lateral mestome-strands being arranged in a single circular band, with deep rays of secondary hadrome, embedded in a large, thin-walled parenchyma, but with neither endodermis, pericycle, nor interfascicular cambium.

Aristolochia Serpentaria.—(U. S. Pharmacopoeia p. 374.) The diagnosis in the Pharmacopoeia is so incomplete that it does not show the structure of a rhizome at all. There is a cortex, of which the hypodermal stratum is collenchymatic, and the cells contain chlorophyll and oil. The stele consists of a thin-walled endodermis, and a stereomatic pericycle surrounding about 10 collateral mestome-strands separated from each other by very broad rays of parenchyma, and connected with each other by strata of interfascicular cambium; the pith is excentric.

Stillingia.—(U. S. Pharmacopoeia p. 410.) The following, and most important characters, are not mentioned in the Pharmacopoeia:

> "Laticiferous ducts abound in the secondary cortex: Stereids is present in the primary leptome; thickness of the roots depending on the numerous layers of cork, secondary cortex and secondary hadrome."

Gelsemium.—(U. S. Pharmacopoeia p. 201.) The remarkable structure of the cortex being divided into two zones by the endodermis and pericycle, as well as several other points, are not mentioned in the official diagnosis.

Sassafras.—(U. S. Pharmacopoeia p. 379.) In describing the bark no mention is made of the sclerotic cells forming longitudinal rows in the cortex nor of the large mucilage-cells, oil-cells, etc.

Finally, the diagnosis of Sarsaparilla (p. 369) seems to apply to a rhizome rather than to a root. What is meant by "a porous central-cylinder" in the root of Veratrum (p. 486) is very uncertain. Under Taraxacum (p. 438) mention is made of "laticiferous vessels and sieve-tubes alternating with parenchyma," which statement could be improved by replacing the words "vessel" with "ducts" and "alternating" with "separated by."

As the drugs are described in the United States Pharmacopoeia, their identification by structure alone is hardly possible, for in too many cases the structure has not been given so as to show the most essential points, besides the botanical terms have not always been applied in the proper manner. It would be a great help to the students of pharmacognosy if the Pharmacopoeia contained some glossary of botanical terms explained in a few words, and some figures illustrating the most important features of the drugs in question, especially the anatomical structure.

DRUG TOPICS.*

BY J. A. BAKER.

No. 4. Bleached Coriander.[1]

At the request of Dr. R. H. True, at that time in charge of the investigations of drugs and medicinal plants for the Bureau of Plant Industry, the study of bleach-

* From the Laboratory of Edward Kremers.

[1] Extracts from J. A. Baker, "The Bleaching of Drugs," Thesis, University of Wisconsin, 1911.

ing coriander was undertaken in connection with the cultivation experiments of this drug at the Northern Station for the Cultivation of Medicinal Plants, located at Madison.

In connection with the preparation of food-stuffs, bleaching agents are used not only for the purpose of bleaching but also for the purpose of killing germs. This problem involves not only the question of the honesty of the label, but sanitary questions as well.

In the case of drugs it may be a matter not only of honesty of label, but also a question of quality. Thus, *e. g.*, in the case of coriander, a bleached coriander certainly presents a more favorable appearance. Whether such a coriander has the same agreeable flavor as the unbleached drug is a question that does not appear to have been decided as yet. Whether a slight bleaching of the pericarp will affect the volatile oil chemically so as to produce a difference in its physical and chemical constants, can be decided only by experiment. Whether the aroma may have been changed without a corresponding change in the more or less flexible limits of the physical and chemical constants is a question of judgment rather than experiment and by no means as easy of a satisfactory solution.

In order to ascertain in a general way to what extent the practice of bleaching is carried on, letters were addressed to expert pharmacognosists attached to the principal ports of entry.

From Dr. H. H. Rusby, who at the time was attached to the New York Laboratory, established under the Pure Food and Drugs Act, the following statement was received:

"I am awfully sorry that I cannot help you to the information asked for in your letter of the 20th. The truth of the matter is that I have practically no knowledge of the bleaching of drugs, except that of general hearsay. It is generally accepted as a fact that dark colored Tragacanth is bleached, also pealed Calamus, Coriander, Cardamom, etc. You will find a brief note about the bleaching of Cardamom in the National Dispensatory. You probably know that Chondrus is bleached by the action of the sun and air, while moistened with sea water, but I should not be surprised if it was sometimes bleached with sulphurous acid.

"I have never seen any drugs bleached and know nothing of the details."

From Dr. Albert Schneider, at the time pharmacognosist for the Port of San Francisco, the following statement was received:

"If you mean by 'bleached drugs' such as have been subject to some bleaching process as sulphuring, etc., I may state that none such are presented for entry at the Port of San Francisco, at least none have come to my notice thus far."

From Dr. E. Gildemeister, Chief Chemist for Schimmel & Co., in Miltitz near Leipzig, who has had considerable experience with enormous quantities of crude vegetable drugs from all parts of Europe and whose knowledge of the subject, therefore, seemed extremely valuable, the following answer to several questions was obtained:

"In Beantwortung Ihrer Anfrage vom 10.2.11. kann ich ihnen mitteilen, dass uns ueber eine kuenstliche Bleichung von Coriander und aehnlichen Saemereien nichts bekannt ist. Bei Coriander ist die Ausfuehrung eines derartigen Prozesses auch sehr unwahrscheinlich, denn dabei wuerden die beiden Fruchthaelften zu leicht auseinanderfallen und die Waare sehr an Wert einbuessen. Wir haben sehr helle Faerbungen bei einigen Sorten, besonders bei Marokkanischem Coriander beobachtet, damit ging stets ein sehr niedriger Oelgehalt Hand in Hand. Beides glauben wir auf die intensive Wirkung der Marokkanischen Sonne zurueckfuehren zu muessen.

Von kuenstlich mit SO_2 behandelten Drogen sind uns bishaer nur Iris und Hopfen begegnet, die beide dann fuer die Destillation unbrauchar werden, vgl. G. u. H. S. 395 u. 437."

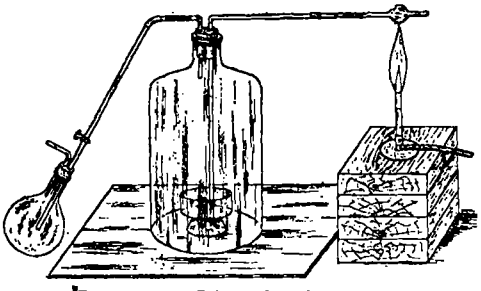
As already pointed out, the light colored imported coriander was suspected of being bleached, by Dr. True. However, the literature on bleaching as well as on coriander affords no reference to the subject, neither could anything be learned about it from importers of drugs, manufacturers of volatile oil, or government drug inspectors.

In order to ascertain something about the effect of bleaching on the appearance of the drug, also on the character of its volatile oil, the following experiments were undertaken.

The first problem was to ascertain the minimum amount of sulphur dioxide or sulphurous acid that would bring about an improvement in the appearance that might be regarded as sufficient in trying to make a dark product more salable. For this purpose both dry bleaching and wet bleaching were tried with 100 gramme lots of coriander raised in the Northern Station for the Cultivation of Medicinal Plants, a station maintained at that time as a coöperative experiment between the U. S. Department of Agriculture and the University.[1]

Dry Bleaching.

In order to ascertain the effect of sulphur dioxide a simple apparatus was constructed. As a receptacle for the coriander to be exposed, a desiccator without a cover was used. Above the contracted part a false bottom was placed so that the coriander occupied the upper half only. A weighed amount of sulphur was slowly burned in a bulb tube of hard glass in such a manner that the vapors were drawn by a suction pump into the bottom of the desiccator and had to pass through the layer of coriander. In order to prevent loss of sulphur dioxide the desiccator was covered by a bell-jar resting air-tight on a glass ground plate. The current of sulphur dioxide was regulated by a stopcock whereas the flask filled partly with water served as a means of counting the bubbles of air and thus regulating the current of sulphur dioxide.



Laboratory Bleaching Apparatus.

The amounts of sulphur used and the effect produced on the coriander by the sulphur dioxide are recorded in the following table. One part of sulphur, upon combustion, yields practically two parts by weight of sulphur dioxide.

Expt.	Amt. of sulphur.	Changes in appearance, etc. of coriander.
1	1 gramme	No striking change in color. Faint odor of SO_2.
2	2 grammes	Color change very striking. Strong odor of SO_2.
3	4 grammes	No perceptible difference between Nos. 2 and 3. Strong odor of SO_2.
4	2 grammes	Same as No. 2. Strong odor of SO_2.

Two grammes of sulphur changed the color of coriander from a dirty hue to a pleasant yellow, which color was by no means improved by doubling the amount of sulphur. One-half of the amount of sulphur, however, did not produce a like-

[1]See Annual Report for 1910. "Coriander."

desired effect. In all cases the odor of sulphur dioxide lingers long with the product. The bleaching effect also was slow.

Wet Bleaching.

In order to ascertain the effect of sulphurous acid, *i. e.*, of sulphur dioxide in aqueous solution, on the coriander, 100 Gm. amounts were covered with dilute aqueous solutions of sulphurous acid for the short period of one minute. The coriander was then dumped into a funnel so that the sulphurous acid would drain off at once. The fruit, having taken up some water, was dried back, by exposure to room temperature, to 100 grammes. The results of these experiments are also recorded in tabular form.

Expt.	Amount of SO_2 sol.	Percentage of SO_2 in sol.	Amt. of sol. absorbed or lost.	Loss of SO_2.
1	500 Cc.	3.55 p. c.	50 Cc.	0.68 p. c.
2	450 Cc.	2.87 p. c.	40 Cc.	0.37 p. c.
3	410 Cc.	2.50 p. c.	60 Cc.	0.33 p. c.
4	350 Cc.	2.17 p. c.	...	.....

Although somewhat varying amounts of solutions of different strength were used, the effect as to the appearance was practically the same in all cases, thus showing that a 2 percent solution, corresponding to 1 gramme of sulphur, will produce as desirable an effect, as to appearance, as will one of almost twice the strength. Moreover, these experiments show that one-half of the sulphur dioxide in the wet state, *i. e.*, an aqueous solution of sulphurous acid, will produce a better looking product after a minute's exposure than twice the amount of dry sulphur dioxide will after an exposure of twenty-four hours or even several times twenty-four hours.

Effect of Bleaching on the Oil.

In order to ascertain to what extent, if any, the sulphur dioxide or sulphurous acid affects the volatile oil, for the aroma of which coriander is largely used, the volatile oil from bleached and unbleached coriander was prepared.

13.75 lbs. of coriander, which after grinding weighed 13.50 lbs. (= 6124.43 grammes), were subjected to steam distillation in the Lentz distilling apparatus of the University with steam under about 15 lbs. pressure. The oil obtained from this unbleached coriander weighed 11.325 grammes, corresponding to a yield of 0.185 percent. According to Gildemeister, the volatile oil content of coriander varies considerably as to geographic source, all the way from 0.1 p. c. to 1 p. c.[1]

Its sp. gr. was 0.863 at room temperature whereas the U. S. P. calls for a sp. gr. of 0.875 at 25° C. In a 50 mm. tube it deviated polarized light 5°47′ to the right. The U. S. P. calls for a dextrogyrate angle of rotation varying from 7° to 14° in a 100 mm. tube and G.-H.-K., "The volatile oils," from +8° to +13°.

A like amount of seeds were then bleached for one minute with a 1 percent aqueous solution of sulphur dioxide. After drying, these were ground and distilled. As the first vapors came over, a strong odor of sulphur dioxide was perceptible, but no oil was obtained even upon cohobation of the aqueous distillate. The latter, however, had a very pleasant odor.

[1] Moravian, Thuringian and Russian, 0.8 to 1.0 p. c.; French, 0.4 p. c.; Dutch, 0.6 p. c.; Italian, 0.5 p. c.; Moroccan, 0.2 to 0.3 p. c.; East Indian, 0.15 to 0.2 p. c.