CHEMICAL CONTROL

(ANSI Sugar Tech. Third Year)

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Pol Balance

- The purpose of Pol Balance is to find out the amount of sugar losses during sugar mfg.
- There is always a difference between to be accounted for and actual account.
- This difference in the account is called unknown loss.

Type of losses

- There are two types of losses .
- Known losses: In Bagasse, In Final molasses and Filter cake.
- unknown losses: These are Chemical loss and Mechenical loss.
- Chemical loss take place as result of decomposition of sugar due to inversion.
- Mechenical losses take place due to entrainment and through leakages.

- The sugar present in cane is distributed as following:
- Sugar in cane
- Sugar in Mixed juice
- Sugar in Filter cake
- Sugar in Molasses
- Sugar in sugar
- Unknown sugar loss

- Sugar in cane = sugar in bagasse+ sugar in MJ
- Sugar in MJ= sugar in FC+ sugar in FM+Unknown loss.
- Unknown loss = sugar in MJ- sugar in FC-sugar in FM-sugar in sugar
- Total losses = sugar in bag.+ sugar in FC+sugar in FM+ unknown loss
- Total losses =Sugar in cane-sugar in sugar

- Unknown loss = Total loss- unknown loss.

Brix Balance

- Brix in CJ%cane = Brix in molasses % cane + Brix in sugar % cane
- Brix in CJ % cane = $\frac{\text{Pol in CJ \% cane X 100}}{\text{Purity CJ}}$
- Pol in CJ % cane = Pol in CJ % cane – Pol in FC % cane
- Brix in sugar % cane = $\frac{\text{Brix \% sugar X Reco.\%cane}}{100}$

- Brix %sugar = 100- Moisture % sugar
- Total Brix = brix in FM % cane + brix in sugar% cane
- Brix loss = brix in CJ% cane-Total brix
- If bx in CJ %cane is greater than total bx ,then there is bx gain. It is due to inversion or wrong weighment or due to wrong analysis or both.

- If bx in CJ% cane is less than total bx, then there is bx loss. It is due to mechanical loss or due to entrainment or slippage of juices.

Brix increases on inversion

- In the inversion each molecule of sucrose splits in to one molecule of glucose and one molecule of fructose, at the same time consuming one molecule of water. Due to the inversion process, the density of sugar solution increases causing a considerable changes in the Brix Value
- Sucrose + water = glucose +fructose.

Non Sugar Balance

- For the same reason as mentioned in bx balance is done for NS balance.
- NS in CJ%cane = NS in sugar %cane + NS in FM%cane
- NS in CJ%cane = Bx in CJ%cane – Pol inCJ%cane
- Pol in CJ%cane = Pol in MJ%cane-Pol in PC%cane
- NS in sugar %cane = bx % sugar - Pol % sugar

- NS in FM%cane = bx % FM - Pol % FM

- If gain in NS which indicate the decomposition of sugar due to inversion.

- If loss in NS it indicate the mechanical loss due to entrainment or slippages of juices.
- Crystal Balance :- It is the balance between available crystallisable Pol in clarified juice%cane and in sugar %cane .
- available crystallisable Pol in clarified juice % cane = Pol in clarified juice %cane – Non sugar in clarified juice % cane x $\frac{M}{100-M}$
- Where M = FM purity
- Avai. Cryst. Pol in sugar%cane = Pol in sugar%cane – NS in
- sugar%canex $\frac{M}{100-M}$

- If crystal loss is more than unknown loss. It is due to inversion after clear juice stage in process.

Time Account

- For time account date of start and date of close with time has to be mentioned in record.
- A) Date of Start the season ----------
- B) Date of close of season ----------
- **Gross season days :-** The total number of days from the date of start to date of close the season is also mentioned .
- **Total hours loss : -** This loss due to the following
  - a) Cane shortage
  - B) General cleaning
  - C) Mechanical + Electrical
  - D) Process
  - E) Miscellaneous
- **Total gross hours** :- It can also be calculated.
- **Total hours for actual crushing:-**
- Total gross hrs -- Total hrs lost

- **Hours loss% Hrs. Available**:- This figure should not more than 10%.
- = Total hrs lost x100
- Total hrs available
- **Duration of season**:- Total hrs actual crushing/22
- **Rate of crushing**:- 1) Inclusive stoppage = Total cane crushed x24
  Total hrs available
  2) Exclusive stoppage = Total cane crushed x24
  Actual hrs crushing
- It is also calculated on 22 hrs per day basis.

Capacity Utilisation

- Capacity utilisation measures the extent to which a business is using its production potential.
- Capacity utilisation can be defined as - **the percentage of total capacity that is actually being achieved in a given period**
- Capacity utilisation (which is traditionally expressed as a percentage) is calculated using this formula:
- Capacity utilisation is an important concept because:
- - It is often used as a measure of **productive efficiency**
  - Average production costs tend to fall as output rises – so **higher capacity utilisation can reduce unit costs**, making a business more competitive
  - So firms usually aim to produce as close to full capacity (100% utilisation) as possible

- It is important to remember that increasing capacity often results in higer fixed costs. A business should aim to make the most productive use it can of its existing capacity.
- The investment in production capacity is often significant. Think about how much it costs to set up a factory; the production line with all its machinery and technology.

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- So firms usually aim to produce as close to full capacity (100% utilisation) as possible
- Is there an ideal level of capacity utilisation? The answer is – it depends!
- There are several reasons why businesses operate at less than 100% capacity utilisation:
- ***Lower demand:***
- General reduction in overall market demand
- Loss of market share
- Seasonal variation in demand
- ***Increase in capacity not yet matched by increased demand:***
- Possibly new technology introduced
- Provide some "slack"

- ***Inefficiency (a problem = less competitive unit costs)***
- Poor maintenance, quality, employee disruption
- When a business is operating at less than 100% capacity, it is said to have "**spare capacity".**
- Sometimes spare capacity is not the problem – a business finds itself with **excess demand** (i.e. it cannot produce enough to meet demand). In such circumstances, what can it do to operate at higher than 100% normal capacity? It can often:
- Increase workforce hours (e.g. extra shifts; encourage overtime; employ temporary staff)
- Sub-contract some production activities (e.g. assembly of components)
- Reduce time spent maintaining production equipment
- However, there are some potential pitfalls with operating at very high capacity (i.e. around 100%):

Stock Taking

- During the periodical shutdown of the factory the total cane crushed is known.
- But total sugar produced is not known because some sugar is still left in the process.
- At the time of shutdown it may be m/c, syrup, juice and molasses in the process which yet to be processed.
- In this situation recovery % has to be estimated by taking stock of remaining material.
- The sugar in stock is added to made sugar and total sugar is called estimated sugar.
- All these procedure is called stock taking.

Process of Stock Taking

- It is divided as follow;
- Weight of each material.
- Analysis of each material.
- Calculation of A. S. And A. Molasses.
- Derivation of formula for A.S. And A. Molasses:
- Let , C = Volume in cubic meter
- B = Brix of material
- D = sp. Gravity of material
- M = Expected final molasses purity
- J = Purity of material
- S = Purity of sugar i.e. 100

- Wt. of material = C x D
- Total Brix of material = (C x D x B)/100 = X say
- Total sugar(Pol) in material = X J /100
- Total non sugar in material = X – XJ/100
- = X(100-J/100)
- If molasses purity = M
- Than , non sugar in molasses = 100 – M
- If, 100-M non sugar in molasses = M sugar in molasses
- If unit NS " " = M/100-M " "

- If X(1-j/100) non sugar = X(1-j/100)x M/100-M NS in mol.
- Available sugar = Total sugar - Non sugar
- A.S. = XJ /100 - X (1-j/100)(M/100-M)
- A.S. = X (J-M/100-M)
- Where , X = C x D x B/100
- A.S. = (CxDxB/100) x (J-M/100-M)
- A. M. = A.S.x (100-J/J-M)x 100/Bm

Example

- Given :- Brix % juice = 17.0 ,Juice Pty = 85.0
- Sp. Gravity of juice = 1.07 , Volume = 5.0 m3
- Brix % F. M. = 90.0 , Pty F.M. = 40.0
- Solution :- A.S. = (CxDxB/100)x(j-m/100-m)
- = (5.0x1.07x17.0/100)x(85-40)/(100-40)
- = 0.6822 M.T.
- A. M. = A.S. X (100-j)/j-m x 100/Bm
- = (0.6822 x 100-85)/85-40 x 100/90
- = 0.22 M.T.
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