After reaching maturity all of the plants were harvested and thoroughly air-dried and their several weights determined in the air-dry condition. The average weight of the 10 different sets of plants receiving manganese was 143.8 g., while the average weight of the 5 sets that received no manganese was 61.3 g., or an increase in the growth of the plants receiving manganese of 135 per cent.

FIG. 4

The second series of cultures, which was a repetition of the first, showed similar relative differences in growth, although the growth was not as luxuriant as in the first series.

The difference in growth shown in these experiments can be attributed only to manganese, because every precaution was taken to carry them out under as nearly similar conditions as possible, in other respects. The reagents from which the basal nutritive solutions were made were tested and found free of manganese. From the standpoint of growth produced in the plants, the experiments confirm the conclusion reached by Bertrand: that manganese performs an important function in the vegetable economy.

In this connection, the manganese content of certain materials commonly used as fertilizers was determined. A number of different agricultural limestones were examined, but their manganese content was found to be so small that the amount of manganese added to the soil by an application of 2 to 4 tons to the acre would be negligible. One sample of raw rock phosphate was examined which showed only 0.0176 per cent of manganese, or less than 0.4 lb. per ton.

It occurred to the writer that basic slag might be a probable source of considerable amounts of manganese. Determinations in 6 samples of this material from different sources gave an average of 4.8 per cent of the element manganese, the range being from 3.30 to 6.16 per cent. Therefore a ton of basic slag, containing the average amount, or 96 lbs., of manganese, when applied to an acre of land and rendered available, would probably supply all the manganese necessary for any crop.

Basic slag has found considerable use in agriculture as a source of phosphorus and calcium. Since this

material contains a noteworthy amount of manganese it is quite likely that, on soils poor in that element, the manganese contained therein may play an important part, in addition to that of calcium and phosphorus, in promoting the growth of crops.

SUMMARY

1—A convenient support is suggested for growing plants in water cultures.

2—Manganese, in suitable dilution, stimulates the growth of wheat, increases the size and the nitrogen content of the grain, and evidently performs an important function in the normal growth and development of the plant.

3—Basic slag contains about 100 lbs. of manganese to the ton and it is possible that some of the benefit to crops resulting from the use of this fertilizer, on certain soils, may be due to this element.

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SCAMMONY AND ITS SUBSTITUTES¹

By W. L. SCOVILLE

There was recently received from a New York broker a sample of a Mexican plant known as *Resina drastica*, with the statement that several hundred pounds of it were available, and asking for an offer for the lot. The drug so closely resembled that known as Mexican scammony, *Ipomoea orizabensis*, as to be mistaken for that drug on quick inspection by our botanist.

On extracting the ground drug with alcohol it was immediately evident that something different from Mexican scammony was at hand, for the percolate was a deep yellow in color, and when it was concentrated and poured into acidulated water a bright lemon-yellow resin was obtained. This resin amounted to 19.2 per cent of the drug taken. The alcoholic solution showed 23.5 per cent of total extractive from the drug.

A comparison of the chemical characters of the resin with true resin of scammony, *Convolvulus scammonia*, and with the resin of Mexican scammony disclosed the following:

	Resin of Scammony	Resin of Mexican Scammony	Resin of <i>Resina drastica</i>
Yield, per cent.....	About 8	9 to 20	19.2
Color.....	Yellowish brown	Straw	Lemon-yel- low
Ash.....	Practically none	Practically none	Practically none
Solubility in			
Petroleum ether.....	3.5 per cent	2.5 per cent	1.0 per cent
Ether.....	Soluble	Soluble	72.6 per cent
Acetic ether.....	Soluble	Soluble	Soluble
Chloroform.....	Cloudy soln.	Cloudy soln.	94 per cent
10 per cent ammonia.....	Cloudy soln.	Cloudy soln.	Cloudy soln.
10 per cent potassium hydroxide solution.....	Cloudy soln.	Cloudy soln.	Cloudy soln.
Acid number.....	20	23.5	28.0
Saponification number.....	198	140	136
Optical rotation.....	-17.3	-24.8	-32.4
Color with FeCl ₃	Dark green	Faint green	Dark green

¹ Presented before the Division of Pharmaceutical Chemistry, Cleveland Meeting, American Chemical Society, September 10 to 13, 1918.

The optical rotation of true scammony resin obtained from the root is reported by P. Guigues to vary from $-18^{\circ} 30'$ to $-23^{\circ} 30'$ and the upper limit of natural scammony resin as -25° . Resins having a rotation of -23° to -25° are considered to be derived from *Ipomoea orizabensis*.

The resin of *Resina drastica* is less soluble in ether and in chloroform than is true scammony resin or the Mexican scammony resin. It is more slowly soluble in alkalis than is true scammony resin, as also is that of the Mexican scammony. All three gave markedly cloudy solutions in ammonia and in potassium hydroxide solution, but the insoluble portions were so fine that the solution passed through an analytical filter without clearing and without collecting an appreciable residue on the filter. Acidulating the alkaline solutions did not precipitate the resin in any case.

The alcoholic solution of *Resina drastica* reduced Fehling's solution both before and after heating with weak sulfuric acid. It is thus uncertain whether the resin has a glucosidal character or not.

The supply was limited and a separation plan could not be carried out.

In general character, this resembles both true and Mexican scammony resins. It is slightly more acid and is more strongly levorotatory. Its color alone would distinguish it, and treatment with decolorizing

charcoal does not take out the color appreciably. When freshly precipitated it has an agreeable tea-like odor which disappears on drying. Probably a small amount of volatile oil is present in the drug. The powdered resin resembles scammony resin in odor.

The special distinguishing features of the three resins are (1) the brownish color of true scammony resin, and the very deep green color which it gives with iron salts, (2) the light color of Mexican scammony resin, producing a colorless alcoholic solution, and giving almost no color with iron salts, and (3) the deep lemon-yellow color of the *Resina drastica*.

The iron test distinguishes quite sharply between true and Mexican scammony when a ferrous salt is used. If 0.5 g. of the resin be dissolved in 10 mls of alcohol and 0.5 ml of a 10 per cent aqueous solution of ferrous sulfate added, the Mexican scammony resin shows only a very faint green while the others become dark green and on standing deposit a dark mass, leaving an olive-green supernatant liquid.

Subsequent efforts to obtain another sample of the *Resina drastica* for botanical study have failed, though samples of drugs having a different character were sent. It seems probable that several botanical species, closely allied, are seeking a market as scammony or scammony substitutes.

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LABORATORY AND PLANT

AN INVESTIGATION OF STENCHES AND ODORS FOR INDUSTRIAL PURPOSES^{1,2}

By V. C. ALLISON AND S. H. KATZ

The Bureau of Mines recently made an investigation of the use of stench as a warning in mines. Odors are put to various other industrial uses; principal among these are the testing of boilers for leaks with either air or water under pressure and the testing of plumbing or pipe lines. Ether, oil of peppermint, and oil of wintergreen are used mostly for these purposes. It has also been suggested that some strongly odoriferous gas or vapor, free of sulfur, be mixed with water gas to indicate its presence in case of leaks or other accidental escape into the air of a room.

During the work described in this paper a considerable number of chemicals were examined to determine their applicability to the mining needs and conditions. It was desired to use stench, that is, unpleasant rather than pleasant odors; and those most powerful at low concentrations were to be preferred. Of the chemicals examined those most useful were adopted for mine warnings. However, those which were less satisfactory for mine use may find other applications. For that reason the results are given in this paper.

¹ Published by permission of the Director, Bureau of Mines.

² Read at the 56th Meeting of the American Chemical Society, September 10 to 13, 1918.

APPARATUS AND PROCEDURE

The apparatus used, the "odorometer," is shown in Fig. 1. A number of Venturi type flow meters were so arranged that a measured volume of air could be passed at a uniform rate through or over the chemical, and this air then mixed with another measured volume of pure air also flowing at a uniform rate. The concentration of the chemical was measured by determining its loss in weight after a measured volume of air had passed through or over it. From this loss in weight and the total volume of air with which the chemical was mixed, the concentration in milligrams per liter of air and in parts of vapor per million parts of air were determined. The mixture of air and chemical passed through a rubber tube with a glass funnel at the open end. The funnel was placed over the nose when smelling to prevent contamination of the issuing mixture by room air.

The apparatus was placed in a good hood and the room was well ventilated to protect the operator from the effect of continually smelling the chemical, which might reduce his sensitivity to the odor.

An arbitrary scale for odors of five degrees was adopted. The degrees are designated:

- 1—Detectable
- 2—Faint
- 3—Quite Noticeable
- 4—Strong
- 5—Very Strong