

Diploma in Milling Technology and Management Course 2010: Trouble Shooting

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Questions and Answers

Question 1: What is the best hydro-cyclone setting with reference to hydro-cyclone cone outlet diameter and size of spacer ring for optimum kernel recovery?

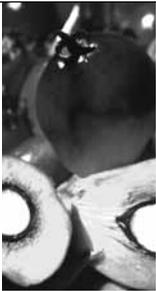
Answer: Even though the principle of separation in a hydro-cyclone is based on density separation, there are other parameters involved in the separation process. The cone outlet diameter, the clearance between the vortex finder and the cone wall and the inlet pressure of the cracked mixture exert great influence on the efficiency of separation. In order to get the optimum setting, you may have to fine tune the system by trial and error as its performance will also depend to a certain extent on shape and size of the shell which may not be the same in all mills. The inlet pressure causes the swirling of the mixture around the vortex finder tube after its tangential entry into the hydro-cyclone chamber and the pressure must be sufficient to sustain the centrifugal force so that

the heavy shell particles will remain at the periphery of the conical chamber to allow the lighter kernels to move towards to the centre of the water column and be pulled up by the viscous drag set up within the vortex chamber. If the pressure is too low, the centrifugal force may not be sufficient to push the shell towards the wall resulting in high dirt content in kernel.

Under normal circumstances, the duty of stage I hydro-cyclone is to separate out the clean kernel. This can be done by keeping the cone as far down as possible so that the kernel shell boundaries are clearly demarcated. In stage II, the emphasis should be to discharge as much clean shell as possible but no emphasis need be given to clean kernel recovery as the kernel with some shell will be recycled. For this, the cone should be placed as high as possible.

Another important factor is need to maintain the differential pressure of the mixture between the inlet and outlet at a minimum of 1.5 bar for best results. The pump impeller condition should be monitored at regular basis as it has a tendency to erode within short intervals.

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Question 2: What are the criteria to look into when designing the depericarp column?

Answer: The column as shown in Figure 1 must be large enough to accommodate the throughput and this can be calculated easily. The air velocity at the throat of the column should be maintained at 12 m s^{-1} , the separating velocity of nuts. It would be a good idea for mills to buy a meter to monitor the velocity on a regular basis as the equipment is inexpensive.

The most important criteria is the height of the drop from the press cake conveyor to the nut polishing drum. If P is the centre line of the press cake conveyor, T the point where the transient piece on the top of the column joins the circular ducting, N is the centre line of the nut polishing drum, and L is the total height of the column, then PN (the drop) should not be less than two-third the total height L and $PT =$ one-third L .

Question 3: What is the most suitable pipe material for application in the oil room?

Answer: Stainless steel is the normal choice in food industry and since palm oil is an edible product it should be the logical choice.

Even with this is bound to be some iron pick up as stainless steel is not resistant to erosion but has the ability to resist corrosion.

Question 4: In our mill we have a L.P. steam range spanning 300 m. Where should I install the steam traps along the whole stretch?

Answer: You need to have one at the extreme end by running a leg to the ground through which the condensate can be drained during warming time. If you have a number of tapping points for heating in closed coils, you need traps at the exit of each of the closed coils so that steam is trapped within but condensate is discharged. All steam engineers should know this as failure to consider this may result in water hammer and eventual blowing up of valves leading to major catastrophe. A British ship sank in the 1990s due to water hammer blowing up of a large valve. Low pressure steam is a very dangerous vapour and must be handled with care. High pressure dry steam is safer to work with than low pressure wet steam. If you need more details, Salco Spirax will be able to assist you as they are experts in this field.

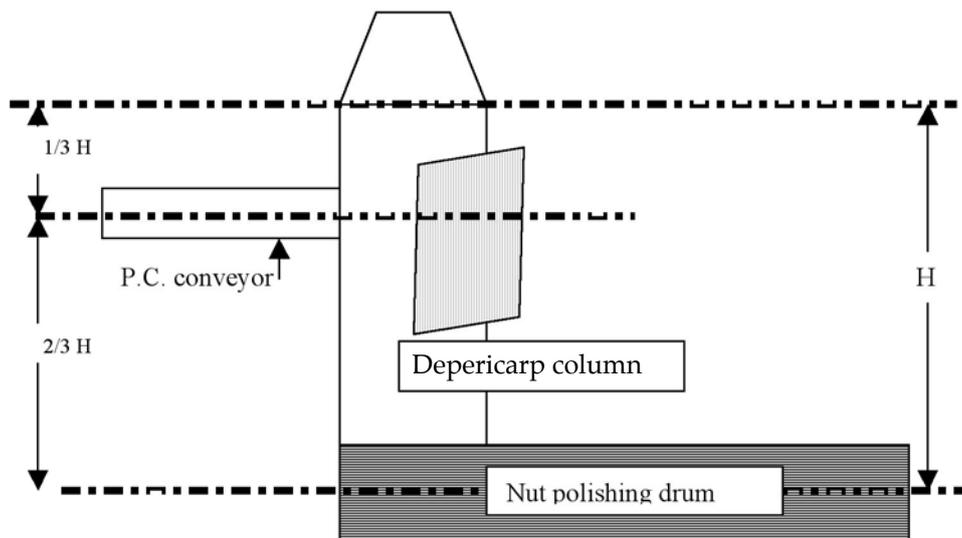


Figure 1. Depericarp column.

Question 5: How do we tackle the problem of algae population in the last facultative ponds?

Answer: To begin with, the algae started growing in these ponds as a result of the conducive environment set up by a marked reduction of BOD brought about by efficient aeration. If the algae is not harvested when they multiply, they start decaying generating a secondary source of organic matter contributing towards a rise in BOD. When this happens, the algae can no longer sustain themselves and gets destroyed in the process. This is the reason for the algae population to vanish. Harvesting can be time-consuming but it is the only recourse as in addition the decaying algae cannot be discharged into the water source.

Question 6: When we overhauled our six-stage steam feed pump (model 55006), we renewed five impellers, gland packing, bearings and 'O' rings. But when we commissioned back the pump, the pump speed refused to go beyond 800 rpm against the normal operating speed of 3000 rpm. What could be the reason for this?

Answer: On the pump side you need to check whether impellers are placed in the correct way like the front and the back correctly assembled. If they are in order, the problem lies with the steam turbine. On the turbine which is identical to your turbo alternator the nozzle could have eroded, corroded or damaged. You have to take a closer look at the Curtis wheel which might have been damaged or has worked itself loose from the shaft. Perhaps the bearing has seized. Many factors could cause the problem. The only way to find out is open the turbine and inspect. You probably had a reason for the complete overhaul of the pump.

Question 7: What is the best way of releasing air and condensate from the sterilizer?

Answer: You must have a condensate by-pass line on the main condensate valve.

As the main pipe will be closed during the third peak, there is no way the air released by the bunch can escape if no by-pass valve is provided. This valve must be kept open for continuous bleeding of condensate and the accompanying air so that bunches are efficiently cooked. If done this way, there will not be any need for double stripping which is actually fighting the consequences rather than the cause.

Question 8: What will be the impact of using an orifice plate as a substitute for a steam trap on heating coil, e.g. the nut silo heaters?

Answer: This is indeed a very non-professional way of saving money for the company. Let us do a thermodynamic analysis on the effect of the orifice on your steam heating coil. As steam issues out of the coil through the orifice the effect is wire drawing or adiabatic workless expansion and during this process the remaining steam in the coil gets dried or in most cases superheated. Is this what we want? The effect of a steam trap is only the condensed water is released and the steam within does not get dryer than before. It is only when steam gets condensed that heat (latent heat of condensation) is transferred to the air in the heater. If steam passes through the coil and out through the orifice plate at a continuous rate, the heat transferred to the air will be negligible as steam will be unable to condensate to release heat. You might as well not have a heating system. Please do not try to save a little money by replacing a steam trap with an orifice plate.

Question 9: Currently most mills have only EFB presses but no shredder. Is it necessary to have shredder? If so, where should it be placed before or after EFB press?

Answer: The general practice of installing the shredder is after pressing the EFB. It is certainly good to shred the EFB as then it can have added value. It can be used as a fuel for renewable energy production pro-



vided you have the surplus power to operate the shredder and the EFB press.

Question 10: How to determine the pump size if the delivery height is too high like 200 m using a small pump?

Answer: It is simply not a good venture to use small pump to pump to 200 m height. For the required head, you certainly need a big pump unless the throughput is very low. You just heard in detail the method of calculation from today's lecture.

Question 11: How do you determine the optimum size for a nut polishing drum?

Answer: There is no special design criteria for this except that the nut must be free from excessive fibre attached to them. If space permits try to make it long say 6 m instead of a short one. You will find your nuts well polished.

Question 12: What is your view on the use of a submersible pump for effluent?

Answer: It is an excellent pump for pumping the effluent. The current method of using a suction head-based centrifugal pump will only deal with the supernatant allowing the solids to accumulate at the bottom of the pond. But when submersible pump

is used the solids are continuously pumped out and there is no need to de-silt the pond. This is good for land application but as that practice has discontinued now the use of submersible pump may not have much application for effluent treatment systems in mills.

Question 13: How to size capacitor banks in mill power plants?

Answer: You will be having almost a full day lecture on this in the next semester as it involves some calculation. You may read the lecture note if you wish to know it now.

Question 14: How to re-activate an effluent pond with diminishing population of bacteria?

Answer: Short operating hours of a mill can reduce the bacteria population due to insufficient organic food supply for them. It seems that chicken droppings are able to activate the bacteria according to some mill engineers.

Question 15: What is the cause of some floc floating on the surface of our water clarifier tank even though the sludge blanket is thin?

Answer: One reason for the floc to float could be due its low density which caused the floc to float on top.