



UNIVERSITY OF GHANA

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FACULTY OF ENGINEERING SCIENCES

DEPARTMENT OF FOOD PROCESS ENGINEERING

B.Sc FIRST SEMESTER FINAL EXAMINATION, 2013/2014

FPEN 201: INTRODUCTION TO FOOD PROCESS ENGINEERING

ANSWER FOUR (5) QUESTIONS

TIME: 2½ HRS

1. (a) Show with the aid of separate flowsheet diagrams, recycling, bypassing and purging. Explain with one sentence each, the purpose of each process.

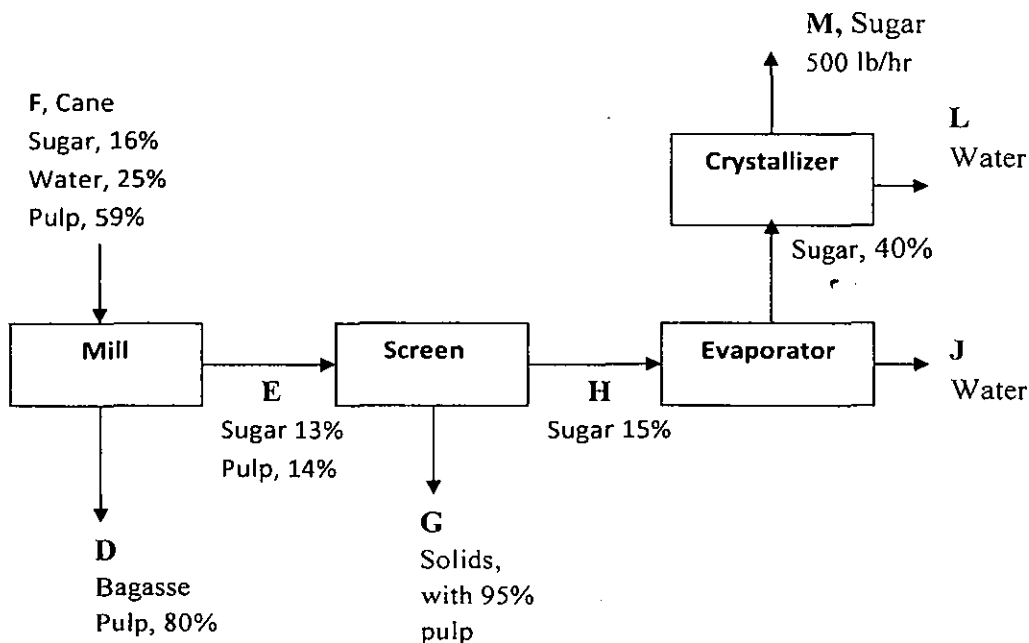
(b) A cereal product containing 65% water is made at the rate of 1000 kg/hr. You need to dry the product so that it contains only 25% water. How much water has to be extracted per hour?
2. A solution of common salt (of molecular weight 58.5) is prepared by adding 20kg of salt to 100kg of water to make a liquid of density 1323kg/m^3 . Calculate the concentration of salt in this solution as a
 - (a) weight fraction
 - (b) weight/volume fraction
 - (c) mole fraction
 - (d) molal concentration
3. The process for producing dried mashed potato flakes involves mixing wet mashed potatoes with dried flakes in a 95:5 weight ratio, and the mixture is passed through a granulator before drying on a drum dryer. The cooked potatoes after mashing contained 82% water and the dried flakes contained 3% water. Calculate:
 - (a) The amount of water that must be removed by the dryer for every 100 kg of dried flakes produced.
 - (b) The moisture content of the granulated paste fed to the dryer.
 - (c) The amount of raw potatoes needed to produce 100 kg of dried flakes; 8.5% of the raw potato weight is lost on peeling.

4. A water solution containing 15% acetic acid is added to a water solution containing 30% acetic acid flowing at the rate 35 kg/min. The product P of the combination leaves at the rate of 100 kg/min. For this process

- Determine how many independent balances can be written
- List the names of the balances
- Determine how many unknown variables can be solved for and state them
- Determine the composition of P

5. A simplified flowsheet for the manufacture of sugar is shown below. Sugarcane is fed to a mill where syrup is squeezed out, and the resulting 'bagasse' contains 80% pulp. The syrup (E) containing finely divided pieces of pulp, is fed to a screen which removes all the pulp and produces a clear syrup (H) containing 15% sugar and 85% water. The evaporator makes a 'heavy' syrup and the crystallizer produces 500 lb/hr of sugar crystals

- Find the water removed in the evaporator, lb/hr
- Find the mass fractions of the components in the waste stream G
- Find the rate of feed of cane to the unit, lb/hr



6. A spray drier used to dry egg whites produces 1000 kg/h of dried product containing 3.5% moisture from a raw material that contains 86% moisture.

- If air used for drying enters with a humidity of 0.0005 kg water per kg dry air and leaves the drier with a humidity of 0.04 kg water per kg dry air, calculate the amount of drying air needed to carry out the process.