# Glucose syrup clarification by ceramic tangential flow filtration

## Glucose syrup

Glucose syrup is a versatile ingredient widely used in the food and beverage industry as a sweetener, bulking agent and humectant. In industrial scale production, hydrolysis is the initial step to transform starch from varied sources into glucose. Hydrolysis is subsequently followed by a series of separation techniques to obtain the desired level of purity and concentration.

Ceramic membranes with different channel geometries produced by TAMI Industries

## Ceramic Tangential Flow Filtration (CTFF)

There are multiple separation techniques that can be employed in the purification of glucose syrup, and ceramic tangential flow filtration (also known as Ceramic Crossflow Filtration) is the ultrafiltration process that combines the unique properties of the ceramic material and the advantages of tangential flow filtration to deliver a high-quality separation in a stable and reliable operation.

Ceramic membranes can resist high temperatures and extreme pHs due to their robustness by nature. In addition, ceramic membranes have a longer lifetime compared to polymeric membranes as a result of the significantly higher overall resistance. These properties not only allow ceramic membranes to operate at extreme conditions, but more importantly allow them to be thoroughly cleaned after each production cycle to eliminate any presence of biological contaminants. The cleaning of the CTFF unit at high temperatures and appropriate sanitation agents also ensure the regeneration of the initial filtration capacity after each cleaning cycle.

## Replacement of the rotary vacuum drum filter

Company A, a leading global supplier of glucose syrup, had started the studies to build a new production plant. The goal of making it more efficient and environment friendly than their previous sites put one separation techniques under scrutiny, the rotary vacuum drum filter (RVDF). This is when SIVA introduced to Company A the working principle and the features of CTFF to replace the RVDF.

The key disadvantages of RVDFs tackled by Company A and the answers presented by CTFF were:

- Low filtration quality; impurities in the permeate contaminate and reduce the lifetime of ion exchange resin => ceramic membranes present a uniform distribution of pore sizes that ensure a steady separation quality and the removal of suspended solids.
- The operation is not stable; difficult to reproduce the quality because it varies according to the skills of the operator => in CTFF, the quality of the separation is stable. The high level of automation makes the quality reproductible by any operator trained to manage the unit.
- Need to manage the stock, refill and discharge the precoat filter medium => CTFF does not require the use of filter mediums and ceramic membranes are not consumables. This eliminates the need to consume and handle non-renewable materials such as diatomaceous earth and perlite.

Company A was convinced by the technological advantages of CTFF compared to RVDF and was immediately interested in adding it to their purification process. The key benefits considered were the stable separation process at steady quality and the minimal need for manual interventions, both due to the absence of consumables and the high level of automation.

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## Pilot test and design

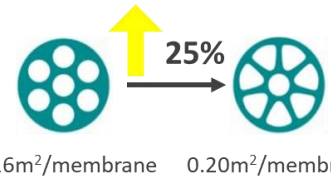
After confirming that CTFF would be a good fit for Company A, SIVA planned and performed the pilot test on site to compare the filtration performance of different ceramic membranes, testing different membrane geometries (channel hydraulic diameters) and pore sizes on a wide range of products under different operating conditions.

SIVA's pilot unit for seven ceramic membranes used during the tests

Once the data needed for the scale-up was acquired, SIVA conducted different simulations and engineering studies to identify the most economic CTFF configuration taking into consideration the specific requirements of Company A, such as the need to filter products of different DEs, working hours and variable shift patterns, space constraints and the option to reduce the hourly filtration capacity as needed.

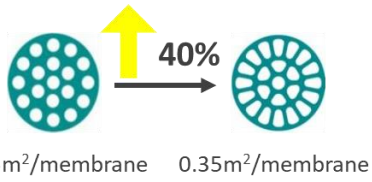
The solution proposed by SIVA was a compact CTFF unit equipped with TAMI Industries' INSIDE CéRAM non-circular channel ceramic membranes.

The use of non-circular channel ceramic membranes supplied by TAMI Industries allowed SIVA to install between 25% to 40% less ceramic membrane elements than it would be necessary if using circular channel ceramic membranes.




7-channel circular vs. 8-channel non-circular ceramic membrane

This has reduced the total cost of the CTFF unit, as a compact unit means the use of less piping, instruments, welds, and accessories compared to a larger unit. To complete the proposal, SIVA has developed a personalized automation program based on +20 years of experience and hundreds of CTFF projects delivered around the world.




19-channel circular vs. 23-channel non-circular ceramic membrane

## Construction and start-up

To ensure and closely monitor the construction quality, the CTFF unit was entirely designed and built at SIVA's workshop in Nyons, France. The unit was tested with water before its shipment, in the presence of representatives from Company A at SIVA. Once delivered, engineers from SIVA assisted Company A on site in the installation of the CTFF unit, tests with water, the start of the production and the training.

## Feedback from Company A

The CTFF unit built by SIVA delivered the promised quality and operational performance expected by Company A.

The high level of satisfaction with the first unit was soon confirmed by the order of a second CTFF unit, for a new production plant under construction.

Glucose syrup clarification unit with TAMI Industries' ceramic membranes at SIVA

Company A was positively surprised by the pragmatic approach of SIVA to design and deliver a CTFF unit optimized for their specific needs. But above all, Company A appreciates the continuous after sales support and the reactiveness of SIVA in proposing solutions and assisting them whenever the CTFF unit needs to be optimized for a new product; providing them with personalized recommendations from someone who thoroughly understands their specific CTFF unit instead of generic and standard answers.

## Related articles:

- What is Ceramic Tangential Flow Filtration and how it works

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