

1 gm. of the syrup was dissolved in 20 cc. of water and inverted with hydrochloric acid in a boiling water bath for about thirty minutes. After it was neutralized with sodium carbonate, 2 gm. of phenylhydrazine hydrochloride and 3 gm. of sodium acetate were added and the mixture was heated in a boiling water bath, exactly in the same manner as above described. After heating for one hour and a half, the crystals were examined under the microscope, but they were all uniform and quite identical with those of phenylglucosazone which was obtained in the previous experiment. When cooled, it was filtered and washed with a little water. The yellow crystals thus obtained were recrystallized from dilute alcohol and dried over sulphuric acid in a vacuum. The product weighed 1.06 gm., and the melting point was found to be 204°. The crystalline form and melting point indicate that the osazone obtained was phenylglucosazone without admixture of other osazones.

The osazone test which was made to separate and detect the sugars in the syrup thus did not yield results differing from those obtained by the qualitative tests, as already described. But, as a result of this experiment, the presence of maltose is excluded, since maltose, if present, would have formed an osazone of a melting point very similar to that of glucosazone, but easily distinguishable from the latter by its crystalline form.

SUMMARY.

1. Sugar of the sweet potato tubers is made up of both reducing and non-reducing sugar.
2. The reducing sugar consists of both glucose and fructose, while the non-reducing sugar is sucrose.
3. The presence of pentose, galactose, and mannose molecules is excluded. The presence of maltose is also excluded.

IPECACUANHA: BOTANICAL SOURCE—MEDICINAL VALUE.

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IPECACUANHA.—Portuguese form of the native Brazilian word, ipe-kaa-guene, which is said to mean "road-side sick-making plant," or a creeping plant that causes vomiting. The plants are perennial herbs 10 to 20 cm. high, with creeping, woody hypogeous stems. It is somewhat shrubby with leaves elliptical, entire, short-petiole, and with divided stipules. The flowers are white and form a bunch of small flowers upon a long-stalked, terminal head. The fruit is a soft, dark, purplish-blue berry, with characteristic spiral arrangement of the carpels.

The part of ipecacuanha used in medicine is the root obtained from *Psychotria*, or *Uragoga (Cephalis) Ipecacuanha*, a small shrubby plant of the natural order Rubiaceæ. It is a native of Brazil, growing in clumps or patches in moist shady

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forests of Brazil and Colombia and is also found in localities adjoining those mentioned, and thrives best in clay soil along the banks of rivers. While it requires a great deal of moisture, it cannot live under water, and consequently in Colombia it is found in its best development in regions where the rainfall is abundant, but where the rivers do not overflow. The root appears to be possessed of very great vitality, for in 1869 botanist M'Nab, of the Botanical Gardens of Edinburg, Scotland, discovered that so small a portion as 1/16 of an inch of the annulated root, placed in suitable soil, would throw out a leaf-bud and develop into a fresh plant, while Lindsay, a gardener in the same establishment, proved that even the leaf-stalk is capable of producing roots and buds; hence there is but little probability of the plant being destroyed in its native habitat. In gathering ipecac, the whole plant is uprooted and the thin and soft rootlets are thrown away and these discarded rootlets serve for reproduction, becoming in a year well-developed plants with valuable roots of their own.

The drug of commerce is procured chiefly from the region lying between the towns of Cuyaba, Villa Bella, Villa Maria and Diamantina in the province of Matto Grosso, and near the German colony north of Rio Janerio. The Sinu River is the ideal region for ipecac. The plant is found in abundance from near the headwaters of this river to near the city of Monteria, about 60 miles from the coast, where the clay formation which ipecac seems to demand stops, and below which point the river is subject to periodical overflows. The growth extends to several miles on each side of the river and also to the more important tributaries of the Sinu, the Esmeraldas, Verde and Manso Rivers. In regions where the water is excessive, such as the valley of the Atrato, the plant, though found, has a poor growth and is of an inferior quality.

The area from which Cartagena ipecac is derived is very extensive and somewhat scattered, though preëminently important is the region of the Sinu River and its tributaries. It is estimated, on good authority, that the land actually covered by the plant must embrace several hundred square miles, though any attempt at an accurate estimate would be useless. A relatively small amount of Cartagena ipecac comes from the Atrato valley, and it is of inferior quality. In addition to the two regions mentioned, there is another, nearer than either of them to Cartagena, called San Onofre. It is traversed by many small streams, none of them navigable. The soil, in addition to the clay so necessary for the successful production of ipecac, contains a considerable amount of sand and humus, formed by the decay of great masses of vegetable matter. The region appears to be of a character that is well adapted to the growth of both rubber and ipecac, which fact is worthy of note for the reason that, in many cases, the same people who gather ipecac collect the rubber milk and by combining the two industries, economy of collecting each is effected. While the ipecac found here in a given area is less than found on the Sinu or Atrato, the quality almost equals that of the Sinu and is far superior to that of the Atrato. A small amount of ipecac is derived from the tributaries of the Magdalena.

It is probable that other localities, especially the areas covered by the rivers and their tributaries flowing from the interior of Colombia into the Amazon and Orinoco are adapted to the production of ipecac and do produce it, but owing to the complete commercial isolation of these sections, their resources are not of-

ferred to commerce or even definitely known. It is not thought that there are any new areas likely to be opened up to commerce in the near future.

The plant is not an object of cultivation in South America, though there is no reason why it should not be, except the fact that it is found wild in such abundance and is gathered from the forests chiefly by the Indians.

Ipecacuanha, although in common use in Brazil, was not employed by the medical profession of Europe previous to 1672. In France, within a few years after that date, it was employed as the chief ingredient in a remedy for dysentery, the secret of the composition of which was purchased by the French Government for 1000 louis d'or, and made public in 1688. The botanical source of ipecac was not accurately known until 1800. The great value of the drug in dysentery, and its rapid increase in price from an average of 2s 9½d per pound in 1850 to about 8s 9d per pound in 1870, led to attempts to acclimatize the plant in India, which, however, have not proven to be a commercial success, owing to the slow growth of the plant and the prices not being maintained at a figure that invited cultivation of the plant for commercial reasons, together with the difficulty of finding suitable spots for its cultivation.

Like other dimorphic plants, ipecacuanha ripens seeds best when cross-fertilized, and in consequence of the botanical culture, presents various forms. The diversity of form is most apparent in the young plants, and tends to disappear with age. *Triosteum Perfoliatum* is a plant belonging to the *Caprifoliaceae* or *Honeysuckle Family*, which is used as a medicine and the rhizome of commerce is known as *Wild Ipecac*. It is a perennial herb with connate-perfoliate leaves and small, orange-red, globular drupes, growing in Canada and the United States as far west as Kansas. Its rhizome is yellowish-brown, somewhat branched, cylindrical, 10 to 20 cm. long, 10 to 15 mm. in diameter, with numerous cup-shaped stem-scars, and coarse, spreading roots; it is rather hard and tough and has a bitter, nauseous taste. *Triosteum* contains an emetic alkaloid, *triosine*, and considerable starch. The seeds of *trioesteum perfoliatum* are sometimes roasted and employed like coffee, the plant being known as wild coffee.

The part of ipecacuanha used in medicine is the root, which is simple or divided into a few branches, flexuous and occurs in pieces about as thick as a goose quill, of a grayish-brown or reddish-brown tint externally, having a ringed or annulated surface and exhibiting a white or grayish interior and a hard wiry center. It has a faint rather musty odor, and a bitterish taste. The different kinds known in commerce, (gray, red, brown), are all produced by the same plant, the differences arising from the age of the plant, the mode of drying, etc. It is usually mixed with more or less of the slender subterranean stem, which has a very thin bark, and is thus very easily distinguished from the root.

The root is collected at all seasons, although chiefly from January to March, and is prepared for the market by mere drying. The activity of the drug resides chiefly in the cortical portion, and hence the presence of the stem diminishes its value. The variety imported from Colombia and known as Cartagena ipecacuanha, differs only in its larger size and in being less conspicuously annulated.

Ipecacuanha owes its properties to the presence of rather more than 1% of the alkaloid emetine, which, with the exception of traces, occurs only in the cortical portion of the root. It is a white, amorphous substance, has a bitter taste and

no odor, turning yellow when exposed to air and light, almost an insipid powder, moderately soluble in alcohol, and having all the characteristics of the vegetable alkaloids. There are also present a volatile oil, starch, gum and a glucoside, which is a modification of tannin and is known as ipecacuanhic acid.

In acute intestinal affections Ipecac has achieved its greatest reputation as a remedy, one of its oldest titles being *radix antidysenterica*. Its power over acute dysentery was known to Piso and Helvetius in the 17th century, and was mentioned by Balmain, (1797), Playfair, (1813), Twining, (1831), and Delioux, (1851). The reports upon its effect in acute tropical dysentery by Docker, (1858), attracted general attention, and since the latter date it has been universally recognized as a specific remedy for acute tropical dysentery and that of malarious districts.

The central emetics—those which produce their effect by acting on the vomiting center in the medulla; gastric emetics—those which act directly on the stomach itself.

Ipecacuanha is classed both as a central and as a gastric emetic; when taken by the mouth it acts as a gastric emetic before absorption into the system, and later produces a further and more vigorous effect by stimulation of the medullary centre. It must be remembered, however, that, valuable though these drugs are, their action is accomplished by so much depression, they should never be administered except under medical advice.

Emetine acts as a violent emetic in doses of 1/16 of a grain or even less, and is a powerful poison. The dose of the powdered root is 1/4 to 2 grains when it is desired that an expectorant action result, and 15 to 30 grains when it is given as an emetic, which is one of its most valuable functions. The Pharmacopœias contain a number of preparations of ipecacaunha, most of which are standardized. A preparation from which the emetine has been removed and known as "de-emetized ipecacuanha," is now upon the market and used in some conditions.

When applied to the skin, ipecacuanha powder acts as a powerful irritant, even to the extent of causing pustulation. When inhaled it causes violent sneezing and a mild inflammation of the nasal mucous membrane, resembling a common cold in the head. Small doses of the drug act as a stimulant to the secretions of the mouth, stomach, intestines and liver, and it therefore increases the appetite and aids digestion; it is very frequently employed as an expectorant in cases in which the bronchial secretions are deficient.

Ipecac is imported into the United States free of duty and the annual importations are about 36,500 pounds, the larger portion of which was purchased from Colombia.