Surface Facilities for Oil and Gas Handling

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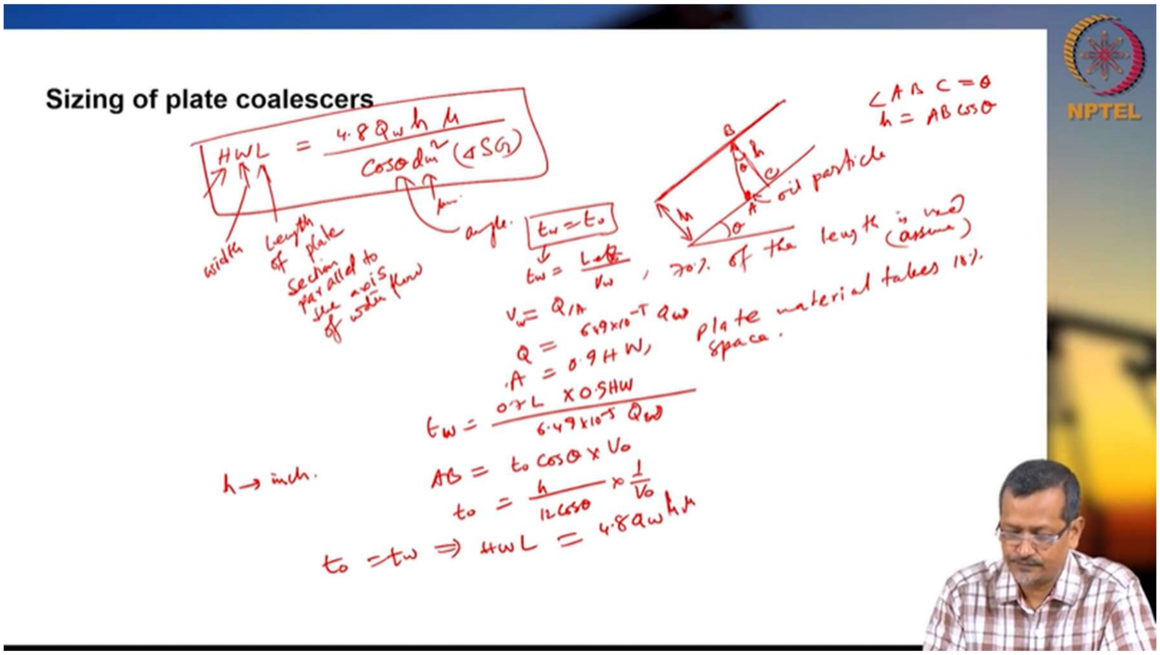
Produced Water Treatment-02

Cross-flow device. So, cross-flow devices can be used for vertical or horizontal presence. So, cross-flow device fluid water will be flowing in one direction and participation will be in the other direction. So, water will be flowing horizontally or your particle will be moving or vertically moving. So, plates can have larger angles for sedimentation. So, like I told you instead of 45 degrees you are giving 60 degrees.

So, in this case, also you are increasing the angle, but sand settlement and pressure things if you have separated. So, this is going to be better for sand handling and for pressure versus. Normally you will have having atmospheric vessel where you are not applying any pressure, but you have applied already pressure. So, in that case, this cross-flow device is better for this.

It will be cheaper and more efficient. So, prefer pressure versus more sedimentation. So, cross-flow devices can be customized with either horizontal or vertical pressure. Horizontal pressure is less in terms of baffling as the ends of nearly each plate contact the oil directly to the oil-water interface. So, however, the pack is long and narrow and therefore it requires an elaborate spreader and collector device whose water travels across the platepacked like there is a possibility of shearing the inlet oil.

So, if shearing is happening the separation particular shearing happening. So, oil particles are getting sheared particle size will be smaller. So, DM smaller is difficult. So, right larger DM is better. So, in some cases particle shearing is possible.



So, that will be getting much more difficult to separate oil particles from water. And whenever you are using a separating system like CPI or parallel plate interceptor. So, in that case, what happens is there is no moving part. So, wherever you are designing mechanical elements if you have lots of moving elements that means your life will be difficult. Moving element or relative motion is there it is two machine element relative motion.

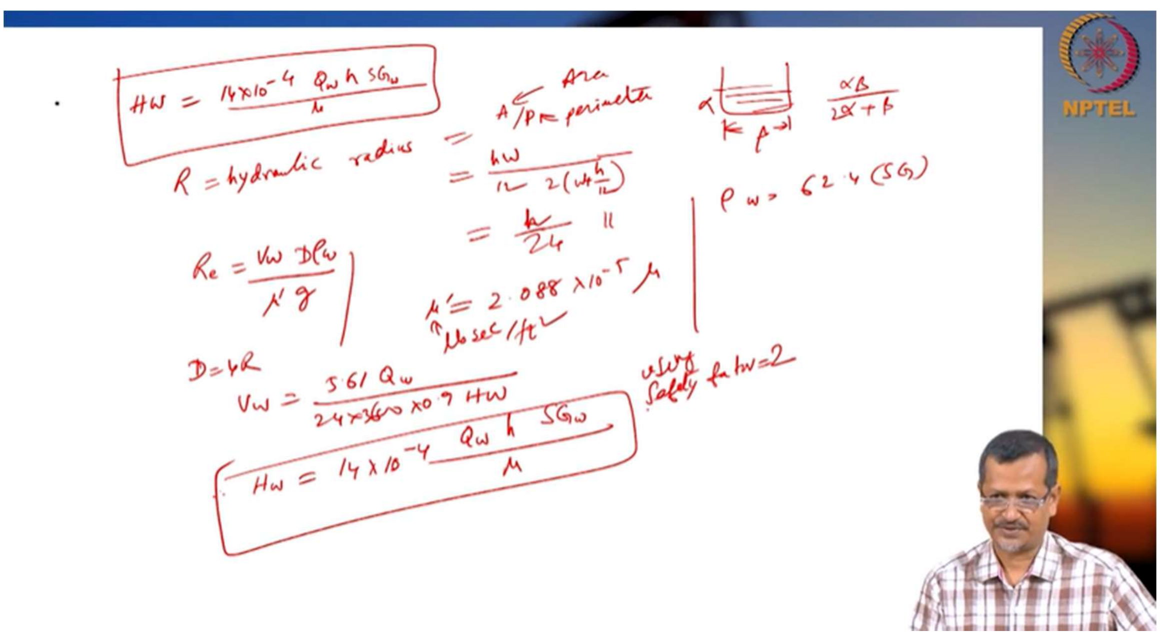
So, the life will be lower there will be friction, and there may be some blocking or blocking after the machine element you are trying to move but it is not moving because of friction. So, that will create many problems. So, in this system, parallel plate or bulk plate whatever system you use there is no moving element just for system static system, and separating it is better. But in many cases, people will be using centrifuges also just to reduce oil particle number. Similarly, hydrocyclone is also a good thing because there is no moving element.

So, whenever the limited amount of moving elements is there system is better. A larger moving element is you have to give electricity then you have to maintain things easily, bearing so many things are there. So, you have to try to reduce element number of moving elements decreasing your system's reliability of it is every system will have its reliability. So, 1, 2, 3, 4 multiple systems are there so total reliability is going down. So, there is no moving element so life is not there.

But the only thing is that cleaning will be required somehow like sand deposition or debris diffusion in the case cleaning may be required. Now coalesce sizing equation hwL equals 4.8 Q h V divided by cos theta tm square L s. So, type see what is this equation. So, dm is the oil droplet diameter already micrometer micron L h is the specific gravity difference h is the water level height w width of the separator system.

L is the length of the plate section. L is the length of the plate section parallel to the axis of the water. W is width L hg already you know specific gravity difference theta is there. So, this is angle angle of the plate with horizontal mu viscosity Cp already knows. So, now we will see how to do a formula for this one.

So, first, you have to draw this parallel plate this h is the distance this angle is theta you have seen already a parallel plate, and let us say I have one particle here oil particle. So, the oil particle moving up vertically up it is moving vertically up. So, how much distance is traveling this one is A B I am giving this name. So, it is BC equals h B C equals h, but AB and h are not equal right AB is the hypotenuse perpendicular distance between parallel plate is h, but oil is flowing at this tip angle. So, it is traveling more right now how to derive it.



So, Tw equals To we know already the basic formula right oil time and water time equal tension time. So, Tw equals effective length divided by V tip. So, the effective length here in the plate interceptor we are using is 90% 70% of the actual length will be used because it is entry and exit some portion will not be used. So, there is 70% of the length will be used. So, 70% of the length is used as used.

So, Vw equals Q by A, and Q already we knows 6.49 to the power minus 5 U w. This is just unit conversion Qw by Bt and Qin cubic feet per second. So, at A A equals 0.9 h whereas the plate material itself takes 10% space ok plate material and all layers 2 layer 3 layers ok.

So, the total of many layers we are using. So, plate material also takes up some space. So, there is a unit plate material that takes up 10% of the space. So, the final Tw becomes 0.

7 L into 0.9 hw then Qw 6.49 10 to the power minus 5 Qw h in h h inch so what is AB distance which is theta right angle ABC is theta right so how to tell not H AB sine theta this is base this is simultaneous h equals AB ok A B cos theta. So, h equals AB cos theta now what is AB AB AB the particle velocity in time. So, particle velocity at a time is To cos theta while velocity is into V. So, now I can get To equals h divided by 12 cos theta into V.

Now To equals Tw this will be giving hw L equals 4.8 Qw h in cos theta L sg into dm square is the final form of equation. So, now another equation is L sg w sg r divided by mu. So, this formula will be trying we are saying that Reynolds number we have to rewrite this one. So, r is hydraulic radius ok.

So, whenever say hydraulic radius remember for rectangular area it will be A by P A means area weighted area by perimeter ok weighted perimeter weighted area how except you have one channel ok. So, this is let us say A or let us say T this is Q I will write something for A by P A alpha beta. So, the area is alpha into beta and the perimeter is alpha plus beta plus alpha alpha plus beta plus alpha so this is weighted area by the perimeter. Now, the hydraulic radius formula is this hw material 1 by 2w h where ok. So, this is the formula and they are approximating if h is half of w then it will be like this h by 2 just approximating h by 2 approximating they have done and Reynolds number value we are taking vw d uo mu dash g and mu inside.

So, mu dash they are converting as like this 2.088 you can form minus 5 mu and unit is different mu dash will be second. Pit spec g is 4r this gives vw equals 5.

61 uw 24 3600 into 0.9 hw. Rho value we have to change rho w equals 62.4 sg. So, finally, HW comes in. 14 into 10 power minus 4 Q w h sg w and divide by mu. So, to account for the surge of water work is the safety factor of 2.

So, they have to use safety factor 2. Using safety factor 2 this form of parallel formula. So, final version if you remember or in between some steps I can give some calculations some conclusions somewhere, or maybe the final formula if you do not remember then I can change some parameters. So, 14 I can say 27 and I give option like I can give option like 1 14 3700 constant.

So, read the diagram. Remember the last one or maybe we can derive any contact. Pressing indicator. Pressing indicator schematic. So, this is like what? Separate system.

You have multiple filters. So, this is a filter they are using. This is called Excelsior. Excelsior or other to Excel medium. So, here inlet exit here inlet exit here, and inlet exit here. Then you are creating water here and while you are creating air.

While there you are creating water. This is oil and while there is air they have to create air also. While there and from there oil will take water. This is water here. So, here we are not using this extractor if it is a normal atmospheric vessel. If you have high pressure system then you have to use this extractor gas like also.

But we are assuming that gas is very negligible. So, we may have this extractor or maybe we could also have that one so that if any extra gas is coming that would be difficult. Normally we don't have gas much. Oil is passing through this excelsior.

So, you create extra resistance also. This was sometimes called an SP pack. There are some companies within the town called SP Pack. So, instead of passing through particles, it is excelsior. So, you are separating particles in this capability.

The company put the name SP pack. So, it is your SP pack. So, it is your they have one formula ET equals one minus one minus one power n. ET is total. It is over the efficiency overall.

Overall efficiency is each cell. So, if we have multiple cells. So, each cell has efficiency. So, this is over the efficiency formula like this, and it is the number of cells, the number of stages. So, this is a simple formula later we will use it and see how to use it.

This is flotation. So, there are two types of flotation. One is a dissolved gas unit. Flotation means you are using gas and you are assisting in separating oil particles from water. So, that term is the flotation unit. So, flotation units are the only common thing you use water to get the effect that will not lie solely on gravity separation.

They are not lying solely on gravity separation. They are attaching air bubbles and trying to push the oil particles up. So, the oil particles create one layer over a particular layer and you can separate them. Flotation units employ a process in which fine gas bubbles are generated and dispersed in water where they attach themselves to the oil droplet or solid particulate. So, when the oil droplet is here let us say some gas bubble is attached here. So, the total average density went up because the gas was there.

So, it will be trying to move moving up. So, total volume increases because of the airflow rate. So, it will be moving up. So, flotation A such as coagulant, poly, electrolytes, and emulsifiers are added to the two particles. Two distinct types of flotation units will be a dissolved gas unit and one dispersed gas unit.

So, we will see what are the different differences. So, one is a dissolved gas unit. You have a chamber like this. And this is oil and a small amount of gas is there. And water will grow. Water will be a large amount or it will be a very small amount.

And this will have one contact gas giving a recycling pump. So, what are you getting? You are researching but you are giving gas. So, gas will be lots of mixtures and mixing up with water. So, it will give a flotation and make oil particles easier to move up. So, it is used to define this where instead of upstream things, but in many cases upstream is also very easy.

Dispersed gas units are more successful, and limited oxygen gives this thing. So, this is a dissolved gas unit. And another is a dispersed gas unit. Dispersed gas unit you are giving gas, an inlet pipe, and your dispersed gas.

Mixing and it will dissolve it. Dispersed gas unit. Dispersed gas unit what is happening? You have one this is the system here. And you give gas here, not gas, water. Water pipe will be going through this and it creates one nozzle, suction. Using a nozzle you mix up gas and water. When you are getting nozzle very high velocity fluid will be going through the water.

At that time gas will be sucked. Gas and water get sucked and get mixed up. When it is mixing oil and water, gas and oil particles will try to flow. Because of the mix-up, it gets separated. So, you can create separate cells too.

Many cells and many nozzles you can create. And over the water's surface, it will fall. Fall will be created. So, that fall you take out. Oil and water will come and water will take.

The same water may be injected. So, this is just a recycling machine. So, this is all. Distinct differences I got from the document. So, like air is mixed with liquid not dissolved in an induced or dispersed air filtration system. But dissolved air system, air is dissolved in liquid, and air saturation is required.

So, a larger amount of air will be there. Air bubble size larger will be there in this case. The dissolved air bubble size will be smaller. Sometimes induced case chemicals can be added. Dissolved gas also can be added. Turbulence below or at the surface should be minimal while designing an operated system.

Or deserve the system. But induced system, energy, and shear turbulence are generally greater. So, you could try to remember these differences.

Thank you very much. So, we will start the next lecture. Stop now. Thank you.