WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Herbal Drugs Used in Treatment of Asthma

Sagar Patki, Laxmi Korde, Faizan shaikh

Valmik Naik College of Pharmacy Telwadi Kannad

ABSTRACT:

Asthma, a prevalent chronic respiratory condition, is characterized by airway constriction and inflammation triggered by allergens, cold air, stress, and other factors. Affecting millions globally, the condition necessitates careful management to prevent exacerbations. Conventional pharmacological treatments, such as bronchodilators and anti-inflammatory agents, provide symptomatic relief but come with adverse effects. In recent years, there has been a growing interest in alternative therapies, particularly herbal remedies, which offer a natural and holistic approach to asthma management. This review examines various herbal plants like thyme, licorice, turmeric, and eucalyptus, known for their anti-inflammatory and bronchodilatory properties, and their incorporation into dry powder inhalers (DPI). DPIs have emerged as an efficient drug delivery system, offering enhanced therapeutic efficacy, stability, and patient compliance compared to traditional metered-dose inhalers (MDI). The study explores the formulation processes, advantages, and evaluation of herbal dry powder inhalers, highlighting their potential in providing a safer and more effective alternative for asthma management.

INTRODUCTION:

Asthma is a respiratory condition that causes airways to constrict and narrow in reaction to a "trigger" like allergens, cold air, or exertion or emotional stress.[1] About 300 milliopeople globally [2] and 7% of the global population (ages 2-3) suffer from asthma.[3] The smooth muscle cells in the bronchi constrict, the airways become inflamed, and attacks (exacerbations) occur. enlarged. It gets tough to breathe. Four thousand people suffer from asthma. deaths in the United States each year. Attacks can be avoided by staying away from triggers as well as through pharmacological therapy.[4] When someone has asthma, their bronchial and bronchiolar walls exhibit histopathological alterations that affect the mucosa (including the lamina propria and epithelium), sub mucosa, including the smooth muscle of the airways (ASM) and glands that secrete mucus], and Ventitia, or the junction of the airway and the surface the lung parenchyma is rounded). [27] Data regarding the pathological alterations associated with asthma have been gathered by examining airway segments from asthma fatalities; those with asthma but who passed away from causes unrelated to asthma; surface lung surgically removed, as well as endoscopic biopsies of asthmatic subtypes, mild, moderate, and severe Transbronchial biopsies of semen samples. Also investigated for inflammation is vereasthmatics. Information and renovation Asthma is increasingly recognized as a chronic condition. inflammation, as well as proof of in Lamemtation is seen in mild, moderate, and serious illness. But the relative mag severity, kind of inflammatory cells, and location of The type of inflammatory infiltration varies between patients. Numerous cells participate in the im Sensitivity and inflammation to allergens They include eosinophils, T lymphocytes, and neutrophils and mast cells. The function of T lymphocyte Activation. [28] Dry powder inhalers (DPI) are a more effective method of delivering drugs to the lungs since they don't require propellant and have a high patient compliance rate, high dose carrying capacity, and medication stability. According to reports, quick development has transpired recently as a result of the realization of the complete potential of the lungs for treating asthma locally and comprehensively.[29]

HISTORICAL BACKGROUND:

It is difficult to envisage asthma in the past due to the strength of the current school of thought surrounding the illness. when conceived. In the seventeenth century, Once Thomas Willis and Sir John Floyer, two English doctors, started claiming that asthma was distinct from other respiratory illnesses and varies from individual to individual. Those noted that one particular type of disorganized breathing, which needs to be handled differently from other types of situations of dyspnea. By the end of the 1800s, doctors thought that asthma was a condition with a particular combination of causes, clinical outcomes, and treatment needs, Despite the wide range of personal experiences. [5] Some persons with asthma very seldom feel symptoms, usually in response to triggers, according to the severity spectrum of the condition, whilst other more severe cases may have a noticeable restriction to airflow at all times. There are two states of asthma: the stable, chronic asthma, as well as the acute phase of an exacerbation of asthma. The symptoms vary according to the state in which the The patient is present. Typical steady-state asthma symptoms include coughing at night and dyspnea during physical activity. however, there is persistent "throat-clearing" type cough, no dyspnea at rest, as well as complains of chest tightness. Severity frequently corresponds to a rise in symptom intensity. Signs and symptoms can get worse over time and in a sneaky way, to the point where a severe escalation. [6] Asthma attacks are widely used to describe sudden, severe flare-ups of the disease. Typical signs of an attack include chest tightness,

wheezing, and dyspnea-like shortness of breath [7] In the latter stages of an attack, air motion may be so compromised that wheezing is not audible in certain patients, who mostly appear with coughing. [8] When coughing, clear sputum may occasionally be produced. The sensation of constriction in the chest may be abrupt. Breathing becomes challenging, and wheezing mostly when exhaling, however it's possible in either respiratory phase). Asthma is categorized based on how frequently symptoms occur. Peak expiratory flow rate and FEV1 [9] Even while an acute exacerbation can cause extremely severe symptoms, a patient may exhibit little to no illness symptoms in between episodes. [10]

RISK FACTORS OF ASTHMA:

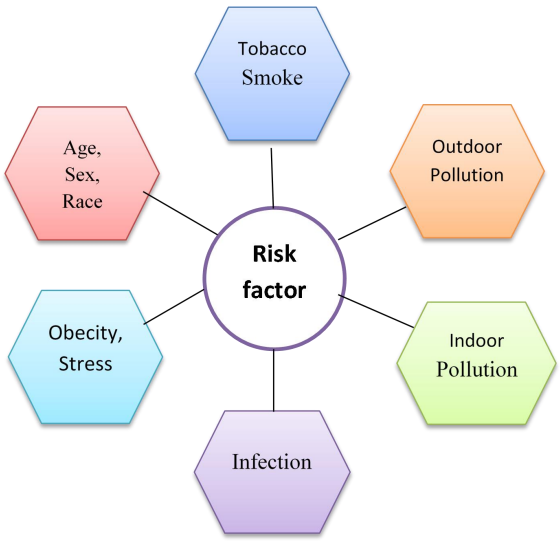


Figure 1. Risk factors of asthma

PATHOPHYSIOLOGY OF ASTHMA:

The pathogenic feature of bronchial asthma is eosinophil infiltration of the airway submucosa. Eosinophil activation causes a variety of secretions to occur. cytotoxic cationic proteins that are strongly charged, like primary basic protein, and is thought to have a essential part in the genesis of this illness by causing harm to the epithelium of the airways.[11] The pathophysiological basis of asthma entails the emergence of both acute and persistent inflammation in airway constriction through heightened vascular permeability, swelling, and smooth muscle of the airways contraction. [12] The overall pathology of asthmatic airways includes thickening of the lamina reticularis, mucosal edema, lung hyperinflation, and smooth muscle hypertrophy. disruption of cilia cells, sloughing of epithelial cells, and excessive mucous gland secretion. [13] It has been noted that a significant rise in the thickness of the lung tissue in persons who have passed away from asthma the wall of the airway in the bronchial tree, due in part to the enlargement of smooth muscles. [14]

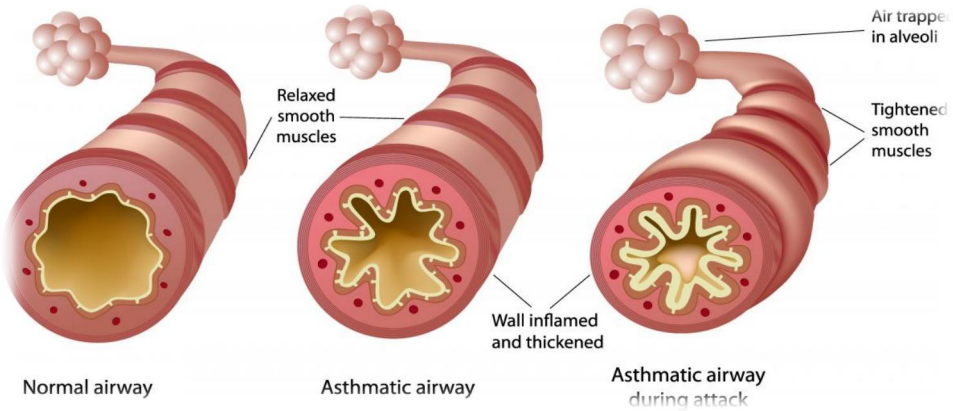


Figure 2. Pathophysiology of asthma

TREATMENT:

The following class of medications is available for usage either singly or in combination to treat asthma. :-[15]

1.Bronchodilators :

- Beta 2 Adrenergic agonists
- Muscarnic antagonists
- Methyl xanthines

2. Anti inflammatory agents :

- Glucocorticoids
- Mast cell degranulation blockers (Mast cell stabilizers)

3. Newer drugs:

- Leukotriene antagonists
- Anti Ig E antibodies
- Allergy vaccination

Herbal Drugs used for Asthma:

Despite the fact that there are several medications available to treat asthma, the comfort they provide depends primarily both symptomatic and transient. Furthermore, these medications have some really unsettling adverse effects. Recently, the global tendency has changed. natural to synthetic medications, which we can Say, "Go Back to Nature." Historically, medicinal plants have been well-known and respected for millennia all globally as an abundant source of medicinal substances that help prevent illnesses and diseases. [16] Historically, a wide variety of medicinal plants have been used to treat asthma and have been demonstrated by science to have qualities that prevent asthma.

LIST OF COMMON HERBAL PLANTS:

Herbal plants	**Family**	**Chemical constituents**	**Synonyms**	**Parts used**
Thyme	Laminaceae	Thymol, Carvocrol	Thymus vulgaris	Leaves
Licorice root	Fabaceae	Glycurrhizin, Flavonoids	Glycyrrhiza glabra	Root
Turmeric	Zingiberaceae	Curcumin, Curcuminoids	Curcuma longa	Rhizome
Eucalyptus	Myrtaceae	Eucalyptol (1,8-cineole)	Eucalytus globulus	Leaves
Ginger	Zingiberaceae	Gingerol, Shogoaol	Zingiber officinate	Rhizome
Peppermint	Laminaceae	Menthol, Menthone	Mentha piperita	Leaves
Mullein	Scrophulariaceae	Saponins,	Verbascum thapsus	Leaves, flowers
Boswellia	Bureseraceae	Boswellic acid	Boswellia serrata	Resin
Allium cepa	Liliaceae	Quercetin, Allicin	Onion	Bulb

Table 1 (List of common herbal plants)

FORMULATION OF HEBAL DRY POWDER INHALERS:

DRY POWDERS:

figure 3. Herbal dry powders

Drug-assisted inhalation therapy is most commonly used to treat obstructive airway illnesses, such as asthma and chronic obstructive pulmonary disease. such as corticosteroids, anti-cholinergic drugs, and agonists with varying durations of action. Historically, these Pressurized metered-dose delivery has been used to distribute agents. inhaler (MDI). However, the use of dry powder inhalers, or DPIs, has increased recently, especially in the United States, in part due to the debut of the first long-acting agonist combination (salmeterol) and fluticasone propionate, a corticosteroid, in an easy-to-use multi-dose DPI (Advair Diskus, GlaxoSmithKline, In North Carolina's Research Triangle Park. [17] A crucial aspect of both MDI and DPI inhalation dosage forms is the requirement to produce the ideal "respirable dose" (particles ~ 5.0 m) of a medicinal substance that will reach the action site, which is the lung. This is an essential component of rational design and selection for a delivery system in the lungs. In the past, MDIs have obtained a 5-to 15% lung deposition of the administered dosage. Although the efficacy of current DPIs is comparable to that of MDIs, they have certain advantages over MDIs, such as are inspired by breath, necessitating less coordination. compared to an ordinary press-and-breathe MDI. Additionally, They don't include propellants made of chlorofluorocarbons, which have been connected to the ozone hole in the atmosphere. [18]

DRY POWDER INHALERS:

Figure 4. Dry powder inhalers

Dry powder inhalers are pulmonary drug delivery devices that administer an active medication in the form of dry powder for site goal and overall impact through the pulmonary the advantages of pulmonary medication administration methods were documented a long time ago. contrasting oral and pulmonary route, parenteral routes exhibit a greater local impact inside the lungs.[19] These days, the pulmonary drug delivery system is becoming more and more popular since it has a number of benefits over other drug delivery systems, including due to the increased blood density, drugs are absorbed quickly. lungs' broad surface area and their many arteries. the respiratory system possess little enzymatic activity, meaning that this path has the lowest possibility of enzymatic breakdown. The pulmonary pathway has acknowledged for both the recurring and localized impacts of the [20] Dry powder inhalers (DPIs) for the administration of pulmonary drugs is more efficacious since it doesn't require propellant, high dosage bearing capacity, medication compliance, and stability. Rapid development has reportedly led to occurred in the past few years as a result of the realization of the full potential of the lungs for methodical, localized therapy of [21] The physiochemical features of dry powders include their size and form, charge, hygroscopicity, and moisture content. These characteristics directly impact the process of aerosolization, treatment discharge gadgets, and aerosolized materials' bioavailability [22] The most popular method for achieving the appropriate physicochemical characteristics of dry powder is mechanical milling; alternative Spray drying and freezing are reported as promising procedures. Lyophilization and drying, as well as the supercritical fluid-carbon dioxide drying method.Novel advances in recent times have been recorded, showing more efficiency compared to traditional dry powder. a dry powder Inhalers work better than other systems because they contain solid medication dissolved or suspended in a non-volatile propellant that lead to the drug's direct distribution into the deep lung [23]

ADVANTAGES OF DPI :

1)Higher therapeutic efficicacy

2) Propellent free

3) Avoid first pass metabolism

4) Rapid onset of action

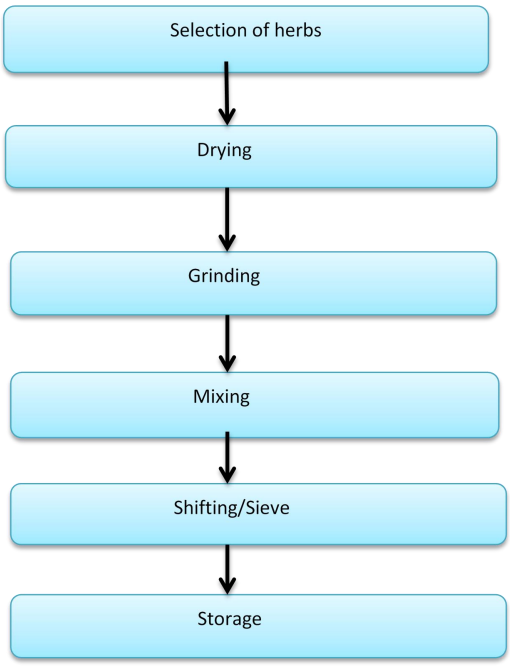
5) Less drugs

6) Formulation stability

7) Site target

8) Rapid absorption

METHOD OF PREPARATION:



EVALUATION PARAMETERS:

1. APPARANCE AND COLOUR:

As a sign of the integrity of the drug product, the appearance of the contents inside the container as well as the appearance of the closure system (the valve and its parts, as well as the inside of the container) should match the descriptions provided. If color is present in the formulation—either from the start or as a result of shelf life degradative processes—a quantitative test with pertinent acceptance criteria needs to be developed for the medication. [24]

2. PARTICLE SIZE ANLYSIS:

Numerous techniques have been devised for quantifying particle size. The utilization of the light scattering decay method and the cascade impactor has increased. The cascade impactor works on the following principle: a stream of particles is projected at high velocity via a succession of nozzles and glass slides; the bigger particles are impacted at lower velocity stages, while the smaller particles pass through and are collected at higher velocity stages. Most inhalation products have an ideal aerodynamic particle diameter that is generally acknowledged to be between one and five microns. Particle size measurement of lactose used in inhalation products is done using sieve analysis and laser diffraction. The fastest-growing method, laser diffraction, provides nearly a complete profile, whereas sieve analysis only provides. [24]

a) Seive analysis:

Air-jet sieving or a nest of regular sieves shaken on a sieve shaker are two methods of sieving. The particle size distribution can be computed by weighing the material that is passed through each sieve. Using reference materials, sieves can be calibrated to determine the particle size distribution. For both granulated and coarse powder, sieves are an effective tool. The gaps in the sieves can frequently be sealed by fine powders. Air-jet sieving, therefore, performs better for finer lactose grades; yet, it has the drawback of only being able to run one sieve screen at a time. [25]

b) Lesser diffraction:

According to the United States Pharmacopeia (USP) General Chapter <429> (4), measuring “a representative sample, dispersed at an adequate concentration in a suitable liquid or gas” is a requirement for laser diffraction. A laser beam is passed through the powder in order to quantify it. Detectors record the scatter pattern created by the laser beam's light diffracting in various directions. Particle size and size distribution have a significant impact on the scatter pattern. There are theories that establish a quantifiable relationship between the particle size distribution and the scattering pattern.[25]

3. MOISTURE CONTENT:

For measuring the minute amounts of water in inhalation powder, which have a significant impact on capillary condensation, solid-state phase behavior, solid-state properties, and solid-state stability of pharmaceutical particles in the solid-state, the Karl Fisher method has gained more acceptance.[26]

4. FLOW PROPERTIES OF POWDERS:

The following tests are part of the Carr's approach, which was used to measure the flow qualities of a DPI:

a) Repose angle

b) The ability to compress

c) Coefficient of uniformity

d) Ratio of Hausner (HR)[26]

5. PACKING PROPERTIES OF DRY POWDER INHALERS:

Using Kawakita's equation to indicate porosity, the tapping method was utilized to measure the packing parameters of the powder employed in DPI.[26]

6. IMPURITIES AND DEGRADATION OF PRODUCTS:

The amounts of contaminants and degradation products should be ascertained using stability indicating techniques. Both individual and total degradation products and contaminants should have acceptance criteria established. See the relevant guidance for identification and qualification thresholds.It should be stated if any specific contaminants or degradation products are present at concentrations of 0.10 percent or higher. Identified or undiscovered degradation products and contaminants that are separately listed and restricted in the drug product specification are known as specified impurities and degradation products.[25]

CONCLUSION:

The increasing prevalence of asthma necessitates the exploration of safer and more effective treatment options. While conventional medications provide relief, they often lead to undesirable side effects and do not address the long-term management of the disease. The integration of herbal remedies, with their proven anti-inflammatory and bronchodilatory effects, into modern drug delivery systems like dry powder inhalers, offers a promising alternative.

These inhalers not only improve drug delivery efficiency but also avoid the harmful propellants found in traditional inhalers. By harnessing the natural properties of medicinal plants, herbal DPIs present a potential path forward in asthma management, combining the benefits of traditional medicine with modern pharmaceutical technologies. Further research is needed to fully explore their therapeutic potential and ensure their widespread adoption in clinical practice**.**

REFERENCES:

1. *Asthma news* (no date) *ScienceDaily*. Available at: https://www.sciencedaily.com/news/health_medicine/asthma/ (Accessed: 27 September 2024).
2. *Merck: Home* (2024) *Merck.com*. Available at: https://www.merck.com/ (Accessed: 27 September 2024).
3. Fanta, C.H. (2009) 'Asthma', *New England Journal of Medicine*, 360(10), pp. 1002–1014. doi:10.1056/nejmra0804579.
4. *Asthma* (2024) *Wikipedia*. Available at: https://en.wikipedia.org/wiki/Asthma (Accessed: 27 September 2024).
5. Kapri, A. *et al.* (2022) *Asthma history, current situation, an overview of its control history, challenges, and Ongoing Management Programs: An updated review*, *Proceedings of the National Academy of Sciences, India. Section B*. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9651109/ (Accessed: 27 September 2024).
6. *Asthma* (2024a) *Wikipedia*. Available at: https://en.wikipedia.org/wiki/Asthma (Accessed: 27 September 2024).
7. Reilly, J. (2001) 'Textbook of respiratory medicine, 3rd edition: By John F. Murray, Jay A. Nadel, Robert Mason, and Homer Boushey, eds., W.B. Saunders, co., 2000', *Journal of Intensive Care Medicine*, 16(4), pp. 207–208. doi:10.1177/088506660101600411.
8. Kinsella, R.A. (1955) '*principles of Internal Medicine* . T. R. Harrison *et al.* , eds. Blakiston, New York-Toronto, ed. 2, 1954. XXIII + 1703 pp. + index. illus. + plates. student 1-vol. ed., $16; professional, 2-Vol. Ed. boxed, $21. (,order from McGraw-Hill, New York).', *Science*, 122(3157), pp. 37–37. doi:10.1126/science.122.3157.37.a.
9. Yawn, B.P. (2008) 'Factors accounting for asthma variability: Achieving optimal symptom control for individual patients', *Primary Care Respiratory Journal*, 17(3), pp. 138–147. doi:10.3132/pcrj.2008.00004.
10. Martinez, F.D. (2006b) 'Genes, environments, development and asthma: A reappraisal', *European Respiratory Journal*, 29(1), pp. 179–184. doi:10.1183/09031936.00087906.
11. Brightling, C.E. *et al.* (2002b) 'Mast-cell infiltration of airway smooth muscle in asthma', *New England Journal of Medicine*, 346(22), pp. 1699–1705. doi:10.1056/nejmoa012705.
12. King, G.G., Paré, P.D. and Seow, C.Y. (1999a) 'The mechanics of exaggerated airway narrowing in asthma: The role of Smooth Muscle', *Respiration Physiology*, 118(1), pp. 1–13. doi:10.1016/s0034-5687(99)00076-6.
13. Salvi, S.S. *et al.* (2001b) 'The anti-inflammatory effects of leukotriene-modifying drugs and their use in asthma', *Chest*, 119(5), pp. 1533–1546. doi:10.1378/chest.119.5.1533.
14. WARDLAW, A.J. *et al.* (2002) 'New insights into the relationship between airway inflammation and asthma', *Clinical Science*, 103(2), pp. 201–211. doi:10.1042/cs1030201.
15. Sharma, V. and Rajani, G. (2011) 'Evaluation of caesalpinia pulcherrima Linn. for anti-inflammatory and Antiulcer Activities', *Indian Journal of Pharmacology*, 43(2), p. 168. doi:10.4103/0253-7613.77354.
16. Awasthi, R., Sharma, B. and Kulkarni, G.T. (2019) 'Plant derived polysaccharides as pharmaceutical excipients: An overview', *Herbal Medicine in India*, pp. 191–204. doi:10.1007/978-981-13-7248-3_13.
17. *Treatment with Advair Diskus (fluticasone propionate and salmeterol inhalation powder) or advair HFA (fluticasone propionate and Salmeterol inhalation aerosol)* (no date) *ADVAIR homepage | ADVAIR (fluticasone propionate and salmeterol)*. Available at: https://www.advair.com/ (Accessed: 28 September 2024).
18. Molina, M.J. and Rowland, F.S. (1974) 'Stratospheric sink for chlorofluoromethanes: Chlorine atom-catalysed destruction of ozone', *Nature*, 249(5460), pp. 810–812. doi:10.1038/249810a0.
19. Chrystyn, H. (2007) *The Diskus: A review of its position among dry powder inhaler devices*, *International journal of clinical practice*. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1974824/ (Accessed: 01 October 2024).
20. Chaurasiya, B. and Zhao, Y.-Y. (2020b) *Dry Powder for Pulmonary Delivery: A Comprehensive Review*, *MDPI*. Available at: https://www.mdpi.com/1999-4923/13/1/31 (Accessed: 01 October 2024).
21. Bentham Science Publisher, B.S. (2016) 'Patent selections':, *Recent Patents on Drug Delivery & Formulation*, 10(1), pp. 77–80. doi:10.2174/1872211310011603030150218.

22. Chaurasiya, B. and Zhao, Y.-Y. (2020a) *Dry Powder for Pulmonary Delivery: A Comprehensive Review*, *MDPI*. Available at: https://www.mdpi.com/1999-4923/13/1/31 (Accessed: 01 October 2024).

23. Prakash, G. (2022) 'T', *International Journal of Research in Pharmaceutical Sciences*, 13(2). doi:10.26452/ijrps.v13i2.139.

24. V, K. *et al.* (2015) 'Integration of National AIDS Control Program and Pharmacovigilance Program of india-antiretroviral drugs safety coactions in India', *International Journal of HIV/AIDS and Research*, pp. 37–38. doi:10.19070/2379-1586-150008.

25. Hossain, D.D. (2019) 'Comparative analysis of metered dose inhaler (MDI) and dry powder inhaler (DPI) at rural Bangladesh perspective', *Journal of Medical Science And clinical Research*, 7(9). doi:10.18535/jmscr/v7i9.22.

26. (No date) *⟨429⟩ light diffraction measurement of particle size* [Preprint]. doi:10.31003/uspnf_m99188_01_01.

27. HUBER, H.L. (1922a) 'The pathology of Bronchial Asthma', *Archives of Internal Medicine*, 30(6), p. 689. doi:10.1001/archinte.1922.00110120002001.

28. Larché, M., Robinson, D.S. and Kay, A.B. (2003a) 'The role of T lymphocytes in the pathogenesis of asthma', *Journal of Allergy and Clinical Immunology*, 111(3), pp. 450–463. doi:10.1067/mai.2003.169.

29. Bentham Science Publisher, B.S. (2016) 'Patent selections':, *Recent Patents on Drug Delivery & Formulation*, 10(3), pp. 253–254. doi:10.2174/1872211310031612072120 26.