovir Eye Ointment**	**ointment**	**spectroscopic**	**UV**
10	**Acyclovir Infusion**	**injection/infusion**	**spectroscopic**	**UV**

11	**Acyclovir Oral Suspension**	**suspension**	**spectroscopic**	**Fluorescence**
12	**Acyclovir Tablets**	**tablet**	**spectroscopic**	**UV**
13	**Dispersible Aciclovir Tablets**	**effervescent tablet**	**spectroscopic**	**UV**
14	**Acitretin Capsules**	**Capsule**	**chromatographic**	**reverse phase HPLC**
15	**Adrenaline Eye Drops / Epinephrine Eye Drops**	**eye drops**	**chromatographic**	**reverse phase HPLC**
16	**Adrenaline Injection**	**injection/infusion**	**chromatographic**	**reverse phase HPLC**
17	**Dilute Adrenaline Injection**	**injection/infusion**	**chromatographic**	**reverse phase HPLC**
18	**Adrenaline Solution**	**solution**	**chromatographic**	**reverse phase HPLC**

19	**Adrenaline and Cocaine Intranasal Solution / Epinephrine and Cocaine Intranasal Solution**	**solution**	**chromatographic**	**reverse phase HPLC**
20	**Adrenaline and Cocaine Intranasal Solution / Epinephrine and Cocaine Intranasal Solution**	**solution**	**chromatographic**	**reverse phase HPLC**
21	**Alendronic Acid Tablets**	**tablet**	**chromatographic**	**ion exchange**
22	**Alfuzosin Tablets**	**tablet**	**chromatographic**	**reverse phase HPLC**
23	**Prolonged-release Alfuzosin Tablets**	**tablet**	**Chromatographic**	**reverse phase HPLC**
24	**Compound Alginate Antacid Oral Suspension**	**suspension**	**Spectroscopic**	**Atomic**

25	**Alginate Raft-Forming Oral Suspension**	**suspension**	**Spectroscopic**	**UV**
26	**Pediatric Alimemazine Oral Solution**	**solution**	**spectroscopic**	**UV**
27	**Strong Paediatric Alimemazine Oral Solution**	**solution**	**spectroscopic**	**UV**
28	**Alimemazine Tablets**	**tablet**	**spectroscopic**	**UV**
29	**Allopurinol Oral Suspension**	**suspension**	**chromatographic**	**reverse phase HPLC**
30	**Allopurinol Tablets**	**tablet**	**spectroscopic**	**UV**
31	**Aloxipirin Tablets**	**tablet**	**spectroscopic**	**UV**
32	**Compound Aluminum Paste**	**paste**	**titrimetric**	**complexometric titration**
33	**Aluminium Acetate Ear Drops**	**ear drops**	**Titrimetric**	**complexometric titration**

34	**Aluminium Chloride Solution**	**solution**	**Titrimetric**	**complexometric titration**
35	**Aluminum Hydroxide Oral suspension**	**suspension**	**Titrimetric**	**complexometric titration**
36	**Aluminum Hydroxide Tablets**	**tablet**	**Titrimetric**	**complexometric titration**
37	**Alverine Capsules**	**capsule**	**Chromatographic**	**reverse phase HPLC**
38	**Amantadine Capsules**	**capsule**	**Titrimetric**	**non aqueous titration**
39	**Amantadine Oral Solution**	**solution**	**Chromatographic**	**gas chromatography**
40	**Amikacin Injection**	**injection/infusion**	**Chromatographic**	**reverse phase HPLC**
41	**Aminoglutethimide Tablets**	**tablet**	**Spectroscopic**	**UV**
42	**Aminophylline Injection**	**injection/infusion**	**Spectroscopic**	**UV**

43	**Aminophylline Injection**	**injection/infusion**	**Titrimetric**	**aqueous acid base titration**
44	**Aminophylline Tablets**	**tablet**	**spectroscopic**	**UV**
45	**Aminophylline Tablets**	**tablet**	**Titrimetric**	**aqueous acid base titration**
46	**Prolonged-released Aminophylline Tablets**	**tablet**	**spectroscopic**	**UV**
47	**Prolonged-released Aminophylline Tablets**	**tablet**	**titrimetric**	**aqueous acid base titration**
48	**Amiodarone Infusion**	**injection/infusion**	**chromatographic**	**reverse phase HPLC**
49	**Amiodarone Oral Suspension**	**suspension**	**chromatographic**	**reverse phase HPLC**
50	**Amiodarone Tablets**	**tablet**	**chromatographic**	**reverse phase HPLC**

51	**Amitryptiline Tablets**	**tablet**	**chromatographic**	**reverse phase HPLC**
52	**Aromatic Ammonia Solution**	**solution**	**titrimetric**	**aqueous acid base titration**
53	**Aromatic Ammonia Solution**	**solution**	**titrimetric**	**aqueous acid base titration**
54	**Dilute Ammonia Solution**	**solution**	**titrimetric**	**aqueous acid base titration**
55	**Aromatic Ammonia Spirit**	**spirit/elixir/linctus**	**titrimetric**	**aqueous acid base titration**
56	**Aromatic Ammonia Spirit**	**spirit/elixir/linctus**	**titrimetric**	**aqueous acid base titration**
57	**Strong Ammonia Acetate Solution**	**solution**	**Titrimetric**	**aqueous acid base titration**
58	**Ammonium Chloride Mixture**	**solution**	**Titrimetric**	**Precipitation**
59	**Amoxicillin Capsules**	**capsule**	**chromatographic**	**reverse phase HPLC**

60	**Amoxicillin Injection**	**solution**	**chromatographic**	**reverse phase HPLC**
61	**Amoxicillin Oral \Suspension**	**suspension**	**chromatographic**	**reverse phase HPLC**
62	**Amphotericin Lozenges**	**powder**	**immunological**	
63	**Amphotericin Oral Suspension**	**suspension**	**immunological**	
64	**Ampicillin Capsules**	**capsule**	**chromatographic**	**reverse phase HPLC**
65	**Ampicillin Injection**	**injection/infusion**	**chromatographic**	**reverse phase HPLC**
66	**Ampicillin Oral Suspension**	**suspension**	**chromatographic**	**reverse phase HPLC**
67	**Aqueous Cream**	**cream**		
68	**Arginine Hydrochloride Infusion**	**injection/infusion**	**spectroscopic**	**UV**

69	**Arginine Hydrochloride Oral Solution**	**solution**	**chromatographic**	**reverse phase HPLC**
70	**Ascorbic Acid Injection**	**injection/infusion**	**titrimetric**	**redox titration**
71	**Ascorbic Acid Tablets**	**tablet**	**titrimetric**	**redox titration**
72	**Aspirin Tablets**	**tablet**	**titrimetric**	**aqueous acid base titration**
73	**Dispersible Aspirin Tablets**	**tablet**	**titrimetric**	**redox titration**
74	**Effervescent Soluble Aspirin Tablets**	**effervescent tablet**	**titrimetric**	**redox titration**
75	**Gastro-resistant Aspirin Table**	**tablet**	**chromatographic**	**reverse phase HPLC**
76	**Aspirin and Caffeine Tablets**	**tablet**	**titrimetric**	**aqueous acid base titration**
77	**Aspirin and Caffeine Tablets**	**tablet**	**spectroscopic**	**UV**

78	**Atenolol Injection**	**injection/infusion**	**spectroscopic**	**UV**
79	**Atenolol Oral Solution**	**solution**	**chromatographic**	**reverse phase HPLC**
80	**Atenolol Tablets**	**tablet**	**spectroscopic**	**UV**
81	**Atropine Eye Drops**	**eye drops**	**chromatographic**	**reverse phase HPLC**
82	**Atropine Eye Ointment**	**ointment**	**chromatographic**	**reverse phase HPLC**
83	**Atropine Injection**	**injection/infusion**	**chromatographic**	**reverse phase HPLC**
84	**Atropine Tablets**	**tablet**	**chromatographic**	**reverse phase HPLC**
85	**Azapropazone Capsules**	**capsule**	**chromatographic**	**reverse phase HPLC**
86	**Azapropazone Tablets**	**tablet**	**spectroscopic**	**UV**
87	**Azathioprine Oral Suspension**	**suspension**	**chromatographic**	**reverse phase HPLC**

88	**Azathioprine Tablets**	**tablet**	**spectroscopic**	**UV**
89	**Baclofen Oral Solution**	**solution**	**chromatographic**	**reverse phase HPLC**
90	**Baclofen Tablets**	**tablet**	**chromatographic**	**reverse phase HPLC**
91	**Barium Sulfate Oral Suspension**	**suspension**	**Gravimetric**	
92	**Beclometasone Cream**	**cream**	**Chromatographic**	**reverse phase HPLC**
93	**Beclometasone Powder for Inhalation**	**powder**	**Chromatographic**	**reverse phase HPLC**
94	**Beclometasone Pressurised Inhalation**	**Solution or Suspension**	**Chromatographic**	**reverse phase HPLC**
95	**Beclometasone Aqueous Nasal Spray**	**suspension**	**Chromatographic**	**reverse phase HPLC**
96	**Beclometasone Ointment**	**ointment**	**Chromatographic**	**reverse phase HPLC**

97	**Bendroflumethiazide Tablets**	**tablet**	**Spectroscopic**	**UV**
98	**Benorilate Oral Suspension**	**suspension**	**Spectroscopic**	**UV**
99	**Benorilate Tablets**	**tablet**	**Spectroscopic**	**UV**
100	**Benzatropine Injection**	**injection/infusion**	**Spectroscopic**	**UV**
101	**Benzatropine Tablets**	**tablet**	**Spectroscopic**	**UV**
102	**Compound Benzoic Acid Ointment**	**ointment**	**Titrimetric**	**aqueous acid base titration**
103	**Compound Benzoic Acid Ointment**	**ointment**	**Spectroscopic**	**UV**
104	**Benzoic Acid Solution**	**solution**	**titrimetric**	**aqueous acid base titration**
105	**Benzoyl Peroxide Cream**	**cream**	**titrimetric**	**redox titration**
106	**Benzoyl Peroxide Gel**	**gel**	**titrimetric**	**redox titration**

107	**Benzoyl Peroxide lotion**	**lotion**	**titrimetric**	**redox titration**
108	**Benzydamine Cream**	**cream**	**spectroscopic**	**UV**
109	**Benzydamine Mouthwash**	**solution**	**chromatographic**	**gas chromatography**
110	**Benzydamine Oromucosal Spray**	**solution**	**chromatographic**	**gas chromatography**