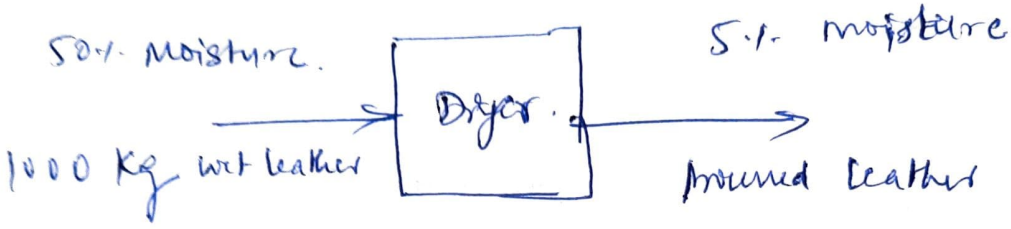
2 (a) Leather after processing contains 50 % moisture by weight. This has to be dried to 5 % moisture. For 1000 kg of wet leather, how many kg of water are removed? What is the weight of finished leather? How many kg of water is removed per kg of finished leather?

Basis: 1000 kg wet leather.



Let x and y be the quantities of water evaporated and product obtained respectively.

M.B. of leather.

$0.5 \times 1000 = 0(x) + 0.95(y)$ — (1)

Overall M.B.

$1000 = x + y$. — (2)

Solving (1) & (2)

$500 = 0 + 0.95y$.

$1000 = x + y$.

$y = \frac{500}{0.95} = 526.3157$ kg.

$x + y = 1000$

$x = 1000 - y$

$= 1000 - 526.3157$

$x = 473.6842$ kg.

Kg of water removed, $x = 473.6842$ kg.

Kg of finished leather, $y = 526.3157$ kg.

$\frac{\text{Kg water removed}}{\text{Kg of finished leather}} = \frac{473.6842}{526.3157} = 0.9$

2(b) A drilling mud contains 60 % water and 40 % clay by weight. A driller wishes to increase its density by adding bone dry clay. Calculate the weight of dry clay to be added to original mud to obtain a clay content of 48 %. Estimate the weight of clay to be added, when clay contains 10 % moisture.

Basis: 1000 kg of original drilling mud.

i.e 600 kg water, 400 kg clay.

Let weight of dry clay to be added be x Kgs.

$$\frac{400+x}{(400+x)+600} = 0.48$$

$$400+x = 400 \times 0.48 + 0.48x + 600 \times 0.48$$

$$400+x = 192 + 0.48x + 288$$

$$x - 0.48x = 192 + 288 - 400$$

$$0.52x = 80$$

$$x = 153.8461 \text{ kg}.$$

Weight of dry clay to be added = 153.8461 kg

When clay contains 10 % moisture.

$$\frac{400 + 0.9x}{(400+0.9x)+(100+0.1x)} = 0.48$$

$$400 + 0.9x = 192 + 0.432x + 288 + 0.048x$$

~~$= 400$~~

$$400 + 0.9x = 480 + 0.48x$$

$$0.9x - 0.48x = 480 - 400$$

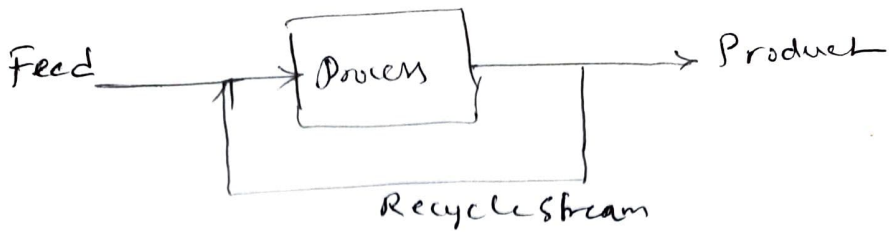
$$0.42x = 80$$

$$x = 190.4761 \text{ kg}.$$

Weight of clay to added (when clay contains 10 % moisture)

Recycle, Bypass & Purging

Recycle



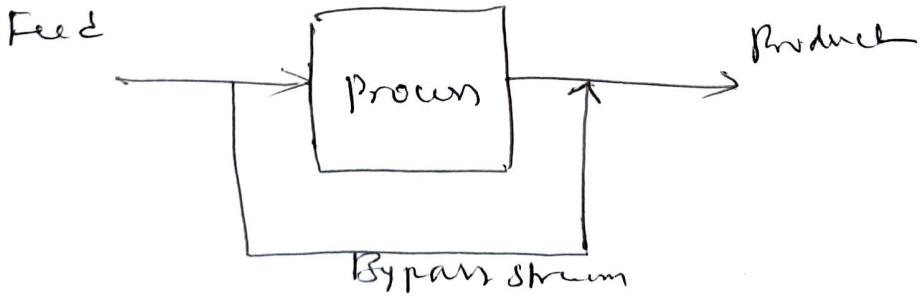
Part of the product stream is sent back and fed along with feed stream. Such a stream is called recycle.

~~used~~ ~~To improve the conversion~~

Uses:

1. To utilize the valuable reactants to their maximum and to avoid wastage (Reactions)
2. To utilize the heat being lost in the outgoing stream
3. To improve the performance of the Equipment
4. To control the operating variable in a reaction
   eg. pressure, temperature

Bypass

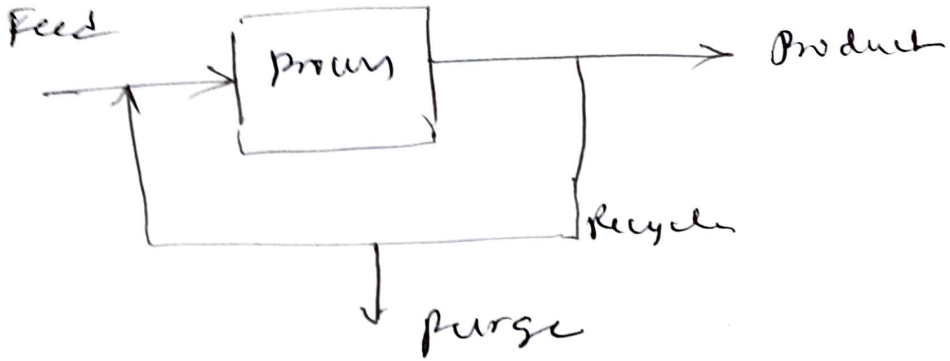


In these operations, a fraction of the feed stream to a process unit is diverted around and combined with out put stream from the unit.

Uses:

1. Accurate control of composition of exit stream

Purge:



During recycling operations, there is gradual increase in the concentration of inert or impurities in the system. A stage may reach when the concentration of these components may cross permissible levels. By bleeding a fraction of the recycle stream, this problem can be solved. This operation is known as purging.