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Solving practical evaporation capacity problems

In order to adapt to increases in milling capacity, it is very common to find mills where there is an overcapacity on the surface of the Robert effects of the quintuple. This situation occurs when taking advantage of the available bodies to conform the necessary surface to the new grinding increase, which is almost always exceeded when grouping the available Robert evaporators.

Overcapacity is more problematic in the first 3 effects where there are temperatures of more than 100°C.

Using the average specific surfaces of the different types of evaporators as predictive tools and correctly sizing the effects to the new milling, we can evaluate and find solutions to reduce the negative effects of overcapacity, even with advantages over a Robert body with adequate capacity.

Let's visualize this with the following example: The grinding rose to 586 tch and a quintuple for that capacity was calculated whose first effect turned out to be 4500 m2 of surface, and for this, 2 bodies of 3000 m2 each were available, that when grouped in parallel, produced an overcapacity of 1500 m2.

The mean specific surface area of a Robert body is around 45 m2/m3 and that of a rising plate evaporator is around 90 m2/m3. This suggests the use a plate evaporator as a supplement or surface relay (Booster) for a 3000 m2 Robert.

For the plate evaporator that easily achieves an evaporation coefficient of 1.5 times that of a Robert, one of 1000 m2 would suffice for the combination to reach a Robert equivalent of 4500 m2. The proposed solution is elegant and produces a set with a retention volume (77.77 m3), even lower than that of a Robert with the right volume (100 m3).

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The predictive calculations of sucrose losses in the first effect were made using the Vukov equations and the resulting residence times, to lead to a clear juice of 13 ° Bx and 84% purity at 65 ° Bx in quintuple, with high steam savings and extractions up to the 4th effect, for greater excess bagasse.

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Predictive calculation sequence of sucrose losses in evaporation

	Sucrose	Brix in	Bx ave.	Sucrose (Kg/tc)	Predicted Vol	Acum. Sucr	Ave. flow	Holding time	Vukov inversion	Inv. Losses in HT	Losses in HT	Sucr. Loss	Sucr. Loss
1°Body (m2)	(Kg/h)	(%)	(%)	per minute	(In m3)	in HT (Kg)	m3/h	minutes	(% per minute)	(%)	(Kg/min)	Kg/min HT	Kg/h
2x3000 m2	64452.73	13.1	15.39	1074.21	133.33	18058.54	475.88	16.811	0.00041701	0.00701	126.59	7.53	451.81
1x4500 m2	64452.73	13.1	15.39	1074.21	100	13543.64	475.88	12.608	0.00041701	0.005258	71.21	5.65	338.89
3000R plus 1000PI	64452.73	13.1	15.39	1074.21	77.78	10533.7	475.88	9.806	0.00041701	0.004089	43.07	4.39	263.55

The saving in sucrose losses when using the relay is of 188.26 kg of sucrose per hour of grinding, equivalent to 4,518.24 kg of sucrose per day.

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Figure 1 shows a diagram of the use of the plate evaporator as a relay or complement to the calandria of a Robert unit. Note that sharing the same separator avoids additional retention, making the plate evaporator an extension of the Robert's calandria (Booster), thus creating a need to expand droplet retention.

The integral safety of any evaporator requires that it never runs out of liquids, especially in plate evaporators whose specific evaporation is very high. Therefore, there must always be a minimum safety flow of juice, or in its absence of condensed water, that guarantees the integrity of the equipment.

As a conclusion, we can confirm that complementing of an existing Robert body with a plate evaporator in order to form an evaporation effect is profitable, when used to eliminate considerable excess capacity incurred when taking advantage of previously existing bodies for an extension.

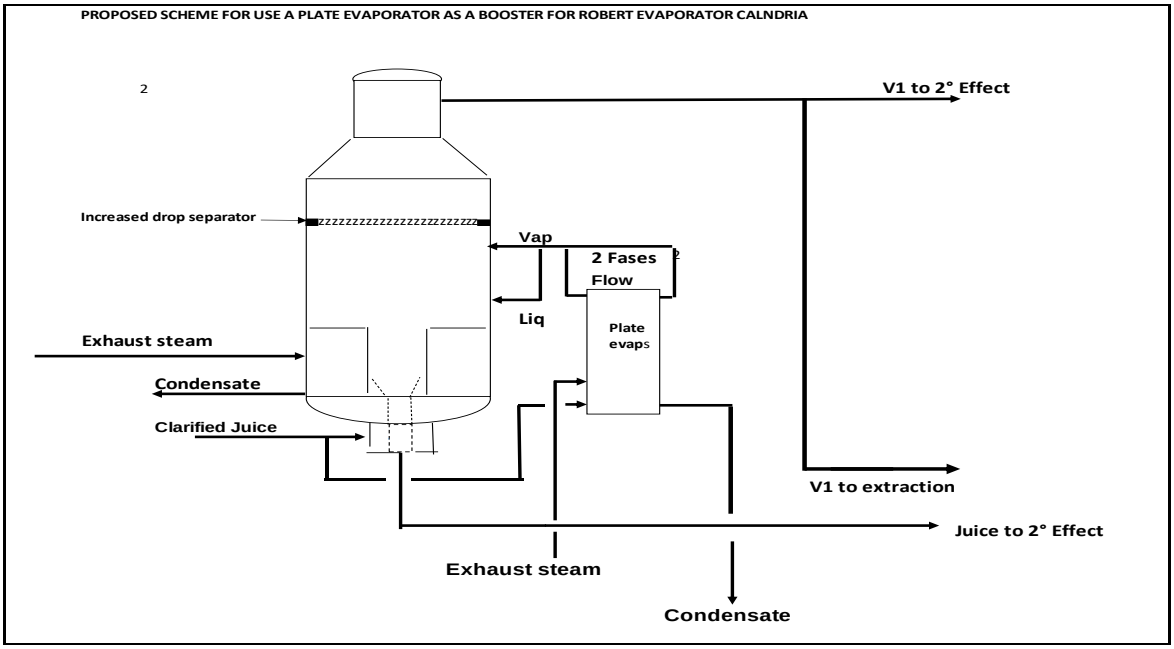

Figure 1- Plate relay for a Robert evaporator calandria.

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