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SOFTWARE REVIEW

Software for Drying/Evaporation Simulations: Simprosys

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Although drying competes with distillation as the most energy-consuming unit operation, development of drying-related process simulation software has almost been completely neglected while several major distillation-related process simulation software packages have been developed and widely used in industry and academia over the past 20 years. Drying is essentially a heat/mass exchanger. While conventional heat exchanger design and analysis packages have been marketed for over two decades and used extensively in industry and academia for teaching and design, this has not been the case of dryers.

Drying-related process simulation requires intensive calculations of not only the states of moist gas for convective dryers, which constitute over 90% of all industrial dryers, but also special state variables such as wet-bulb temperature and absolute and relative humidity. Due to the nonlinearity and complexity of these calculations, humidity charts were developed a century ago and have been widely used. It is obviously inadequate in this electronic age for engineers and university students to still hold a ruler on humidity charts to measure and read data for drying-related calculations, however.

Simprosys, perhaps one of the first drying-centered process simulation software, is now available from Simprotek Corporation (www.simprotek.com). It is designed specifically for drying- and evaporation-related process simulations. With Simprosys, engineers and university students are relieved from the complex calculations needed for design, analysis, and parametric evaluations of various drying and evaporation equipment.

The user-friendly Simprosys 1.0 software package includes 19 unit operations, namely, solids dryer, liquid dryer, cyclone, air filter, bag filter, electrostatic precipitator, wet scrubber, scrubber condenser, fan, compressor, steam jet ejector, pump, valve, heater, cooler, heat exchanger (which can be used as an evaporator), liquid-vapor separator, mixer, and tee. It also includes a logical unit operation, *viz*. recycle, to simulate recycled gas or material stream. In addition to heat/mass/pressure balance calculations in all the unit operations, Simprosys contains a simple dryer scoping model, a detailed cyclone rating model, and simple as well as complex heat exchanger rating models for single-phase heat transfer. Also included in Simprosys 1.0 are two utilities, *viz*. humidity chart and unit converters. The humidity chart utility can be used to visualize either the state of a drying gas or an isenthalpic drying process. The unit converter utility covers all engineering units.

Since different units may be used in different countries, Simprosys has a complete unit conversion system. Users can convert the inputs and outputs of a large flowsheet from one set of units to another with just one click.

This software can be used to simulate a drying process, an evaporation process, or a combined evaporation and drying process. Using the unit operations provided by the software, users can construct any drying- and evaporation-related processes they wish to model, design, and analyze. They can also explore different arrangements of unit operations and experiment with different operating conditions to optimize their designs and operations. It can simulate not only almost any typical drying- and evaporation-related process but also recycled exhaust gas stream and product material stream in a drying process.

Engineers can use this software package to design drying- and evaporation-related plants. Based on design requirements, they can quickly layout the heat/mass/pressure balance calculations using this software and obtain the necessary process parameters such as the air flow rate of a dryer, the capacity and power input of a fan, the heating duty of a heater, etc. They then can choose equipment according to the simulation results. They can also simulate existing plants by easily laying out their plants on a flow sheet and input the operating conditions of the plant and see whether their operation is efficient or not. Then they can try different operating conditions and optimize their operation.

University professors will find this software an efficient tool for undergraduate and postgraduate projects in chemical engineering/unit operations/food engineering and related courses. With this software package, students can do what-if analysis, which otherwise would take an unrealistically long time to accomplish. It can also be used as a

teaching tool to show students the effects of input parameters on the output parameters for a typical plant. Since drying is an interdisciplinary operation found in almost all industrial sectors, this software should be very useful to many engineering and applied science disciplines in academia as well as industry.

Simprosys is extremely user-friendly, with an intuitive user interface. It is provided with maximum protection to prevent users from making simple mistakes. It also has an effective tutorial to teach users step-by-step how to use the software to simulate typical drying and evaporation related processes. Users of this software will require minimal self-training and effort to use it effectively.

This reviewer recommends potential users from industry as well as academia to test this software for their needs. It is a helpful instructional tool for courses in unit operations, mass transfer, design projects, etc. Consulting engineers, dryer designers, and vendors, as well as process/produc-production engineers will find it to be of immense value in simplifying their engineering calculations. With appropriate parametric studies and what-if calculations, one can use this software for optimization of operating conditions of dryers. Overall, it is a very useful and timely software package of special interest to both academic and industrial readers of this journal.