
ALOE SUCCOTRINA.

BY
JOHN URI LLOYD,
CINCINNATI, **○.**

REPRINTED FROM
The Western Druggist,
CHICAGO, August, 1898.

CONCLUSION OF LLOYD'S DRUG STUDIES.

The monograph on aloes by J. U. Lloyd appearing in the present number no doubt will be read with unusual interest, as it is one of the most important and valuable in the entire series. Its publication was deferred at the request of the author who found the subject extremely tangled and perplexing, especially in its early history, and he desired time to clear as far as possible all doubtful points, and we are sure that the picture now presented is as true and faithful as it is possible to present.

The present monograph brings to a successful close a brilliant series of fifteen studies of standard drugs, and our readers will regret this fact no less than the editor and the publishers.

The Western Druggist conceived the plan, selected the subjects, and submitted tracings of the illustrations taken from Koehler's Medicinal pflanzen to the author of the papers with the request that if possible he undertake the work personally, to which request he acquiesced, the aim being to present comprehensive useful scientific studies of the drugs under consideration. Great care was exercised as far as possible to exclude all but first-hand authorities. Many valuable scientific data have been brought before our readers; also many new and interesting historical features in connection with these important standard drugs, and facts concerning their early records that have slumbered in ancient books of travel, rare botanical works or in histories inaccessible to most pharmacists. And in no other place, perhaps could this work have been done than in the great Lloyd Library, and we know of no other man who could have performed it so well as Mr. John

Lloyd, to whom in this place we desire to express our thanks for the faithful manner in which he has acquitted himself of his arduous task.

That our effort in bringing these contributions before the profession is appreciated is evidenced by the fact that permission to translate and republish them in Germany has been asked and granted, and also from the fact that the author has been greatly encouraged by many communications from well-known authorities who appreciate the research as well as the scientific and historical value of the contributions. We do not know of a similar amount of work having been put on any line of similar magazine contributions in America, and it is no vain assumption to predict that future writers of works on materia medica will find it necessary to refer to this work of Mr. Lloyd when compiling the historical portions of the respective drugs.

[Editorial in the **WESTERN DRUGGIST** for August, 1898.]

ALOE SUCCOTRINA.

BY JOHN URI LLOYD.*

BOTANICAL DESCRIPTION AND HISTORY.

The genus aloe comprises a large family of succulent-leaved plants native of tropical countries. Most of the species have showy flowers and many are cultivated in hot-houses. Aloe succotrina "grows in the Indies, and especially in the island of Soccotera" (Lam.,)¹⁰, but has long been cultivated in England. It is a shrub five or six feet high, with a stem marked with the scars of the fallen leaves. The stem is at first simple, but when the plant is old the stem is usually divided. At the top of each branch is borne a large cluster of thick, crowded, fleshy leaves. Each leaf is one and one-half to two feet long, rounded beneath, flattened on the upper side, the margins being each a row of white spines. The flowers are in a large terminal spike-like raceme, proceeding from the center of the leaf cluster. The flowers are orange-red, nodding, cylindrical, each borne on a short peduncle

*The accompanying essay on aloes closes the series of fifteen papers on medicinal plants contributed to the Western Druggist. The work has been to me both instructive and enticing, although, appreciating the amount omitted from each paper, by reason of necessary discriminative excisions, I cannot but feel dissatisfied. Very interesting side issues connected with the history and introduction of each drug was, necessarily, also passed in silence. Hundreds of literary treasures outside those recorded in the subject matter were unearthed in the bibliographical study and these likewise, much to my regret, could not be utilized. By restricting the book references with the utmost severity the list was brought within reasonable limits; had this not been done, they would have dominated each issue of the journal. That injustice has been shown many valuable works by omitting their titles from among the references, I do not deny, and in extenuation can only say that credit may be given not only the works cited, but all others in the Lloyd Library connected with the subjects studied.

In closing I take pleasure in extending my thanks to Mr. C. G. Lloyd, who wrote the botanical notes; to Dr. Sigmond Waldbott, librarian of the Lloyd Library, for invaluable assistance; and to Mr. A. W. Whelpley, librarian of the Public Library of Cincinnati, for many courtesies. And, lastly, I desire to thank Mr. Engelhard and Mr. Vogeler of the Western Druggist for their patience and care concerning proof and revisions of same, and it is also due them that I should take on myself all blame for the blemishes that may stand.-J. U. L.

slightly exerted. The pistil has a three-celled, many-seeded ovary and a long simple style.

The earliest history of the aloe plant. is somewhat obscured by the fact that the name aloe, for example as it occurs in the Bible, relates to a substance entirely different from the inspissated juice of the various species of the modern aloe plant. The aloe of the Bible is the wood of *aquilaria agallocha* (Roxburgh) or *lignaloës*, which was used among the ancient nations as an incense and was held in high esteem on account of its scarcity.⁸ With modern cathartic aloes it has nothing in common except the bitterness.

The aloe plant is considered by modern writers to have grown wild in India from a very remote period.²⁶ It was most likely introduced into that country by the Arabs who probably were the first distributors of knowledge concerning the medicinal virtues of aloes. This drug was employed by Galen, and later described by the Greek and Roman writers of the first century, chief among whom are Dioscorides and Pliny, whose descriptions of aloes and its uses, however, bear much resemblance to each other.

Socotrine aloes appears to have acquired its reputation at an early date. Clusius² in 1593 reports that Mesue, the Arabian pharmaceutical writer, "the father of pharmacopeias," (who died about A. D. 1028) knew of the Socotrine origin of aloes, mentioning Persia, Armenia and Arabia likewise as sources of aloes of commerce. Ibn Baitar (1197-1248) speaks of aloes from the island of Socotrine as being superior to that of the Arabian district of Yemen.²⁴

The name aloe socotrina was undoubtedly derived from the island of Socotra off the entrance to the Red sea. Yet, some authors maintain⁵ that this appellation was by some given to the inspissated juice of aloe (*succus citrinus*) on account of the lemon-yellow color of its powder in the axis of a pinkish bract. The stamens are six,

(pulvis citrinus.)* Not all of the earlier medico-pharmaceutical writers who afterwards considered the drug refer to Socotrine or any other special kind of aloes, Hieronymus Bock (1556) merely alludes to the drug being brought from India and Arabia,¹ a statement already found in Dioscorides. He relates an instance where the aloe plant is cultivated in Germany under the name **sempervivum** as an indoor ornamental plant.

Samuel Purchas (1625), however, in his important collection of travels² gives prominence to Socotrine aloes and places on record the commercial transactions of British merchants with the king of Socotra. One of his contributors (William Finch, merchant) gives the following interesting information which he gathered about A. D. 1607 concerning the occurrence and preparation of aloes in the island of Socotra:

“I could learne of no merchandise the iland yeeldeth, but Aloes, Sanguis Draconis and Dates and, as they say on the shore of Aba del Curia, Blacke Ambergreese. Of Aloes I suppose they could make yearly more then Christendome can spend, the herbe growing in great abundance, being no other then **semper vicum**, in all things agreeing to that description of Dioscorides in seed, stalke, etc. It is yet all of a red pricklie sort, and much chamfered[†] in the leaves, so full of a rosin-iuyce that it is ready to breake with it. The chiefe time to make it, is when the winds blowe northerly, that is, about September, and that after the fall of some raine, which being then gathered, they cut in small pieces, and cast into a pit made in the ground, well cleansed from filth and paved; there it lieth to ferment in the heat of the sunne, whereby it floweth forth. Thence they take and put it in skinnes, which they hang up in the wind to dry, where it becommeth hard. They sold us for 20 Rials a Quintall which is 103 pounds English, but we were after told that

*Usage accepts that *Aloe Succotrina* is the plant described by Lamarck (10) and that *Aloe Socotrina* is the commercial extract derived from certain species of aloes. Exceptions in the spelling of the latter word have occurred in older pharmacopeias. (See Pharmacopeia, Record below.)

[†]Grooved.

they sold to others for 12, which considering the abundance and ease making, may be credible." Elsewhere the statement is made that "the Aloe of Socotra exceedeth in goodness that which is gathered in Hadhramut of the land of Jaman, Arabia, or anywhere else." 1800 lbs. of Socotrine aloes were bought at one time and 2722 lbs. at another.

The ancient trade of the island has never increased, and in 1833, we are informed, only two tons were exported, while at present the manufacture and export seem to have ceased altogether. No doubt this results from unfavorable local conditions as well as the intrusive competition of other countries. In the sixteenth century or perhaps before,²⁴ the aloe plant was introduced into the West Indies and was especially dwelt on by Ligon⁹ (1673) as having occurred in Barbadoes as early as 1647-1650, which is only about twenty years after the English came into possession of this island.' It soon became an article of export, appearing in the London market in 1693,²⁴ In this connection, however, it is strange that J. B. Labat, a French monk and careful student of nature, having visited the island of Barbados in 1700, fails to mention Barbados aloes among the staples.' He says on this point: "Formerly much tobacco was planted, and subsequently ginger and indigo; cotton is now grown up in some parts of the island, but sugar is at present the only article to which attention is devoted." That his omission could not be from ignorance is shown by his careful reference to aloes when twenty-eight years afterwards (1728) he refreshingly describes the resources and the people of Senegambia on the west coast of Africa,⁸ and strongly advocates the use of aloes that may be made from aloe plants growing in abundance in that district, in the place of aloes from the island of Socotra which, in his opinion, possessed an imaginary superiority only "because it comes from afar and costs much." The three commercial forms of the drug then known, Socotrine, hepatic and caballine aloes, Labat ascribes to one and the same origin, the differences

resulting only from the mode of preparation, caballine “or horse aloes, the lowest grade, being made from refuse material.

Yet, Barbados aloes is not herein referred to. Whether this neglect is due to interruption of cultivation or to some other cause difficult to determine may never be settled. It is established, however, that Barbados aloes was exported from the island both before and soon after these reports. Samuel Dale, in 1751, expressly states⁹ that aloes is brought to England from the island of Barbados in large gourds and that the inspissated juice has the properties of aloes succotrina.

From Cape Colony, Africa, where it was made at that date by Peter VanWett,²⁴ aloes has been an article of export since 1773.

Curacao aloes was known in the Dutch market in 1847,¹² and appeared in the English market for the first time as late as about 1876.²⁵

CULTIVATION, PREPARATION AND COMMERCIAL VARIETIES,

The aloe plant, wherever it is cultivated, requires but little care. It will thrive in almost any soil, and in a wild state is known to be abundant on arid plains, as e.g. in the interior of Cape Colony. In this connection, Mr. P. L. Simmonds' book on Economic Products of the Vegetable Kingdom, 14 although written in 1854, contains much valuable information that holds good to-day, concerning the cultivation and preparation of aloes, as well as statistics regardmg all kinds of aloes known at that date.*

The usual mode of aloe propagation is by sprouts, the only care required being to keep down the weeds. In Barbados, Mr. Simmonds relates, great care is taken to pick the stones from the ground, the plants being then set in rows one foot apart to facilitate the removal of

*We had repeatedly occasion, also in the present series of articles, to refer to some of the writings of this author, who, notwithstanding his scientific attainments and conspicuity, died in poverty last year, aged 83, See American Journal of Pharmacy, 1897, p. 616.

weeds. The aloe is planted usually between April and June, and is so hardy that it will live for many weeks without a drop of rain. The collection is made in March following. The plants thrive for ten to twelve years if good manure is used every three or four years. Similarly the aloe plant (*Aloe vulgaris* var. *chinensis*²²) is now cultivated in the Dutch island of Curacao. No fertilizer whatever is required, nor any preparation of the soil. The young plants thrive even though the roots have to work their way between stones. When sufficient rain falls, abundant juice is produced, and many young sprouts are formed around the mother plant. They are sold by the thousand on the Curacao market.²²

Mr. Simmonds in the aforementioned work¹⁴ described the mode of preparation of aloes, as observed by him in the West Indian islands and also as it is conducted in Cape Colony.

A more recent report on the collection and treatment of the aloe in the island of Curacao²² presents the following details :

The aloe plants are cut after sufficient rain has fallen, the time being selected so as to obtain a juice that is neither too watery, as is the case after much rain, nor too thick, as is the result in the dry season. In Aruba the cutting is done by men, in Curacao and Bonaire by women. The operator seizes the crown of the leaves with one hand and by one horizontal stroke with a bread knife severs them from the base of the stem. The leaves are at once placed, base downward, in sloping wooden troughs, which are open at one end. The exuding juice is collected in tin vessels which when filled are emptied into barrels. The abstracted leaves are then spread on the ground and when dry are occasionally used as fodder for animals but more often as a fertilizer. When the aloe field has its own brick furnace, the juice is at once boiled down in a large copper kettle heated by direct fire. The mass is stirred constantly, and when it has reached a certain consistence, is laded into wooden

hests where it is allowed to cool, and then the mass is prepared for shipment. When there is no furnace in the field, however, the barrels of juice are hauled to special "boiling houses" where the boiling is conducted after a sufficient number of barrels have arrived. If the amount of juice is not sufficient to warrant boiling, the aloe juice is sometimes left for weeks, and as a result fermentation has been known to take place, certainly to the detriment of the commercial product, although it has been asserted that aloe juice is not liable to ferment.

In Aruba there is only one boiling house that evaporates the juice by steam instead of by direct fire, where, as Mr. C. G. Lloyd learned on his journey through the West Indies, the vacuum pan is now employed. This place seems increasingly to supply the bulk of the Curacao aloes, as the following table of exports from the Dutch West Indies from 1884 to 1887 would show:

	1884.	1885.	1886.	1887.	
Curacao.....	2080	500	kilograms.
Bonaire	19,083	5,821	18,640	2,075	"
Aruba.....	98960	123,115	158,011	189,925	"

It has been customary in trade circles to distinguish by name *Socotrine*, *Barbados*, *Curacao*, and *Cape aloes*, as well as certain commercial forms of minor importance, such as *Natal*, *Indian* and *Mocha* aloes.

The term *hepatic aloes* has been employed to classify any aloes of a liver-color, regardless of its geographical origin.

Professor Tschirch distinguishes between the crystalline aloes (*aloe hepatica*), prepared at lower temperatures, and the transparent variety (*aloe lucida*), prepared at a higher heat which more or less precludes crystallization, as shown in Cape aloes.²⁸ The botanic origin of these commercial products, however, is not always precisely known, e. g., the exact plant used in making Natal aloes or socotrine aloes. Yet, even if they are produced by different varieties of the aloe plant, their marked differences in appearance, odor and composition can hardly be attributable to this factor alone. It is safe to say that

the manner of collection and the care bestowed upon the juice as well as its subsequent manipulation influences the character of the commercial product regardless of the aloe plant yielding it. Dr. Squibb, for example, who champions purified aloes, admits that so simple a process as that of purification of the commercial drug alters it to some extent.¹⁷

Commercial *Socrotine* aloes is now collected from the coast countries of the Red sea and Zanzibar, and occurs sometimes in a semiliquid state, which is due to imperfect inspissation.¹³ It is exported from Bombay and Zanzibar, the bulk of the product being consumed in the United States. That shipped from Bombay is previously received via Zanzibar and the Red sea ports, and arrives in skins of varying sizes, which are opened and repacked into boxes for exportation.²⁶

The Socotrine aloes of ancient times is not now found in trade and according to Squire²⁷ exists probably only as museum specimens. It was derived from a species of aloe indigenous to Socotra, rediscovered in 1878 and named *Aloe Perryi* by Baker, after Commodore Wickham Perry,* who for the purpose of identification carried a specimen of the plant from the island of Socotra to England.

The description of commercial Socotrine aloes may be found in any modern work on pharmacognosy ; also see in this connection the article by Dr. A. R. L. Dohme³¹ in the Druggists' Circular, 1897. The Zanzibar (hepatic) variety is brought to us in monkey skins of a capacity varying from 20 or 30 to 40 pounds. A writer in the London Chemist and Druggist says on this point that this peculiar mode of wrapping the parcels suggested itself on account of the abundance of these animals in Zanzibar and the ease with which they can be killed.²⁰

Barbados aloes is no longer manufactured in Barbados,³⁰ its place in trade being taken mainly by Curacao aloes.

*Not Commodore Perry of Put-in Bay battle (Lake Erie) fame.

Curacao aloes has suffered a gradual decline in price, falling from 11 cents a pound in 1883 to 3 cents and less even at present, owing to excessive shipments made during this interval; but, as Dr. Dohme has shown²⁴ that this species is rich in aloin (18.5 per cent, against 7.5 per cent of Socotrine and 4.5 per cent of cape aloes), Curacao aloes may have a fixture, notwithstanding the disagreeable odor which it possesses, provided *aloin* is demonstrated to be the only active principle of the various aloes of commerce. In contrast with the present unpleasant odor of this form of aloes A. Faber, in 1847, stated that Curacao aloes (of the Dutch market) has a "beautiful saffron-like odor."¹²

Cape aloes is distinguished from all others by its glassy appearance and by being translucent at the edges : it yields a brown-yellow powder. This is the favorite aloes in Germany and is the variety most soluble in water and alcohol. Messrs. Bainbridge and Morrow have found a specific test for this aloes as follows: When treated with nitric acid, on a white plate, cape aloes, like others, (except Socotrine aloes) yields a red color; but after five minutes' standing, cape aloes changes to a rather permanent green.

CHEMICAL CONSTITUENTS, ADULTERATIONS AND USES.

T. and H. Smith of Edinburg in 1873 obtained from Barbados aloes traces of an essential oil lighter than water. Not more than two fluidrams (about six grams) were produced by 500 pounds of drug.²⁴ The medicinal virtues of aloes seem to reside in a crystallizable principle, collectively called aloin, and respectively designated as *socaloin*, *barbaloin*, *nataloin*, *zanaloin*, according to the source from which it is obtained, the supposition being that they differ in chemical composition. It has been known for some time that aloin is an *anthracene derivative*, but not until within the last few months, when Prof. Tschirch and G. Pedersen demonstrated its mutability into *emodin* (trioxymethyl-anthraquinone), was a

connection drawn between aloin and the laxative principle of rhubarb, senna, cascara and frangula.

Solutions of aloin, when exposed to the air, or when heated with a 1-per-cent solution of caustic potash, develop considerable amounts of emodin; hence the suggestion that the transformation of aloin into emodin takes place within the organism, which would account for the cathartic action of the drug. Borntraeger's test for aloes (viz., shake out aqueous aloes solution with benzine, treat benzine solution with ammonia; a cherry-red color will develop on standing) is, in reality, a test for emodin.

Mr. Pedersen has continued the study of resins instituted by Professor Tschirch to include the resins contained in the various forms of commercial aloes. All of them, as far as examined, contained a peculiar alcohol, called *alo-resino-tannol*, combined in the form of an ester with various acids. For example, in Barbados aloes the acid is cinnamic acid and in cape aloes it is paracumaric acid. A corresponding study of Socotrine aloes has not yet been inaugurated. In Barbados aloes Pedersen found resin, 12.65 per cent; barbaloin, 12.25 per cent, and emodin, 0.15 per cent^{33*}

Foreign bodies found in aloes, either intentional additions or the result of carelessness in its preparation, have been dealt with in detail by Dr. E. R. Squibb¹⁹ in order to lend force to his arguments in favor of an official purified aloes. The loss of weight by reason of admixture or of accidental impurities in Socotrine aloes amounted to 5.3 per cent, while the total, including that due to moisture, averaged 15 to 18 per cent, running in some cases as high as 27 per cent. He found a veritable museum of stones, sticks, goat skins, and even working implements, such as knives, in commercial aloes. In our experience gourd aloes has been heavily weighted with fragments of iron. Wittsteir¹⁸ enumerates colo-

***For information concerning this summary of the work of Prof. Tschirch the author extends thanks to Dr. A. R. L. Dolme, who kindly submitted him his manuscript on aloes, for this purpose, since published in the American Journal of Pharmacy (34).**

phony, pitch, ochre, sand, white-burned bones, gummy matter and licorice. In this connection it is perhaps of interest to call attention to a new industry quietly conducted in China, which consisted in the adulteration of the expensive imported Indian opium by the skilful 'admixture of Curacao aloes'²⁹

Aloes is valued medicinally as a tardy laxative, not taking effect at once, but acting in from 6 to 24 hours after its ingestion¹⁶ It enters into the composition of a great variety of pills and medicines, ancient and modern. Among some natives of aloe-producing countries the juice of an aloe plant is used as a dye-stuff, and the fibers of the leaf have been utilized in rope-making.

Merat and DeLens¹¹ make the curious statement that aloe juice has been used by nurses to prevent children from sucking their fingers. The same authors put on record Boullay's suggestion to mix extract of aloes into the pulp intended for making herbarium paper, in order to preserve botanical collections from the ravages of insects.

PHARMACOPEIAL RECORD.

The London Pharmacopoeia of 1650 directs the use of Socotrine aloes (*aloe succotrina* and *aloe socotorina*), which enters into the formulas of not less than twenty-one out of a list of thirty-one of the official pills of that work. A process is directed for purifying aloes by means of warm water, which is exactly the opposite of the alcohol method adopted by the U. S. pharmacopeia, 1890; the purified product is named *aloe lota*.^{*} In the 1788 edition aloe barbadensis is added, but aloe socotrina is given preference and is specified throughout.

The present British Pharmacopoeia (1898) recognizes: (1) Aloe barbadensis (oe Vera, Linn; aloe chinensis, Baker), imported from the West Indian islands, and

^{*}A few years preceding this pharmacopeia (1693) an Antwerp physician, Dr. Wm. Marquiss, wrote a monograph on aloes, naming it *aloe morbifuga*. This paper, a modern writer (15) has determined, was copied verbatim in many parts from the *Alcedarium* of Raymund Minderer, 1622. He accepts, however, that in some parts it shows progress in advocating an aqueous extract of aloes, because, as he states, it excludes the inert resins.

known in commerce as Barbados and Curacao aloes. (2) *aloe socotrina*, (from *aloe Perryi*, Baker, and probably other species of aloes). Imported principally by way of Bombay; and known in commerce as Socotrine and Zanzibar aloes.

The German pharmacopeia, as well as other European pharmacopeias (for example Holland and Austria,) recognize only aloes from the Cape Colony (*aloe lucida*), derived from *Aloe ferox* and *A. africana* and other African species.

The U. S. pharmacopeia, from its first issue in 1820 and the preceding pharmacopeia of the Massachusetts Medical Society of 1808, naturally gave aloes conspicuity. The U. S. P. editions of 1860 and 1870 recognized Barbados, Cape and Socotrine aloes; the latter alone being continued in the 1880 edition. The U. S. pharmacopeia of 1890 recognizes *aloe barbadensis*, the inspissated juice of the leaves of *aloe vera* (Linne) Webb and *aloe socotrina*, the inspissated juice of the leaves of *aloe Perryi*, Baker. *Aloe purificata*, obtained by alcohol from Socotrine aloes; and *aloinum*, from several varieties of aloes, are likewise official.

LITERATURE ON ALOES.

- (1) Hieronymus Bock, (Tragus) *Kreutterbuch*, Strassburg, 15513, p. 351.
- (2) Carolus Clusius, *Aromatum et Simplicium, etc. Historia*, 4th ed. Antverpiæ, 1693, p. 9-15
- (9) Sam. Purchas, *His Pilgrimes*, Vol. I, p. 419 and 5(1 and Vol. II. p. 1496. 5 vols, London, 1625.
- (4) Joh. Bauhinus, *Hist. Plant. Vol. III*, p. 696 Ebroduni, 1661.
- (5) Caspari Bauhini, *Pinax Theatri Botanici*, Basileæ, 1671. p. 495,
- (6) Ligon, *History of Barbados*, London, 1673, p. 98.
- (7) J. B. Labat, *Nouveaux Voyages aux Isles de l'Amerique*. Paris. 1724, Vol. IV. p. 495.
- (8) J. B Labat, *Nouvelle Relation de l'Afrique Occidentale*. 5 VoIs. Paris, 1728, Vol. II, p. 48-65.
- (9) Samuel Dalei, *Pharmacologia*, Lugd, Batav. 1751, p. 272
- (10) A. M. De Lamarck, *Encyclopedie Methodique*, Paris, 1788, Vol. I. p. 85.
- (11) Merat & De Lens, *Dictionnaire de Matiere Medicale*, Paris, 1829 Vol. I, p 194.
- (12) A. Faber. *On Curacao Aloes*. *Pharm. Jour. Trans.* Vol. VII, 1847,48, p.547.

- (13) Jon. Pareira. On Socotrina Aloe Juice or Liquid Socotrinic .
Aloes. Pharm. Jour. Trans.1851-52, p. 489.
- (14) P. L. Simmonds The commercial Products of the Vegetable
Kingdom. London, 1854, p. 628-632
- (15) Aloes. Pharm. Jour. Trans. (2) Vol. X, ~~1868-69~~, p. 106-110.
- (16) Wm. Murrell, The Chemist and Druggist, 1871, p. 884.
- (17) E. R. Squibb, Proc. Am. Pharm. Assoc. 1873, p. 236-41.
- (18) Wittstein, Handwörterbuch der Pharmacognosie des Pflanzen-
reichs. Breslau, 1882, p. 14
- (19) E. R. Squibb, Ephemericis, Sept., 1894, also see Pharm. Jour.
Trans., Vol. XV, 188-85, p. 304,
- (20) The Chemist and Druggist, 1884, Vol. 26, p. 114.
- (21) The Chemist and Druggist, 1887, Vol.31, p. 130.
- (22) E. M. Holmes, Pharm. Jour. Trans., Vol. XX, 1889-1890, p561,
and Vol. XXI, 1890 1891, p. 205.
- (23) J. Bainbridge and C. Morrow, Pharm. Jour. Trans. Vol. XX,
1890, p. 570; see also Bulletin Kew Gardens, 1890, p. 168-
168 on Natal Aloes.
- (24) Flückiger, Pharmacognosie des Pflanzenreichs, 3rd ed. Berlin,
1891, p. 208.
- (25) The Chemist and Druggist, 1893, Vol.43, p. 49.
- (26) Dymock, Warden & Hooper, Pharmacographia Indica, London,
1893, Vol. III p. 467-471.
- (27) P. Squire, Companion to the British Pharmacopoeia, 16th ed,
London, 1894.
- (28) B. Hirsch and A. Schneider, Commentar zum Arzneibuch für
das Deutsche Reich. Göttingen, 1895, p. 106.
- (29) The Chemist and Druggist, 1898, Vol. 49, p. 52.
- (30) The Chemist and Druggist. 1897, Vol. 51, p. 465.
- (31) A. R. L. Dohme, Histology and Pharmacognosy of Aloes, etc.,
Druggists' Circular, 1897, p. 74.
- (82) The British and Colonial Druggist, Curacao or Curacao Aloes?
Vol. 34, 1898. p. 74.
- (83) G. Pedersen and A. Tschirch, Beiträge zur Kenntniss der
Aloe. Archiv der Pharmacie, Vol. 286, 1898, p. 200-212.
- 94) A. R. L. Dohme, The Chemistry of Aloes, Amer. Jour. Pharm.
Aug., 1898, p. 898.