Introduction to Mineral Processing
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Lecture – 44
Hydrocyclone (Contd.)

Hello welcome back. So, we were discussing about the hydrocyclone selection criteria in the last lecture. I have discussed that how the equipment manufacturers they specified there or giving as soon give as soon as to their clients based on the d 50 concept.

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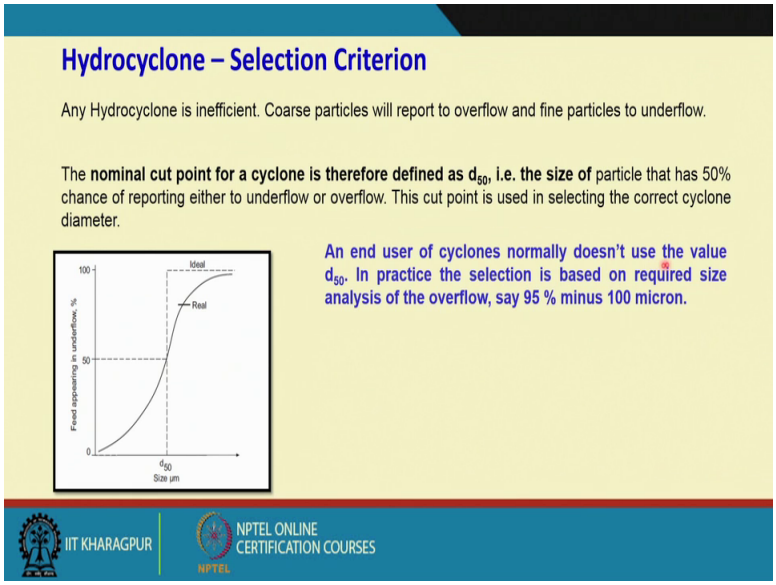

And end user of cyclones normally does not use the value d 50. In practice the selection is based on required size analysis of the overflow that is you know that you cannot give me a 100 percent your product, 100 percent your separation at a particular size.

So, what did you do? Now when I want a 40 micrometer particle that is my liberation size is 40 micrometer. So, you have to decide that what kind of size analysis of your product you are asking for the closed circuit grinding operation to offer you. So, what did they do that is in practice the selection is based on analysis size of the overflow and they decide that say 95 percent minus 100 micro.

So, suppose by end user I am an user, I am a manager of a mineral processing plant and I have seen and I will be satisfied if I am getting a closed circuit dining product which is

95 percent 5 percent I am leaving it because I have said at the beginning that you have to accept that hydrocyclone operation is to some extent inefficient. So, I decided that I will accept a product having 95 percent minus 100 micrometer.

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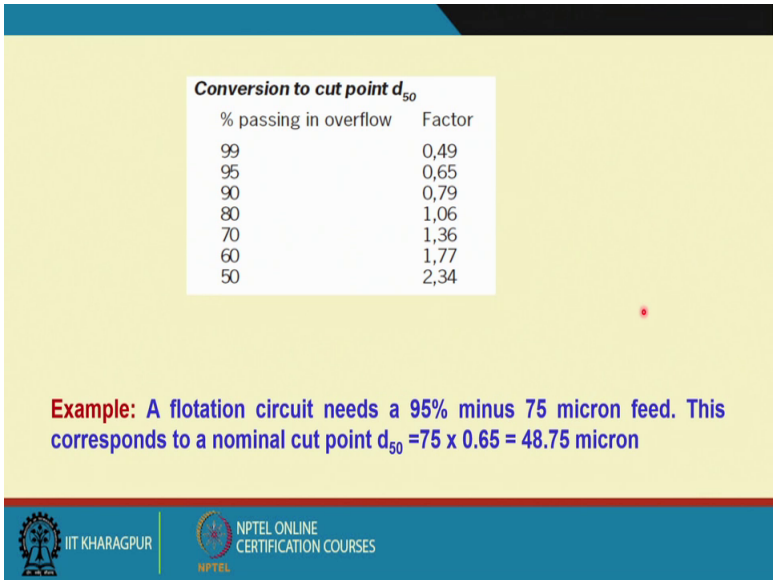

Then what we do then they have got some kind of chart we follow that is conventionally I have taken it from this type of cut point and your say your conversion factor. This I have taken it from your open source that is published by accompanied large a company it is called metso minerals. I kindly acknowledge there your say data and the information leaving it is opened open to help me in teaching.

So, what they do that is now they have got some kind of your correction factors it may not be always correct that. So, you may have to check sometimes this correction factors. It is based on their engineer's experiences they are saying that if I want 99 percent passing in overflow because I have to select a cyclone based on the equipment manufacturers specification and their specification is based on d 50. But I want 95 percent minus 100 micrometer.

So, I have to convert the data into d 50 sizes. So, the what are the conversion factors that is I want 99 percent passing size of this size x and if I want to convert it to d 50 size I have to multiply it with 0.49 likewise the different factors are given. So, I am trying to explain you through some numbers.

Like a flotation circuit needs a 95 percent minus 75 micron feet. Flotation is a process which will discuss in the 11th lecture of this series is called froth floatation process in most of the cases. So, that circuit it acquires a 95 percent minus 75 micron meter feed now these corresponds to a nominal cut point d 50 is you look at the 95 percent in the correcting factor is conversion factory is 0.65 so that means, it is 75 multiplied by 0.65 is equal to 48.75. What is the meaning of this? Like if I select a cyclone whose d 50 is 48.75 micrometer that can give me a consistent product that is coming through overflow which is 95 percent below 75 microscope meter size.

So, if my requirement is 75, 95 percent 75 micrometre size do not select a cyclone for d 50 of 75 micrometre, rather you have to select at the cyclone of d 50 of 48.75 micrometer.

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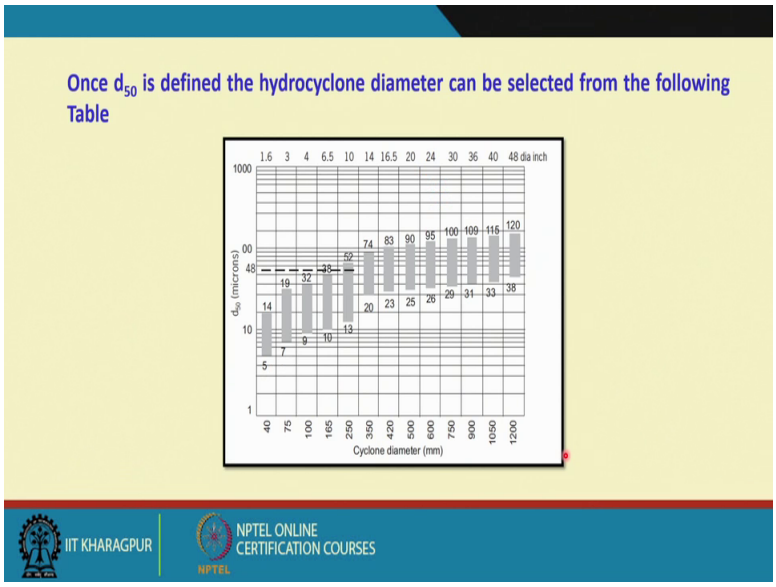

Now, once d 50 is defined as one side know the d 50 of cyclone now there a charts, like your this company is having their own chart that is a client has send a requirement to (Refer Time: 06:13) is also an equipment manufacture that we want you to install that is your cyclone hydrocyclone circuit or a closed circuit grinding operation where I want cyclone overflow to be 95 percent below 75 micrometre that is the clients requirement. How do we ensure that the cyclone what you provide that will give that kind of product consistently to your client?

So, automation engineer what an engineer will do that is was the d 50 is selected. So, he has got a chart or it is called a one kind of your chart that is based on their own experiments at the laboratory scale with different materials with different particles having different densities what I understand of that different varieties of cyclones that up to what size range it can give or different density materials, at what is the minimum and maximum size they can produce that is your d 50 size.

So, if you look at that is a cyclone diameter if it is 40 millimeter it can give a d 50 size from 5 to 14 micrometre so that means, depending on the density of your material it can give you a d 50 size of 5 to 14 micrometre. So, like that I will they will look for that at 48.75 what is that cyclone what are those cyclones that can give me that d 50, so this cyclone that is the 250 millimeter diameter cyclone it d 50 ranges from 13 to 52 micrometre. So, this cyclone can give me a d 50 of 48.75 micrometre.

If I extend this line even you see that even this cyclone can give that is 350 millimeter even this cyclone can give, even this cyclone can give, even this cyclone can give. So, if I draw a horizontal line all these cyclones are capable of giving you the cut size of 48.75. So, it is not a single cyclone, the number of cyclones a bigger dimension they can keep. So, what I have to do? Now, I have to look at the logistics I have to tell my client suppose I am the equipment manufacturer that you can even go with this that is your 900s millimeter cyclone, but this capacity will be this say suppose 200 tons per hour.

I may not required to process 200 tons per hour of material why should I select it maybe another reason is that that is for this 900 millimeter cyclone the cost may be and the tune of cost maybe more than say suppose say cost maybe around say 10,000 dollar suppose just for discussion case. But that 200 tons per hour as a suppose this cyclone capacity is 40 tones per hour. So that means, if I have to match 200 tons per hour I need 5 of this, but each cyclone here cost you 1000 dollar. So, 5 of this cyclone will cost you 5000 dollar where as a single unit of this will cost you 10,000 dollar that is why should I buy your single cyclone if I am the end user. So, I will say 50 percent of the money.

Another question is that if this cyclone when I am depending on only one person that is one cyclone to give me at a rate of 200 runs per hour. So, if something goes wrong that is your related to maintenance related issues my entire circuit will be closed. But when I have got 5 cyclones at least if one cyclone goes wrong I can have still my 80 percent of

the material we can process. So, these are the decisions or these are the options as an equipment manufacturer you can pass on to your client and let the client decide or maybe your logistics supports all such things are there.

So, now let us say we have selected based on some reasons that this is the 250 your millimeter diameter of cyclone I have selected.

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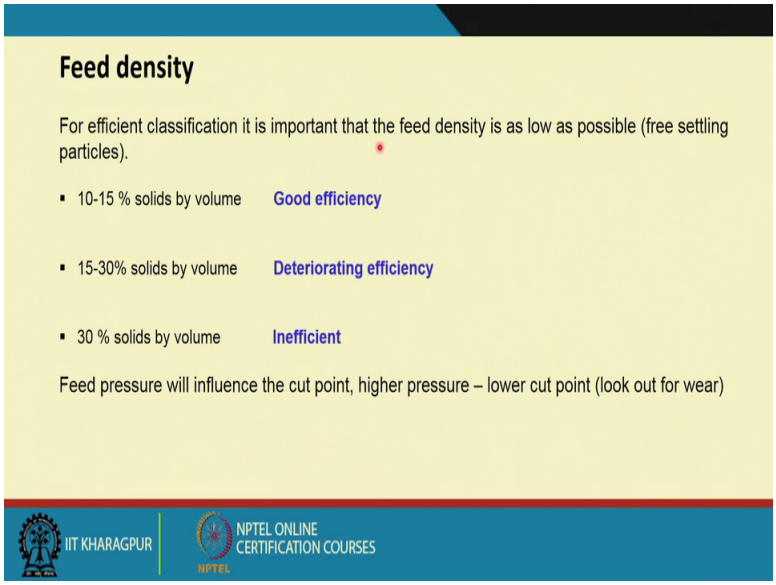

Now, what they do that is I have to select the capacity, now capacity I want to process is suppose 100 tones per hour of dry solids, but hydrocyclone x accepts solids in the form of slurry and we have already discussed that the cyclone wax well when the volumetric ratio of the fluid and the solid is 8 is to 1.

So, that is why I have written that for efficient classification it is important that the feed density is as low as possible feed density means that is a percentage solids that is we want the cyclone to work at free settling conditions. So, 10 to 15 percents solids by volume that is 8 is 1 that is your 1 is to 8, 1 by 8 is around 12 to 13 percent you get good efficiency. Now, if I want my cyclone to run at its best efficient condition. So, I have to run my cyclone at say suppose 12 percent solids by volume.

So, now I want to process a suppose 100 tons per hour. So, what is your say volumetric concentration of my slurry should be because my cyclone capacity is designated in terms of volumetric concentrate volumetric your flow rate of the slurry. So, I have to select this

first that what is the solid concentration I want to run my cyclone. 15 to 13 percent solids by volume deteriorating efficiency, as the cyclone manufacturer you will question your client that you have to sacrifice the efficiency if you are increasing the solid concentration and more than 30 percent solids by volume it is inefficient. So, you have to choose either of this. So, normally when the entire efficiency of a plant depends on the efficiency of your separation of your hydrocyclone normally it is a practice that you go by this that is 10 to 15 percent.

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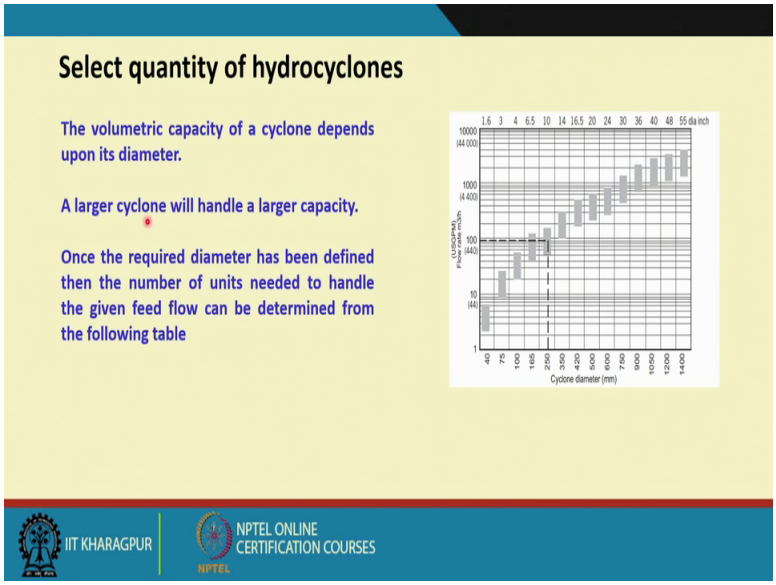

Now, once I know that is. So, I can calculate back that what is that volumetric capacity I am looking for so, the volumetric capacity of a cyclone depends upon its diameter and there is another chart. The equipment manufacturers they have that now you look at that is a 250 millimeter cyclone diameter it has got a your flow rate that is your volumetric flow rate that is in meter cube per hour is 100 meter cube per hour.

So, when it is 100 meter cube per hour and I know that the maximum solid concentration could be 15 percent solids by volume. So, I can calculate back that if I have to process 100 tons per hour whether I need one of the cyclone or whether I need 5 of this cyclone or 10 of this cyclone, then I do the cost benefit analysis I look at the logistics I look at the maintenance related issues then I decide that which cyclone I will use. So, or whether we will go for a single larger diameter cyclone looking at that chart that is whether it can also give me a d 50 of 48.75.

So, this is how normally the negotiation or the discussion goes on along with the end user and the cyclone manufacturers both of them they sit together, they discuss it and then they ultimate select it. A larger cyclone will handle a larger capacity once the required diameter has been defined, then the number of units needed to handle the given feed flow can be determined from the following table that is what already I have discussed.

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So, if you want to learn more about this topic that is hydrocyclone I would suggest you to refer this your books related books or may be mono grams that is by one is a classic book by D Bradley as a hydrocyclone, then Svarosky is a compilation of many literature and then the again the classic book mineral processing technology by Barry (Refer Time: 16:24). These days it is (Refer Time: 16:26) you know that is (Refer Time: 16:29) university partnership they have produce recent partition.

So, and during my say discussion also I have taken the some information from metso minerals website also. I acknowledge all this help and all this information collected from this three books and mesto website.

Thank you very much.