Q.127

Published May 11, 1943

Serial No. 415,634

ALIEN PROPERTY CUSTODIAN

METHOD FOR THE CONCENTRATION OF CRUDE SUGARCANE-SAP

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No Drawing. Application filed October 18, 1941

The invention relates to a process to concentrate the sugarcane sap, without using pre-cleaning-methods.

In the Netherlands Patent No. 39,465 is published a process for cleaning crude sugarcane sap, this sap, being precleaned, before being concentrated to at least 40% and at most 50% of dry substance.

In practice concentration of sugarcane sap is done by using an evaporator with so-called multiple effect.

Till now it was the ordinary way to clean the sap before admitting it to the evaporator thus preventing the inner tubes of the evaporator growing filthy.

Working the material before evaporation i. e. the minimal working which was needed for preparing the crude sap for concentration by evaporation existed of a defecation- crudesap cleaning.

This method was not chosen as a sap-purification but as the cheapest way to make a clear looking sap (thin sap), which is in the right condition to be evaporated in a normal multiple evaporator.

By using the procedure of Netherlands Patent No. 39,465 the difficulty which arose consisted of a special wanted battery of presses to work the defecation dirty sap; this battery should be the third needed in the sugar factory.

One battery of presses was already needed for filtering the first carbonized dirty sap and one for filtering the second carbonized dirty sap.

The whole factory therefore grew so complicated and expensive, that people switched over to the process of dirty sap on cane-trash.

Thus the crude sap was limed till the reaction became more or less alcalic, then boiled and settled down in a first deposit.

The dirty-sap thus obtained was limed again till the reaction became plain-alcalic; boiled again and settled down again afterwards for a second deposition. After all these processes a sufficient small quantity of dirty sap was left to be used with success in the mill-battery. (Dirty sap on cane trash process.)

By putting into practice the sap-purification method according to the Neth. Patent No. 39,465 the quality of thus obtained sugar did not come up to the expectations; this quality could not compete with the quality of normal carbonized sugar; fuel consumption did not come up to the expectations too.

This was due to the big losses of heat in the preparatory treatment.

Every 100 kg of cane provides 90 kg of crudesap with a specific heat of 0.9. This sap goes to the first settling down process with a temperature of 100° C and is cooled off to ±80° C, which is in accordance with a loss of heat of $90\times20\times0.9=1620$ cal. About 25% of this sap, i. e. 22.5 kg goes to the second settling down process, where it cools off again ±20° C. Loss of heat in this point is $22.5\times0.9\times20=405$ cal. At last 10% of the crude sap goes to the mill battery where it cools off from 80° C to 30° C; this means a loss of $9\times50\times0.9=405$ cal.

This last quantity of heat is only lost when it disappears in the cane trash or in the air near the mills by radiating. A part of it is absorbed in the crude-sap and thus not lost.

Estimating this loss on 50% of these 405 cal., we come to 200 cal.; the total losses of heat on 100 kg of cane being $1620+405+200=2225$ cal. In a normal caloric consumption of about 36000 cal in steam per 100 kg of cane, this means a loss of about 6% of the total steam consumption.

These circumstances being very aggravating, it will be clear that only one sugar factory followed this process till now notwithstanding a big economy in a yearly purchase of lime-stone and coke.

The difficulties of this process are not the carbonisation of the concentrated thin-sap but in the preparatory treatment of the crude sap before this is admitted to the evaporators.

The main fact is that the crude-sap stays for too long in the preparatory treatment (about two hours), which causes a loss of heat of about 6% of the total needed calories for the whole process; then, combination of time (about two hours), temperature (from 100° C to 80° C after cooling off), and pH (values of about 7.5 and even 8.0) are of such a degree that an important decomposition of the reducing sugars must evolve; by these, quality of sap and sugars is of course very badly influenced.

Entirely modifying the preparatory treatment is therefore badly needed when the manufacturing process of the Neth. Patent No. 39,465 should be universally adopted.

The time wanted for sedimentation and circulation of the crude-sap can be suppressed entirely for the full 100% by relinguishing the method of extracting the impurities before the sap is admitted to the evaporators.

Temperatures cannot be changed a bit because the sap must reach the boiling point in any case in the first evaporator. This lasts only a few minutes, in contrary to the two hours needed for the defecation purification.

Besides by applicating the Neth. patent No. 39465 method the sap has to be passed through the evaporator too.

pH must be high in the defecation process when a decent decomposition is wanted with only a small quantity of crude-sap.

By relinguishing the separation of impurities before evaporation, an alcalic reaction is not wanted and pH can be fixed at such a value that neither decomposition of saccharose nor that of reducing sugars will take place.

According to the invention this process simply involves addition of a small quantity of an alkaline reacting stuff to the crude sap till a pH.-value that decomposition of saccharose or of reducing sugars will be kept to a minimum, or even avoided completely; after this, the sap will be ready for the multiple evaporator.

Till now it was the popular opinion that such a method should not have the slightest chance of success according to fouling of the tubes within a very short time, i. e. 24 or 48 hours—then heat transmission would be reduced to zero. (Neth. patent No. 39465, page 2, lines 62–75).

This statement involved the popular idea that the suspending elements would settle down very soon on the tubes.

By observing a lot of phenomena in sugar-factories it was concluded that this opinion was a mistake. Elements of insoluble stuff being fibres of cane-trash or crystals of precipitated salts etc. have no tendency of settling down on the tubes along which they are streaming.

Considerations from a chemical and technical point of view showed that incrustations on tubes originate from crystals which come into existence during the time the sap is flowing along the tubes. This was proved by the following observation. During a second carbonatation with a great delay of crystalization an 8" waste pipe was choked down within a few weeks to a 4" passage by layers of $CaCO_3$.

As soon as the delay of crystalization was stopped by grafting the sap which was to be carbonated with crystals already in existence no choking down of the tubes could be observed even during a four-month campaign, while at least the same quantity of suspending elements passed the tubes per time-unit.

From this, could be concluded that an evaporator should not foul quickly when crude-sap and precipitation were sent to this apparatus but besides this could be expected that the evaporator will grow dirty in a much slower degree, because the crystals always coming into existence during the evaporation process will not only precipitate on the tube pipes but also on the layers already present and so form an excellent base for crystallisation.

A test evaporation for this process was then put into practice. After 12 days' use the tubes were inspected and they were found completely clean.

After 23 days' use the transmission-coefficient practically did not change at all, therefore conclusion was right that the evaporation had grown less dirty in comparison to the purified sap obtained by the usual sap defecation where an apparatus had to be cleaned thoroughly after a 3 to 4 weeks' use.

According to the invention every preparatory purification of the crude-sap before submitting it to a concentrating process can be omitted now.

By this all losses are abolished connected inevitably to a preparatory purification; this result only is already a very important technical effect.

Besides a lot of apparatus included their pumps and pipes with their service and upkeep can be omitted, as two settlers, one defecation-pan and several recipients.

Finally the inevitable break down of reducing sugars during preparatory purification is avoided, therefore a considerable better quality of sugar will be obtained.

By putting this process into practice the normal evaporator had to be improved.

It is not necessary to change the tubes, but inlet- and outlet-pipes and casing conducts between the separate bodies had to be chosen with a wider passage.

Of course this depends upon the chosen size of the evaporator; further alterations are not necessary.

As a result of this new idea the proper sap-purification can be applied now to a concentrated, neutralized crude sap, which will give an entirely new aspect to the sugar-fabrication.

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