

FRONTROL - Tereos Case Study

We asked some questions to Luciano Rangel, who is the engineer responsible for the implementation of advanced process control in two ethanol and sugar plants in Brazil, about the application of APsiControl (APC), which is the version of the system from Frontról used in Brazil. Initially his short Résumé is presented.

Luciano Rangel

Company: Tereos

Position in the Company: Process Specialist

Short Résumé: Graduated in Electrical Engineering (UFTM), Computer Engineering (UNIUBE), Systems Analysis and Development (IFTM), Mathematics (UNESP Rio Preto). He also holds an MBA in Project Management (FGV) and a Master in Advanced Process Control. He has been working with industrial automation at Tereos since 2015. As a process specialist, he has already implemented solutions involving plant information management system (PIMS), advanced process control (APC), real-time optimization systems (RTO). He is currently working in digital transformation and issues related to Industry 4.0.

What is his opinion about the application of APC to control the density of the ethanol distillation column?

We know that more than 90% of our industrial process is controlled through PID type controllers which have good performance combined with its simplicity. However, some parts of the process are often difficult to achieve good efficiency just using traditional PID control. For example, processes with nonlinear characteristics, with high dead time, multiple inputs and multiple outputs, equations that are difficult to estimate, or with wide operating ranges.

In distillation columns, all these items can be present, and that makes it unfeasible to use PID controllers. It is necessary to go to the top layer and use alternatives such as fuzzy control to operate the process more efficiently. We chose to use fuzzy logic to control density, wine flow, column level and pressure.

Regarding the deployment of the APC system, what did you notice in terms of infrastructure needs and deployment time?

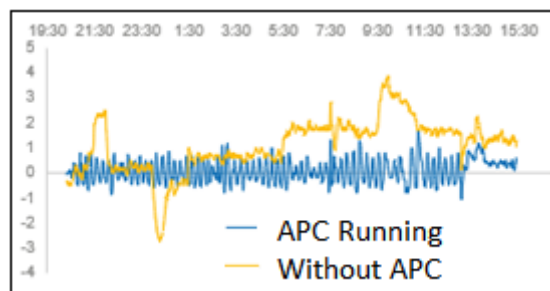
After the infrastructure implementation, and the creation of the logics, which are usually done by the plant automation specialist, the whole implementation lasts for 1 week, and then, another 2

weeks, for tuning control parameters and training the operators. The involvement of the operators and the managers is essential, as at the end they are the ones who will use the tool.

Would it be possible to measure the reduction of the process variability and the steam savings after the implementation of the APC?

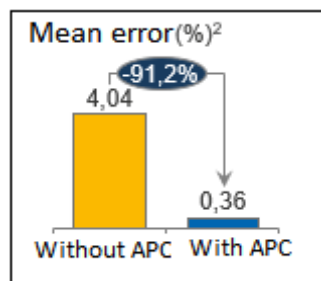
The use of advanced control in the distillation columns brought positive results with important reduction in the process variability and higher ethanol production.

Data were evaluated between 09/01/2020 and 11/20/2020 to which the advanced control was applied to the columns at different times. The error was calculated by the percentage difference between the setpoint and the process variable. It can be seen in the figure below that the control error is smaller when the advanced control system is enabled.



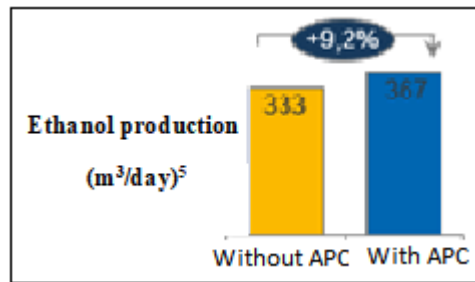
Temperature control error of the input wine of the distillation column 1.

As shown in the figure below, the average control error was also 91.2% lower when the APC was enabled.



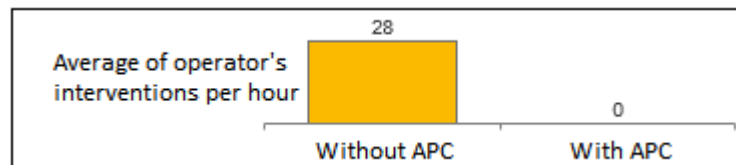
Mean error of the control loops

Ethanol production was 9.2% higher when the APC was running in the plant, as shown below.



Increase of the ethanol production

It also contributed to reducing the number of operator interventions in the process. The reduction was from 28 interventions per hour to no one intervention.

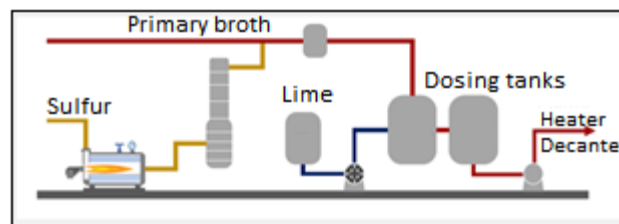


Reduction in the number of interventions

Describe your experience with the application of APC to control the pH of dosed broth.

APC was also applied to pH control of sugar dosed broth in the Tereos sugar mills UICA and UIM, in São Paulo, Brazil

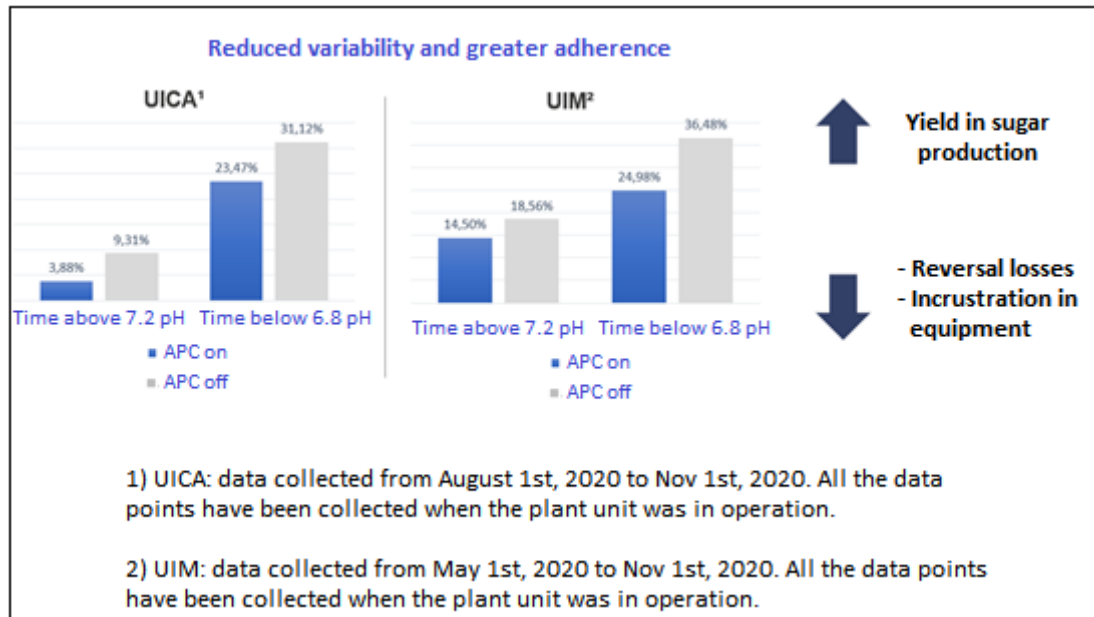
Goal: Reduction of the variability of the dosed broth pH.



The proposed method allows the integration of the control loops, predicting disturbances and resulting a stable and efficient process.

An important variability reduction was obtained for the dosed broth pH in the Tereos plants of UICA and UIM, as shown in the figure bellow.

Performance analysis of the APC of the dosed broth.



What is your opinion regarding the contribution of the APC to the implementation stage of the industry 4.0 process at Tereos?

The industry 4.0 program projects bring returns on one of the three pillars: cost reduction, experience gain, and safety. About advanced control, we have seen a reduction in process variability that results in operating closer to the restrictions, that is, we are able to make more use of the asset capacity and thus reduce the cost of utilities, such as steam, and water, and this brings a very high added value to the operation. We consider that, every plant must have advanced control and we are looking forward to implementing it in all of them.