

CHEMICAL PROCESS CALCULATIONS

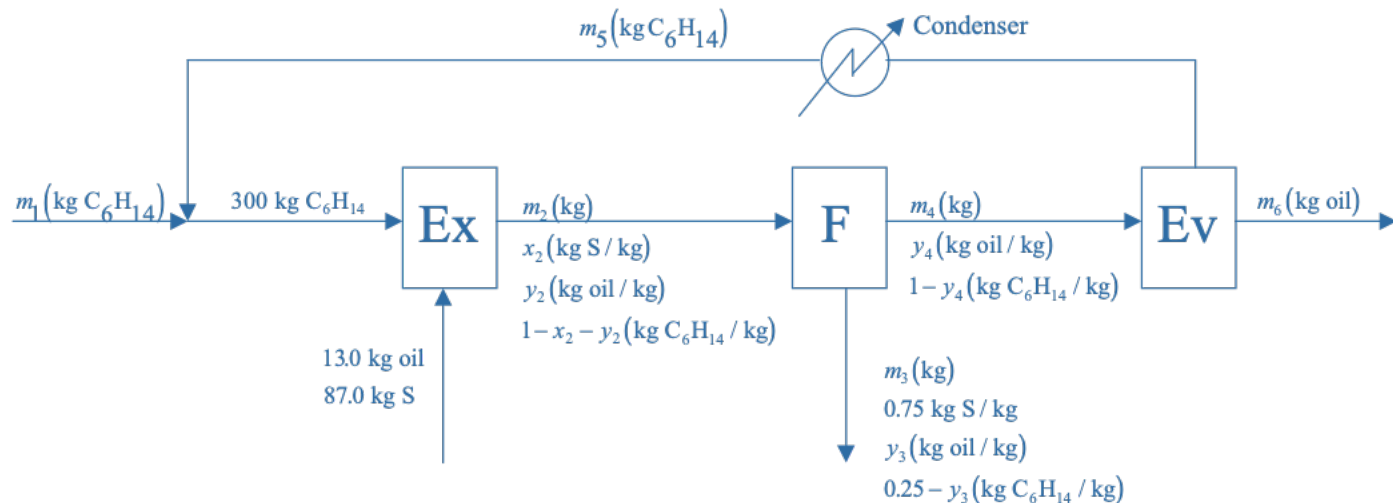
(Reactive process balance)

Lecture # 17: October 31, 2022

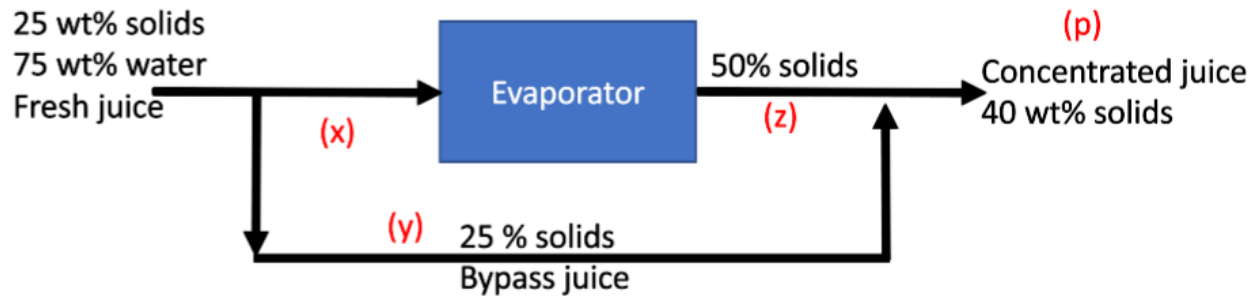
PART A

1. In the production of a bean oil, beans containing 13.0 wt% oil and 87.0% solids are ground and fed to a stirred tank (the extractor) along with a recycled stream of liquid n-hexane. The feed ratio is 3 kg hexane/kg beans. The ground beans are suspended in the liquid, and essentially all of the oil in the beans is extracted into the hexane. The extractor effluent passes to a filter. The filter cake contains 75.0 wt% bean solids and the balance bean oil and hexane, the latter two in the same ratio in which they emerge from the extractor. The filter cake is discarded and the liquid filtrate is fed to a heated evaporator in which the hexane is vaporized and the oil remains as a liquid. The oil is stored in drums and shipped. The hexane vapor is subsequently cooled and condensed, and the liquid hexane condensate is recycled to the extractor.
- a) Draw and label a flowchart of the process, do the degree-of-freedom analysis, and write in an efficient order the equations you would solve to determine all unknown stream variables, circling the variables for which you would solve. **(2+4+2)**
 - b) Calculate the yield of bean oil product (kg oil/kg beans fed), the required fresh hexane feed (kg hexane/kg beans fed), and the recycle to fresh feed ratio (kg hexane recycled/kg fresh feed). **(1+1+1)**

a. Basis: 100 kg beans fed



Basis: 100 kg of fresh juice fed to the process.



Fraction of juice that bypasses evaporator in percent = **25 %**

The amount of concentrated juice obtained finally is (p) = **62.5 kg**