UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN PROCESSES OF OBTAINING SUGAR FROM THE JUICE OF BEET-ROOT AND OTHER SACCHARINE LIQUIDS.

Specification forming part of Letters Patent No. **219,281**, dated September 2, 1879; application filed April 29, 1879.

To all whom it may concern:

Be it known that I, CARL LÖWIG, of Breslau, in the Kingdom of Prussia, have invented a new and Improved Process of Obtaining Sugar from the Juice of Beet-Root and Cane, and from molasses and other by-products, of which the following is a full, clear, and exact description.

This invention relates to a new method of obtaining sugar from beet-root, from cane, and from molasses, and of purifying the osmotic sugar and the dark-colored by-products in sugar-mills and sugar-refineries, in order to obtain from them the greatest quantity of sugar possible.

This method is based upon the principle of removing the salts as much as possible, and of perfectly removing the organic non-sugar matters by means of materials which have such removing power without introducing any damaging new matters in place of the removed ones; and it consists in the treatment with lime and gelatinous alumina, as hereinafter described.

I. *Method of obtaining sugar from juice.*—I add to one thousand parts of juice at the ordinary temperature two parts, by weight, of lime, in the form of lime-water, and after several minutes I add about from 1.25 to 1.5 per cent. of alumina, in a gelatinous state. I then slowly raise the heat to from 60° to 70° Celsius, keep the mixture for several minutes up to this heat, and afterward separate the juice, by filter-presses, from the dark-colored alumina-slime created, which is easily effectuated. The separation will be a perfect one if a filtered sample of the mixture will not become cloudy by adding oxalic acid, or oxalate of ammonia, or a solution of sugar of lead mixed with a few drops of acetic acid. Should, however, a filtered sample of the mixture become cloudy, a small quantity of gelatinous alumina must be added to the juice.

The above-mentioned small addition of lime will cause no separation. It is added only for the purpose of obtaining a solution of lime-sugar.

Along with the action of the alumina, the acids of the present salts (especially salts of potassa) will be precipitated, which, with the lime, will enter into insoluble combinations, and which will not be separated by the alumina alone, while the freed bases—that is, mainly the potassa—will take the place of the lime. The juice remains alkalized. The alkalinity, however, is caused by the potassa.

Simultaneously with the reaction mentioned, the alumina causes the precipitation of the excess of lime and the total amount of the organic non-sugar matters, colored as well as not colored, contained in the juice, and after the process of filtration by filter-presses a colorless or very slightly yellow-colored juice is obtained, which, as already mentioned, owes its alkalinity to the potassa. The juice is perfectly odorless, and possesses an agreeable sweet taste.

In some instances, if fluosilicic acid is to be had, I prefer to saturate the alkaline juice with this acid, but not to perfection, which acid may be precipitated as fluosilicate of potassium, the removal or separation of which may easily and in very short time be effected by means of adding a small quantity of gelatinous alumina. If no fluosilicic acid is to be had, I prefer adding to the juice a small quantity of hyperhydrochloride of alumina, but with this precaution, that the juice remains alkaline.

The small quantity of alumina which is thereby separated will increase the purification of the juice.

The juice obtained is now to be considered as perfectly purified, save of the present salts and the small quantity of potassa contained in the juice, and may be evaporated without further chemical treatment for crystallization. If, however, it is preferred to let the juice pass before crystallization through an animal-charcoal filter, the charcoal will act with all its efficacy upon the salts of the juice, as the latter contains neither lime nor organic matters, and the return in crystallized sugar will be increased in proportion to the removal of salts.

It is evident that the animal charcoal, having but very trifling quantities of impurities

to remove, and having to absorb no lime, may easily be revivified by lixiviation and subjecting to heat only, without the employment of muriatic acid.

II. *Method of obtaining sugar from juice after the usual separation of the latter by lime.*—The juice obtained by the method of separation by lime hitherto generally in use, especially in beet-root-sugar mills, will contain, besides lime, considerable quantities of organic matters, which will be only removed in part by the process of filtration, and these matters will increase the formation of molasses. As, now, the gelatinous alumina will perfectly remove the lime as well as the organic non-sugar matters from the so-treated juice, it is evident that in removing from the juice before saturation and filtration over animal charcoal the lime and the organic non-sugar matters, by adding a proportionate quantity of gelatinous alumina, not only the saturation and the most disagreeable formation of slimy masses may be avoided, but also, after filtration over animal charcoal and the subsequent removal of salts, a juice is obtained which will be nearly as much purified as the juice obtained by the above-described separation by alumina.

The process of treating the juice with the gelatinous alumina is substantially the same as described for the first method; but, of course, no lime is added.

III. *Method of obtaining sugar from molasses.* The molasses obtained—for instance, in beet-root-sugar mills—according to the process hitherto in use, will contain, besides water, sugar capable of crystallization, and sugar incapable of crystallization to a certain extent, the salts of potassium and organic matters, which latter may be precipitated by sugar of lead and gelatinous alumina. These latter ingredients of the molasses will prevent the crystallization of sugar. Now, in order to remove these matters, I dilute the molasses to from 40° to 45° Brix, and I add to this dilution, while cold, one per cent. of lime, and afterward add gelatinous alumina till a sample proof of the mixture, after warming, will not be rendered cloudy by a solution of sugar of lead. The molasses thus purified may henceforth be freed from a portion of its contents of salts by filtration over animal charcoal. The molasses, however, may advantageously be treated by the osmotic process, by which process nearly all the salts capable of crystallization may be removed, though with a small loss of sugar.

After evaporation a slightly-colored odorless sirup of an agreeable sweet taste will be obtained, of which, after a certain lapse of time, a high percentage of sugar will crystallize.

I have found by experiment that from molasses treated thrice by the osmotic process, and delivering no more sugar after having been submitted to the purifying process with lime and alumina, according to my process nine per cent., in weight, of the molasses has been obtained as purified white sugar after filtration.

IV. *Purification of the dark-colored osmotic sugar.*—I dissolve one hundred parts, by weight, of the dark osmotic sugar in two hundred parts of water, and to this solution I first add 1.5 per cent. of lime, and I then add such quantity of gelatinous alumina which may be found necessary for removing the contents of organic matters. The solution, of slightly yellow color, running from the filter-press, will, after having passed the charcoal filter, deliver a perfect white sugar. I use the same process for purifying the dark by-products in sugar-mills or sugar-refineries.

I claim—

The process herein described of clarifying and purifying saccharine liquids, the same consisting in first mixing lime-water with such liquids at the ordinary temperature, and afterward adding to the same gelatinous alumina, and raising the temperature of the liquid to about 60° or 70° Celsius, then separating the alumina-slime from the juice by filtering, substantially as set forth.

This specification signed by me this 19th day of November, 1878.

PROF. DR. CARL LÖWIG.

Witnesses:

A. RABER,

A. GERKHART.