

Extended Homework Project, Part 1  
due October 16, 2007

The objective of the extended homework project is to demonstrate your ability to apply material and energy balances to a more complicated overall process. Quizzes have tested individual concepts; this assignment will assess combining many concepts together within an overall solution to a problem.

The project involves a modification to the process described in chapter 4 problem 38 of Felder Rousseau. Specifically,

- Each group will consider a different mass of leaf fed to the first mixing tank (step 1 in the problem description).
- Each group will consider a different amount of extraction solvent fed to the third mixing tank (step 3 in the problem description).
- The extraction product stream that contains drug (D), ethanol (E), and solvent F (step 5 in the problem description) will be considered further in the project. Specifically, the drug D will need to undergo a reaction and purification in order to make the final product. (See below.)
- The mass of drug will be taken into account to enable the reaction to be analyzed properly. An average yield of (1 kg drug/1000 kg leaf) should be used to estimate the amount of drug that is available.

The following steps are added to the process:

7. The extract product stream from the extractor (step 5) is fed to a reactor. There it mixes with a stream containing another reactant G, which is present at 10 mass% in solvent F. The G and drug are required in a 1:1 mass ratio. Reaction conditions and specifications will be provided in a later handout.

8. The reactor products are cooled in a crystallizer, and most of the drug precipitates out. (The reaction changes its solubility.) The two products are the solid drug and the filtrate. Each group will consider a different filtering temperature (and thus a different drug recovery efficiency.)

9. The drug is dried by passing an air stream over it to remove residual solvents E and F. The outlet air stream is passed through a flare to burn the E and F, with the heat used elsewhere in the process.

The first part of the project involves **drawing and fully labeling a flowsheet**. Reminder: this means that flow rate and mass (or mole) fraction variables must be present for all streams and compounds. Incorporate both the 4.38 problem and the new steps into your flowsheet.