

Process Simulation in research labs and educational activities

(MAX 500 words)

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Process simulation software designs equipment, simulates operations, optimizes a plant's configuration (heat exchangers network, for example), estimates operating and capital expenses. Simulation tools are increasingly used not only in engineering companies but also in experimental research laboratories. Furthermore, the same software can be used in innovative teaching methodologies with excellent results.

The coupling between experimental activity and process simulation allows to identify the best thermodynamic and / or kinetic model for the representation of the studied processes, the cross-check between the experimental data and the calculation result and a significant decrease in the experimental tests necessary for the verification of a theory or for the optimization of a new process. The use of process simulation in experimental research on a laboratory scale opens the possibility of optimizing the bench scale plants that will be used for data collection on which to build new models and new process schemes, and therefore represents the first phase of the modern scale up.

Concerning the educational impact of these software, the use of virtual immersive laboratories is an appealing and synergistic possibility for education in science, technology and engineering, complementary to experimental activities performed in laboratory or exercises delivered in traditional rooms.

A new educational project, called Eye4edu, proposed different exercises on a virtual immersive Crude Distillation Unit (VCDU), with the aim to apply an active scenario for the learning of the structure of the single unit operations, the whole plant and the control and intervention operating procedures. The project was proposed to the bachelor and master students for the degree in Industrial Chemistry in the Milan University in the years 2019 and 2020.

VCDU is based on the combination of the action of "Aveva XR for Training", formerly Eyesim, and Dynsim software, from Aveva Company, for the physical representation and the dynamic chemical behaviour of the plant.

Several exercises on the plant were proposed to the students both for practical and management operations in the plants. The students were required to work on the basis of the information available in the technical documents as PFD and P&ID. The project was proposed both in the presence and as distance learning, respectively before and during the health emergency due to SARS-CoV-2 pandemic. The description of the virtual laboratory and an analysis of its use and educational impact in face-to-face and remote delivery is reported in this contribution.