

Part I: Use the solver block to simulate a variety of plant situations

In ProTreat®, it is possible to automatically manipulate the variable within any block to obtain a desired result in a material stream using a Solver block. The Solver will change the variable specified by the user in a block through a user defined range until the target variable in a material stream is within the error tolerance specified. The Solver has a variety of possible uses. For example, a plant engineer in the amine unit has been informed that the feed gas composition is going to increase in H₂S concentration and they need to know what solvent flowrate would be needed to meet the treated gas specification.

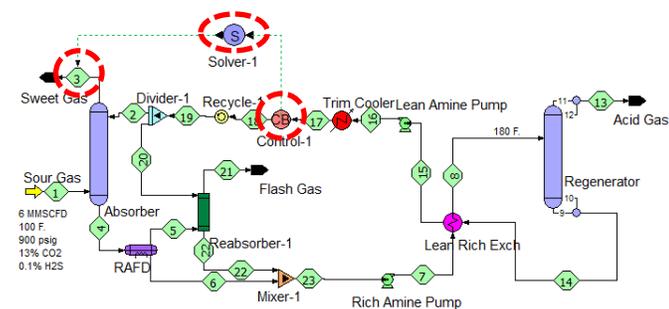


Figure 1 – Determining solvent flowrate to meet treated gas specification

In this case (Figure 1), the input (or block connection) to the solver would connect to the Control block and the output (or stream connection) would connect to Stream 3. The Solver would then iterate within the user specified range of flowrates until the sweet gas was within tolerance of the specified target value.

Another critical application of the Solver block is in the ProTreat® Sulphur Plant model. As discussed in the last issue of ProTips™, the Solver block is used in conjunction with a Flow Multiplier to model the Air Demand Analyser (ADA) feedback control loop (see Figure 2). The inlet to the Solver would connect to the Flow Multiplier and the outlet would connect to the tail gas stream (typically the outlet of the last sulphur condenser), or wherever the user wants to control the ratio of H₂S:SO₂. The Solver would then adjust the multiplier value on the combustion air to the reaction furnace until the H₂S:SO₂ ratio in the stream being controlled is within tolerance of the user specification.

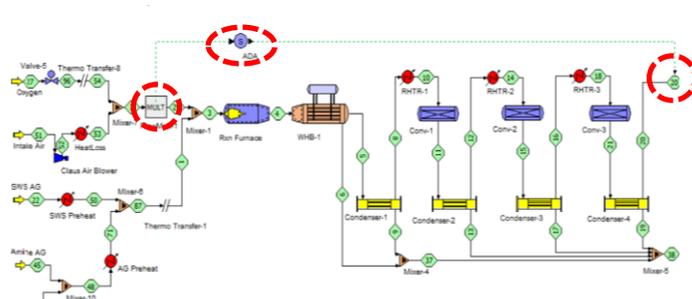


Figure 2 – Determining the flowrate of combustion air to meet a specified H₂S:SO₂ ratio in the tail gas

Another application for the Solver block is to determine the amount of steam required (or reboiler duty) in an amine regenerator column reboiler to obtain a specific acid gas loading in the lean amine. To do this, the input to the Solver would connect to the regenerator column and the output would connect to the lean amine stream leaving the regenerator (Figure 3). The Solver varies the reboiler steam (or duty) until the target lean amine acid gas specification is satisfied.

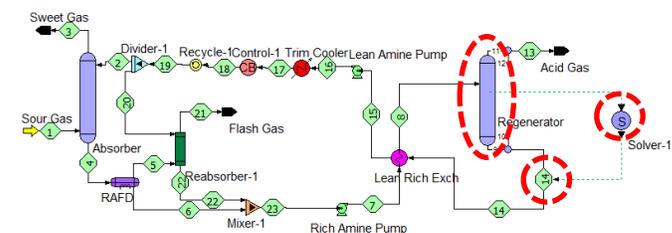


Figure 3 – Determining the steam flow to the reboiler (or duty) to meet a lean amine acid gas loading

PROTIP: The Solver block uses interpolation to meet the target specification. There are three interpolation methods available in ProTreat®; interval halving, linear, and quadratic. It is good practice to manually determine what the upper and lower bounds are before feeding them to the Solver to calculate automatically. To do this, disable the Solver and input the upper and lower values into the block being manipulated to ensure the solution is within the bounds. If the solution is not within the specified bounds, the Solver will be unable to find a solution.

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