

NOVEL DESIGN OF A CONTINUOUS CENTRIFUGAL AND ITS OPERATIONAL BENEFITS

Irma Geyer*, Hans J. Schmidt

BMA Braunschweigische Maschinenbauanstalt AG, Am Alten Bahnhof 5, 38122 Braunschweig, Germany

Introduction:

Continuous centrifugals are in great demand in the sugar industry due to their smooth running and ease of operation. BMA continues to develop its tried and tested products. The new K3300 centrifugal combines innovative solutions for improved performance with enhanced ease of operation.

Optimized centrifugation concept:

The development of the new centrifugal with regard to improving performance focussed on achieving excellent technological results and, at the same time, increasing throughput. The two-step basket with patented slots and specific wash water addition as well as optimized massecuite distribution, are the crucial innovative features in the separation process. The newly designed basket (see Fig. 1) has a pre-separation and a main-separation step. Based on sound industry-specific experience, angles of 14° and 30° were defined. The upper basket diameter is 1300 mm. In the lower section of the basket, a large part of the syrup is separated from the crystals creating a uniform sugar layer in the main separation stage. Moreover, the entire basket shell is equipped with an optimal number of special, patented outlet openings, which ensure quick syrup discharge from the basket. Also, in the case of lower throughputs, this two-stage basket distinguishes itself with clearly improved sugar purity. Since the syrup need not be accelerated unnecessarily, depending on the massecuite quality, energy consumption can be reduced by up to 25%. This new basket therefore allows considerably increased throughput values to be achieved compared to conventional designs.



Fig. 1: Newly designed two-stage basket

Since continuous centrifugals are designed for use with highly viscous massecuite, efficient preparation of the massecuite is crucial. The new BMA centrifugal is equipped with a

Turbo3 product distributor. It allows direct mixing of steam and massecuite to reduce the massecuite viscosity, which helps to improve product distribution and the separation of the original liquor in the centrifugal. Using this product distributor and adding a small quantity of steam (e.g. 0.2% on massecuite), the massecuite can be heated up to 15K without dissolving the sugar. Furthermore, its optimized blades provide even more efficient processing and smoother distribution of the massecuite.

At the cane sugar factory Ingenio La Union S.A., Guatemala, low-raw products from different product distributors have been examined. Massecuite purity was between 59.5-61.5% and the Brix was 96-97. The massecuite was processed at a temperature ranging from 60-62°C/140-143.6°F. With its Turbo3 product distributor the new K3300 centrifugal with dry discharge achieved a throughput that was 10% higher compared to the standard distributor at a sugar purity of 85.4% (see Fig.2).

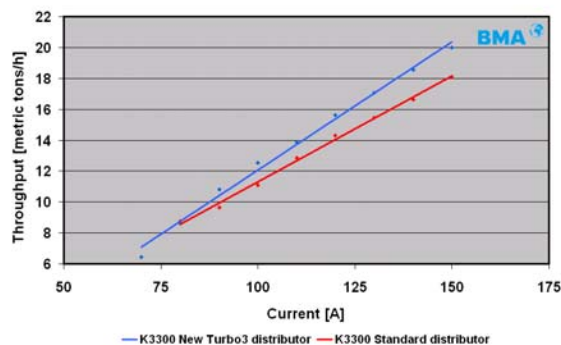


Fig. 2: Comparison of product distributors

A third innovation that improves centrifugal efficiency is the split spray nozzle lance that has 2 nozzles for the basket's bottom and up to 5 nozzles for the upper part. It allows the selective addition of wash water to the bottom and/or upper section of the basket according to the sugar quality. Therefore, the total amount of water is reduced, the output sugar quality is optimized and crystal losses are minimized at the same time.

Innovative design features:

The new continuous centrifugal's innovative design is not only easily visible, it also ensures a high standard of hygiene. Several centrifugals may be installed in a centrifugal station showing a smooth surface without gaps. Furthermore, even in the standard version, all components in contact with the sugar crystals are made of stainless steel. Optionally, an all-stainless steel version is available (see Fig. 3). Its low height of about 1,000 mm (~40") provides easy accessibility without additional steps and the compact design allows for simple substitution of old machines.



Fig. 3: Compact design in stainless steel

The K3300 is available with dry discharge or with an integrated melting or mixing device. This solution is particularly cost effective as it makes sugar screw conveyer and downstream melting tanks redundant.

One main aspect in designing this centrifugal was the safety and reliability of operation. All important components have undergone FEM analysis to ensure high safety. The water and steam supply is centrally located and clearly marked to prevent any wrong alignment and enable fast and easy installation. Furthermore, the distributing valves are protected against undesired contact and are also clearly marked. Water and steam hoses are substituted by stainless steel piping to further enhance the availability of the centrifugal.

High degree of automation:

Apart from cost savings, automation also improves process reliability. In the case of the K3300, massecuite, wash water as well as mixing or melting medium feed are controlled either electro-pneumatically or by inductive flow meters. Furthermore, the machine disposes of vibration monitoring and V-belt tension sensors, which can be monitored on the local operator panel. The controllers can also be supplemented by a Profibus DP connection to a higher-level process control system. The idea of “plug & play” has been implemented for the whole centrifugal. The machine is prewired and tested at the BMA workshop prior to shipping.

Long service life:

Moreover, very high availability at correspondingly low costs is obtained thanks to a minimized number of wear parts, the use of long-life components and low maintenance requirements owing to the compact and easy-to-survey design.

The pre-separation step of the basket is equipped with a long life wedge wire screen liner. Since the major part of the syrup is separated there, the screens in the upper basket stage are also subject to lower wear and their longevity is significantly enhanced. Furthermore, in case of maintenance, the screens are quickly and easily replaced as they are fixed by a clamping ring system. Another often time-consuming part of maintenance is omitted thanks to the intelligent new rubber buffer concept. It incorporates a reduced number of buffers, which are all located outside the heat affected area. On the one hand, this enhances their lifetime significantly and, on the other hand, replacement is done in a fraction of the time formerly needed as it can take place without waiting for the machine to cool down.

Operational experience:

At the sugar beet factory in Toury, France, the separated sugar is mixed with thick juice in the centrifugal (with a dry substance content of 66-68% and a purity of 93%) and partially melted. Complete melting takes place in a downstream melting tank. The centrifugal is equipped with a Turbo3 product distributor. High raw product with a purity of 87-88% and a temperature of about 75°C (167°F) could be very well separated in the two-stage basket. The result showed a throughput of 40.9 metric tons per hour and a dry sugar purity of 98.14%. Likewise, very promising results were obtained in Guatemala, where low raw cane massecuite with a Brix of 95.2 and a purity of 59.5% was processed. The centrifugal achieved a throughput of 18.9 metric tons hour with a purity of 85.4% (see Fig. 4).

	Toury, France	La Union, Guatemala
Product		
Massecuite	High raw beet	Low raw cane
Brix	91.9	95.2
Purity [%]	87.8	59.5
Conditions		
Temperature [°C/°F]	75/167	60/140
Current [A]	120	150
Water [% on massecuite]	3.0	8.4
Steam [% on massecuite]	0.1	0.4
Results		
Throughput [mt/h]	40.9	18.9
Dry sugar purity [%]	98.14	85.4
Color [420nm]	833	n.a.
Brix of run off	80.5	85.8
Purity of run off [%]	76.41	41.3

Fig. 4: Test results in France and Guatemala

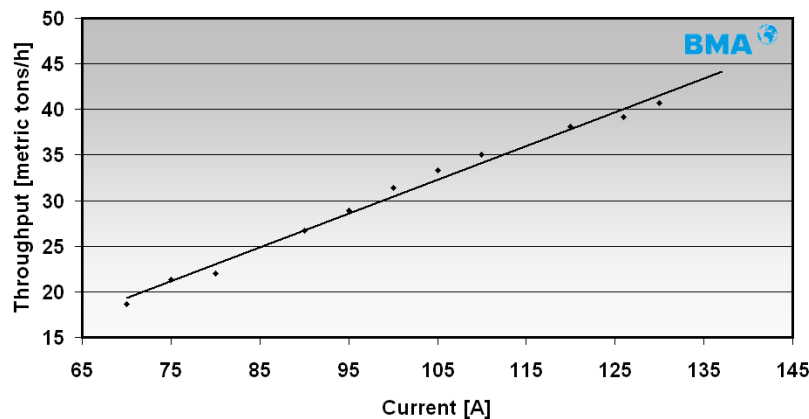


Fig. 5: Throughput depending on current, results of Toury, France

Summary:

In continuous centrifugation, the BMA K3300 sets a new benchmark in terms of operational reliability, process stability and economic efficiency. The results from high raw beet massecuite processing demonstrate that the K3300 meets the requirements for high throughput and simultaneously high product quality.