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Formulation And Evaluation of Fast Dissolving Oral Tablet of Cetirizine Hydrochloride for Allergic Symptoms

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Abstract

This work focuses on the development of rapidly dissolving oral pills for the purpose of treating allergies. The focus of this study is the antihistamine cetirizine HCl. Improving patient compliance is the aim, especially for the categories of young people, the elderly, and those with swallowing difficulties. Many techniques are being researched for formulation, including direct compression, sublimation, and freeze-drying. Excipients such sweeteners, flavouring compounds, and super disintegrants are employed to achieve rapid disintegration and palatability. Stability tests, in vitro dissolution studies, and physicochemical characterization are done to evaluate the produced tablets. The results demonstrate the potential of the developed fast-dissolving oral cetirizine HCl tablets as a convenient dosage form with improved patient acceptability and efficacy. According to the research findings, the fast-disintegrating tablets of cetirizine hydrochloride were effectively designed to have the required characteristics, such as quick disintegration, quick start of action, and improved the comfort of patients and adherence.

Keywords - Direct compression, quick disintegration, cetirizine HCl, super disintegrants.

INTRODUCTION

Tablet dose forms that are meant to have been took in whole, disintegrate, and release the medication quickly in the digestive system continue to be the favored manufacturing via a standpoint of manufacturing facilities along with a patient acceptability perspective, even though focused on and monitored release systems for drug delivery have received more attention recently.[1]

Therefore, for a medication that is given as a tablet to be absorbed and ultimately enter the bloodstream, the tablet must dissolve. The most effective formulation both from the manufacturing and patient acceptance perspective remain tablets that are intended to be taken completely, break apart, and release their medication quickly in the digestive system, although specialised controlled drug delivery methods have been in the headlines recently [2]. As a result, medications are taken, processed, and eventually absorbed into the bloodstream. FDDDS, as opposed to the major option, oral liquids, provide the convenience of a substantially more accurate dose [3]. In order to improve patient compliance, recent developments in inventive drug delivery techniques (NDDS) seek to preserve a medication's therapeutic effectiveness while boosting its safety Scientists have been inspired by recent technological advancements to create FDTs that enhance comfort for patients and adherence [4].

The pills disintegrate or dissolve in the mouth as they are presented, making it simple to take the active medical ingredients without the need for extra water. The formulation's adoption and practicality have sparked the creation of multiple FDT technologies [5]. FDTs, or fast-dissolving solid unit dose forms, dissolve on the tongue without needing to be chewed or moistened. According to the US Food and Drug Administration's "Orange Book," an FDT is defined as "a solid form of dosage containing medicinal substances, which breaks down rapidly, usually within a matter of seconds, when placed upon the tongue" [6].

Oral administration is the most often used drug delivery method. Of all conceivable dosage forms, oral solid dose forms make up over 60%. By holding the drug in the mouth and dissolving it quickly without requiring the user to drink any water, oral fast-dissolving pills represent an innovative approach to medicine delivery [7]. These movies can be utilized to administer the drug locally and systemically to any specific or broad demographic group. robust mechanical properties and rapid release of an oral polymeric film. Melting and dissolving, leaving a bearable flavour on the tongue [8]. The oral films are produced using the solvent casting procedure. Choking phobia and other problems associated with conventional intraoral tablets that dissolve and disperse rapidly are resolved in the film. It is quick to prepare, assures precise dosage administration, is straightforward and convenient to package, easy to handle, and lessens unpleasant taste [9]. FDTs, which are designed to dissolve in three minutes, are described as "uncoated tablets intended to be placed in the mouth where they scatter rapidly before being swallowed" by the European Pharmacopoeia [10]. Every year, millions of people suffer from allergic responses; often, these reactions require immediate attention to prevent further problems and alleviate discomfort[11] Second-generation antihistamines like cetirizine hydrochloride are frequently given due to their effectiveness in treating allergy symptoms like sneezing, itching, and rhinorrhoea.[12] Millions of people experience allergic reactions each year; in order to minimise suffering and stop more issues, these reactions frequently call for quick medical intervention.[13]

Cetirizine hydrochloride, a typical second-generation antihistamine, is prescribed to treat rhinorrhoea and swelling and sneezing symptoms of allergies.[14] In order to satisfy patient demand for a dose form that is simple to take, this effort aims to evaluate and develop cetirizine hydrochloride FDOTs [15]. To improve patient compliance and happiness, a formulation that not only dissolves fast in the oral cavity but also has a flavour and texture that patients will find acceptable should be developed. Utilising cutting-edge formulation techniques and excipients like taste-masking agents and super disintegrants, this will be achieved.[16]

Cetirizine hydrochloride is the active metabolite of the piperazine H1-receptor antagonist Hydroxyzine.[17] Atopic dermatitis, chronic urticaria, seasonal and perennial allergic rhinitis, seasonal asthma, and allergic cough are all treated with this medicine, a non-sedative second-generation antihistamine.[18] When an allergic reaction is progressing, cetirizine prevents eosinophil chemotaxis as well as the production of histamine and other cytotoxic mediators by platelets.[19] Because of their sore throats, the patient finds it difficult to take tablets as a dose. Fast-dissolving tablets would therefore be the best dosage form for young children who have trouble swallowing regular pills and capsules.[20] If a young patient has trouble swallowing regular pills and capsules, fast-dissolving tablets would be a great prescription form [21]. An attempt was made to formulate a fast-disintegrating pill of cetirizine hydrochloride with the goals of increasing patient compliance and convenience, shortening the duration of treatment for allergy and respiratory disorders, and initiating action sooner.[2

Potent histamine of the second kind Pollen-induced asthma, chronic urticaria, and allergic rhinitis can all be effectively treated with H-1antagonist cetirizine hydrochloride.[23] unlike many traditional antihistamines, it doesn't cause drowsiness or have any negative anticholinergic effects. Cetirizine tablets have a delicate and bitter taste and smell, and they can be difficult to swallow, which makes many people find them unpleasant to take even if many of them are useful and efficient.[24] Hives, runny or stuffy nose, sneezing, and red, itchy eyes are among the allergy symptoms that cetirizine is intended to treat and prevent. It blocks histamine, a substance released by the body following an allergic reaction. It is a medication that belongs to the antihistamine class.[25]

Drug profile

Cetirizine hydrochloride

Structure

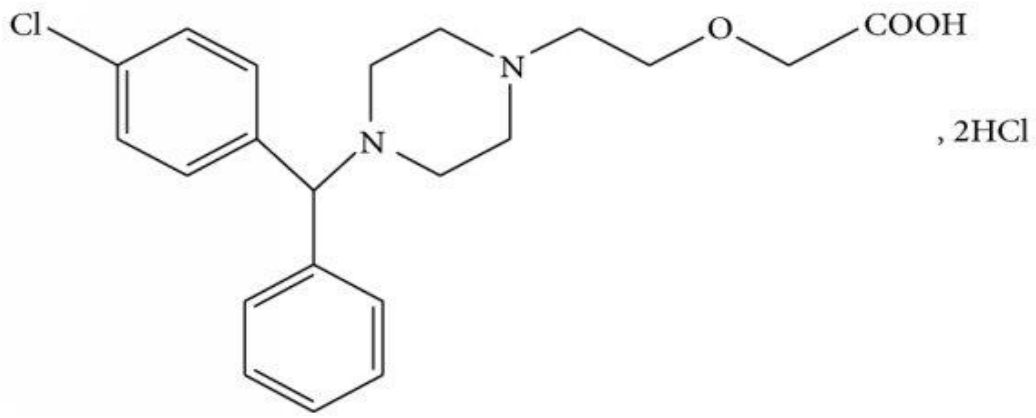


Figure 1: *Structure of Cetirizine hydrochloride*

Formula -C21H25ClN2O3

Molar mass :388.89 g·mol−1

Trade names: Allacan, Piriteze, Zyrtec, others

Route of administration: By mouth

Excretion: Urine 70–85% and Feces 10–13%

Dissolution: less than 80 -90 min

Mechanism of action of fast dissolving oral tablet

Disintegration in the Mouth

Because the FDOT is made with super disintegrants such sodium starch glycolate, cros povidone, or croscarmellose sodium, it dissolves on the tongue very rapidly.

Adsorption via the Oral Mucosa

Upon dissolving and beginning to dissolve in saliva, cetirizine hydrochloride is released. Partially absorbing the medication through the oral mucosa can speed up its beginning of effect in comparison to conventional tablets [26]

Swallowing and Gastrointestinal Absorption

Any remaining dissolved drug is swallowed by the gastrointestinal system and absorbed. Cetirizine is absorbed quickly; in about 60 minutes, peak plasma concentrations are reached.

The pharmacological action of cetirizine hydrochloride is selective antagonistic against the histamine H1 receptor. By blocking these receptors, the chemical histamine which is responsible

for allergy symptoms including sneezing, watery eyes, runny nose, and itching is kept from doing its job.

Distribution and Effect

The body absorbs cetirizine, which is then distributed throughout it. Its activity on H1 receptors lessens the symptoms associated with allergies by preventing histamine from binding to these receptors and thereby reducing the allergic response.[27]

Figure 2: *Mechanism Action of Cetirizine Hydrochloride*

Method And Materials:

Active Ingredient

Cetirizine hydrochloride.

Excipients

Super disintegrants

Sodium carmellose

They ensure that the tablet disintegrates rapidly in the mouth, allowing the active ingredient, cetirizine hydrochloride, to be released and absorbed via the mucosal lining as soon as possible.

Hydroxypropyl methylcellulose (HPMC)

It is used as a binder. They help maintain the integrity of the pill during handling, but when it comes into contact with saliva, they dissolve fast.

Calcium Carbonate

As a filler or diluent These provide the tablet with a body and enhance its mechanical properties, enabling it to be sized appropriately for oral administration.

A smooth tablet ejection from the press and prevention of adhesion are ensured by the use of lubricants, such as talc and magnesium stearate, during the production process.

Artificial sweeteners and flavourings (sucrose and orange oil) enhance the taste of the pill and make it easier to swallow, which is especially important for younger and older patients.

Method of preparation

The selection of excipients and the optimization of their concentration:

The disintegration time is the most crucial parameter to modify when creating tablets that disintegrate rapidly. During the tablet's production process, a variety of excipients (binders and super disintegrants) were employed until the ideal blend was discovered for producing quickly dissolving tablets. After that, a number of properties, such as friability testing hardness, and

disintegration time, were assessed for these excipients. For more research, the combination that had the shortest disintegration time and the best hardness and friability was chosen. [28]

Formulation Development

Select suitable filler-binders, including croscarmellose sodium and crospovidone, as well as excipients, like lactose, mannitol, and other necessary substances. The choice of excipient is dictated by the tablet's desired characteristics, such as its rapid disintegration and palatability.

Blend preparation

To confirm stability and effectiveness between the medication (cetirizine hydrochloride) and excipients, compatibility studies should be carried out.

Compaction

Press the mixture or the grains directly into tablets using suitable tablet press equipment.

Tablet Evaluation

Examine the manufactured tablets for a variety of attributes, including as weight variation, consistency of drug content, in vitro dissolving rate, thickness, hardness, friability, and disintegration time.

To ensure the safety, effectiveness, and quality of the final product, compliance with relevant regulations and standards is essential during the development and evaluation phases. Moreover, adjusting may be necessary to get the desired results of rapidly dissolving tablets, which include rapid disintegration and effective drug release. [29]

Assessment test for tablet

Weight Variation:

This is a weight variation test for a rapidly disintegrating oral tablet. A weight variation test is necessary to ensure dosage uniformity and consistency for fast-dissolving oral tablets. Every tablet is weighed separately to ensure that the weights of the tablets in a sample batch fall within predefined ranges. This enables the consistent delivery of the required dosage of medication with each pill.Using a digital weighted balance, the average weight of the selected tablets was determined. After that, the weight of each tablet was measured separately, and the findings were compared to an average weight.[30]

Time of Disintegration

Duration of Disintegration One tablet should be placed inside each of the disintegration device's six tubes. Consider employing a phosphate buffer or synthetic saliva substitute as a medium. Keep track of how long it takes for the tablets to completely dissolve.[31]

Thickness

The consistency of thickness is evaluated using Vernier callipers.[32]

Hardness

The crushing strength of the tablets was ascertained using a Monsanto Hardness Tester (Perfit). Three tablets were randomly tested for each batch of formulations, and the average reading was noted. The hardness unit of measurement is kg/cm^{2}.[33]

Friability

A friabilator is used to gauge how resistant a tablet is to abrasion.

After the tablets were weighed, they were placed in a Roche Friabilator (Veego, India) and run at 25 rpm for four minutes. The pills were taken out, cleaned, and then weighed once more.

The friability percentage of the tablets was determined using the following formula. [34]

$$\text{Percentage friability} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Formulation table

Sr. No.	Ingredients	Quantity 10 tablets (mg)	Quantity 1 tablet(mg) F1	F2
1	Calcium carbonate	50	5	5
2	Cetirizine	100	10	5
3	Carboxymethylcellulose sodium	40	4	8
4	Sucrose	6	0.6	0.6
5	Talc	2	0.2	0.3
6	Magnesium stearate	2	0.2	0.2

Table 1: *Formulation table*

Procedure

To make mouth fast dissolving tablets, or MFDTs, the direct compression method was employed. All components were passed through mesh #40, except for the magnesium stearate. The magnesium stearate was passed through mesh # 60. Using a mortar, the mixture was homogenized to a uniform consistency by adding a little amount of each drug and super disintegrant in ascending order of compatibility.[35]

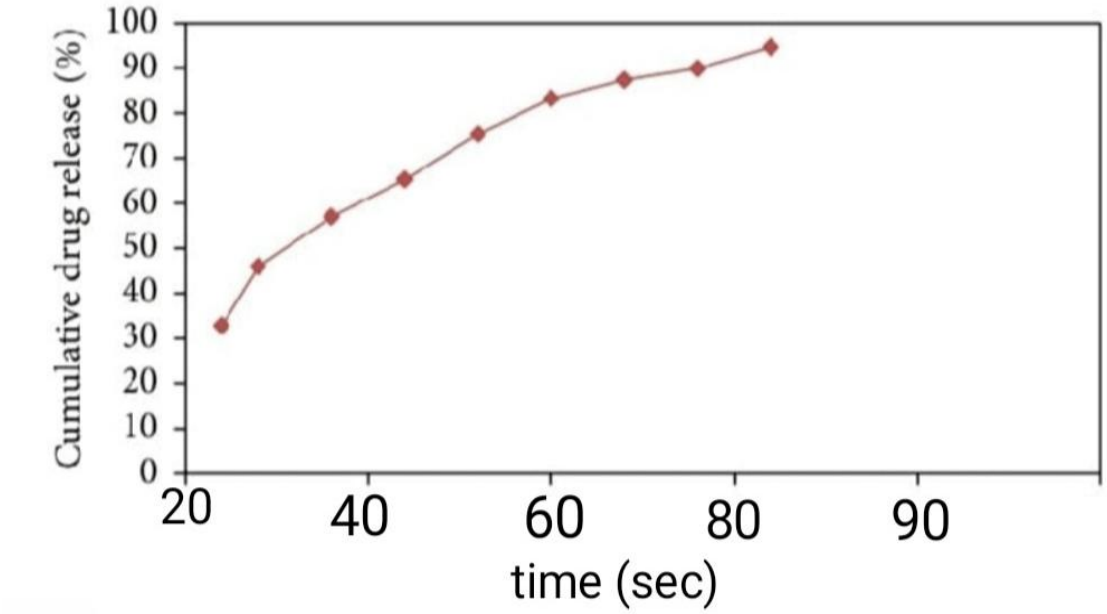
After the remaining elements were weighed and put in a geometric order, a punching machine was used to compress the tablets. A total of ten 200 mg tablets were manufactured in large quantities. Oral tablets containing cetirizine hydrochloride that dissolve rapidly are usually made using methods such as direct compression.[36]

Figure 3: *Formulation of Cetirizine tablet*

Result

Formulation	Hardness ($kg/cm^{2)}$	Friability %	Thickness mm	Weight variation (Mg)	Disintegration time(sec)
F1	1.8 ±0.28	0.2	7.10mm	25	40±1.45
F2	2.0 ± 0.35	0.5	9.50mm	30	60±1.70

Table 2: *Formulation (F1) shows good result for allergic symptoms*



Graph 1: *Dissolution profile of Cetirizine Hydrochloride FDT*

Discussion

The results demonstrate that the formulation of fast dissolving oral tablets of Cetirizine hydrochloride is significantly influenced by the type and concentration of super disintegrants. Crospovidone was found to be the most effective in enhancing the disintegration and dissolution profile of the tablets. The tablets exhibited acceptable pre-compression and post-compression characteristics, ensuring good manufacturability and quality. The rapid disintegration and high drug release rates suggest that the formulated tablets can provide quick relief from allergic symptoms

Conclusion

In order to enhance the start of action and patient compliance in the treatment of allergy symptoms, cetirizine hydrochloride fast-dissolving oral tablets have been evaluated and formulated. Tablets that dissolve swiftly in the oral cavity were effectively manufactured using this study's formulation approaches, which included direct compression and the application of super disintegrants. The

pharmacopeial requirements were met by the optimized formulation, which showed favourable properties such suitable hardness, low friability, and quick disintegration time.

Reference

1. Al-Hazmi HE, Łuczak J, Habibzadeh S, Hasanin M, Mohammadi A, Esmaeili A, Kim SJ, Yazdi MK, Rabiee N, Badawi M, Saeb MR. Polysaccharide nanocomposites in water treatment: A review Chemosphere. 2023, 6:140578.
2. Nayak AK, Manna K. Current developments in orally disintegrating tablet technology. Journal of Pharmaceutical Education and Research. 2011,1;2(1):21.
3. Corveleyn S, Remon JP. Formulation and production of rapidly disintegrating tablets by lyophilisation using hydrochlorothiazide as a model drug. International Journal of Pharmaceutics. 1997, 26;152(2):215-25.
4. Shukla D, Chakraborty S, Singh S, Mishra B. Mouth dissolving tablets I: An overview of formulation technology. Scientia Pharmaceutica. 2009;77(2):309-26.
5. Sreenivas SA, Dandagi PM, Gadad AP, Godbole AM, Hiremath SP, Mastiholimath VS, Bhagawati ST. Orodispersible tablets: New-fangled drug delivery system-A review. Indian Journal of Pharmaceutical Education. 2005,39(4):177.
6. Nayak AK, Manna K. Current developments in orally disintegrating tablet technology. Journal of Pharmaceutical Education and Research. 2011,1;2(1):21.
7. Jadhav SB, Kaudewar DR, Kaminwar GS, Jadhav AB, Kshirsagar RV, Sakarkar DM. Formulation and evaluation of dispersible tablets of diltiazem hydrochloride. International Journal of PharmTech Research. 2011;3(3):1314-21.
8. Chiranjib B, Bhowmik D. Fast dissolving tablet: An overview. Journal pharmaceutical Research 2009;1(1):163-7.
9. Habibh W, Khankarik R, Hontz J. Fast-dissolve drug delivery system. Critical Reviews in Therapeutic Drug Carrier Systems. 2000;17(3):61-72.
10. Sharma D, Singh M, Kumar D, Singh G. Formulation development and evaluation of fast disintegrating tablet of cetirizine hydrochloride: a novel drug delivery for pediatrics and geriatrics. Journal of pharmaceutics. 2014;20(5) :52-70.
11. Patro C, Patro SS, Panda BP, Rao MB. Formulation and evaluation of Cetirizine HCl mouth fast dissolving tablets. Der Pharmacia Lettre. 2011;3(4):63-70.
12. Chiranjib B, Bhowmik D. Fast dissolving tablet: An overview. Journal of Chemicals Pharmacy Research. 2009;1(1):163-7.
13. Simons, F. E. R., & Simons, K. J. Pharmacokinetics and Pharmacodynamics of H1-Receptor Antagonists. The Journal of Allergy and Clinical Immunology.,1994;94(4), 979-981.
14. Pahwa R, Piplani M, Sharma PC, Kaushik D, Nanda S. Orally disintegrating tablets-Friendly to pediatrics and geriatrics. Archives of applied science research. 2010;2(2):35-48.
15. Kulkarni, U., Juvekar, A., & Gandhi, S. Formulation and Evaluation of Fast Dissolving Tablets Containing Cetirizine Hydrochloride. International Journal of Pharmaceutical Sciences and Research, 2011;2(9), 2463-2470.

16. Divate S, Kavitha K, Sockan GN. Fast disintegrating tablets—an emerging trend. International Journal of Pharmaceutical Sciences Review and Research. 2011 Jan;6(2):18-22.
17. Mishra, B., & Panigrahi, D. Orally Disintegrating Tablets: A Review. Tropical Journal of Pharmaceutical Research, 2012;11(2), 153-160.
18. Sharma, D., Kumar, D., Singh, M., Singh, G., Rathore, M. S., & Saraf, S. Fast disintegrating tablets: A new era in novel drug delivery system and new market opportunities. Journal of Drug Delivery and Therapeutics, 2010;2(3), 58-63.
19. Deshpande, A. V., & Upadhye, K. P. Formulation and Evaluation of Orally Disintegrating Tablets (ODTs) of Cetirizine Hydrochloride Using Direct Compression Method. International Journal of Pharmaceutical and Biological Science Archive, 2014;2(2), 1-9.
20. Baniya, D.P., Pandey, G., Bajaracharya, M. and Dhungana, B.R. Formulation and Evaluation of Fast Dissolving Oral Films of Cetirizine Hydrochloride.Europasian Journal of Medical Sciences,2020,2(1), .23-29.
21. Linku, A. and Sijimol. J Formulation and evaluation of fast dissolving oral film of anti-allergic drugs. Asian Journal of Pharmaceutical Research and Development, 6(3), 2018 .5-16.
22. Mishra, R. and Amin, A., Optimization and characterization of rapidly dissolving films of cetirizine hydrochloride using cyclodextrins for taste masking. International Journal of Pharma Technology Research, 2013,5, .536-552.
23. Chonkar, A.D., Bhagawati, S.T. and Udupa, N., An overview on fast dissolving oral films. Asian Journal of Pharmacy and Technology,2015, 5(3),129-137.
24. Patel, D.M., Patel, D.J. and Darji, P.J. Formulation and Evaluation of Fast-Dissolving Film of Cetirizine and Dextromethorphan. International journal of Pharmaceutical Science & Nanotechnology, 9(3), 2016, 3305-3311.
25. Mishra, R. and Amin, A. Optimization and characterization of rapidly dissolving films of cetirizine hydrochloride using cyclodextrins for taste masking. International Journal of Pharmaceutical Technology Research, 2013,5, .536-552.
26. Pasupulati, H. and Rudra, S., Formulation, Characterization and In-Vitro Evaluation of Fast Dissolving Oral Films of Cetirizine HCL. Journal of Drug Delivery and Therapeutics, 2019,9(4-A), 122-125.
27. Harini, C., Sowjanya, C.H. and Kumar, K.S., Formulation and evaluation of mouth dissolving film containing cetirizine hydrochloride. International Journal of Advance Research and Medicine Pharmaceutical Science 2016,1(1).20-5.
28. Gondkar, S.B., Namrata, P. and Saudagar, R.B., Fast dissolving oral films. Asian Journal of Pharmaceutical Research, 2016,6(1), .56-58.
29. Thakur, N., Bansal, M., Sharma, N., Yadav, G. and Khare, P Overview “a novel approach of fast dissolving films and their patients”. Advances in biological research, 2013,7(2).50-58.
30. Bi YX, Sunada H, Yonezawa Y, Danjo K. Evaluation of rapidly disintegrating tablets prepared by a direct compression method. Drug development and industrial pharmacy. 1999 1;25(5):571-81.
31. Parrott EL. Pharmaceutical dosage forms. Tablets. Marcel Dekker, Inc., New York and Basel. 1990; 2:202-5.

32. Sonawane SD, Bais SK, Waghmare PR. Novel herbal drug delivery system: a review. International journal of Pharmacy and Herbal Technology, 2023;1(3):168-179.
33. Dhanave SS, Mane NR, Shitole PD, Pore AV, Bais SK. Current scenario of pharmaceutical and herbal medicines. International journal of Pharmacy and Herbal Technology,2024;2:1650-1656.
34. Nagansurkar SB, Bais SK, Khilare SK. Review on polymers used in oral dissolving film. International journal of Pharmacy and Herbal Technology,2024;2(1):1386-1400.
35. Pore AV, Bais SK, Kamble MM. Pharmacovigilance in clinical research. International journal of Pharmacy and Herbal Technology,2024;2(1):759-775.
36. Pathak MC, Mhamane MS, Magade PD, Nagansurkar SB, Bais SK. Contemporary trends in pharmaceuticals, herbal remedies, and prospects ahead. International journal of Pharmacy and Herbal Technology,2024;2(2):1570-1576.