

**INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**  
**NPTEL**  
**NPTEL ONLINE CERTIFICATION COURSE**  
**Mechanical Operations**

**Lecture-04**  
**Characterization of collection of particles-1**

**With**  
**Dr. Shabina Khanam**  
**Department of Chemical Engineering**  
**India institute of technology, Roorkee**

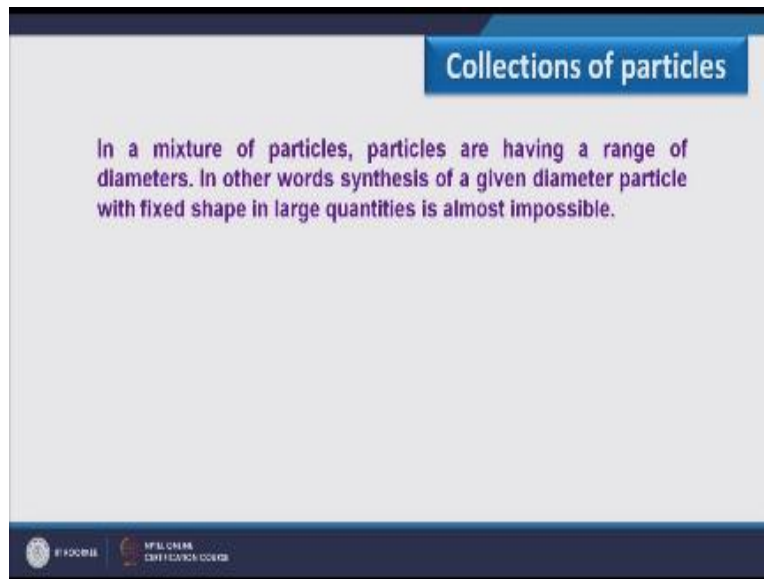
I welcome you all in the fourth lecture of week 1 of mechanical operations course.

(Refer Slide Time: 00:31)



Which is on characterization of collection of particle part. In this particular lecture I will discuss about the collection of particles because for any product collection of particles or mixture of particles matters instead of a single particle.

(Refer Slide Time: 00:50)



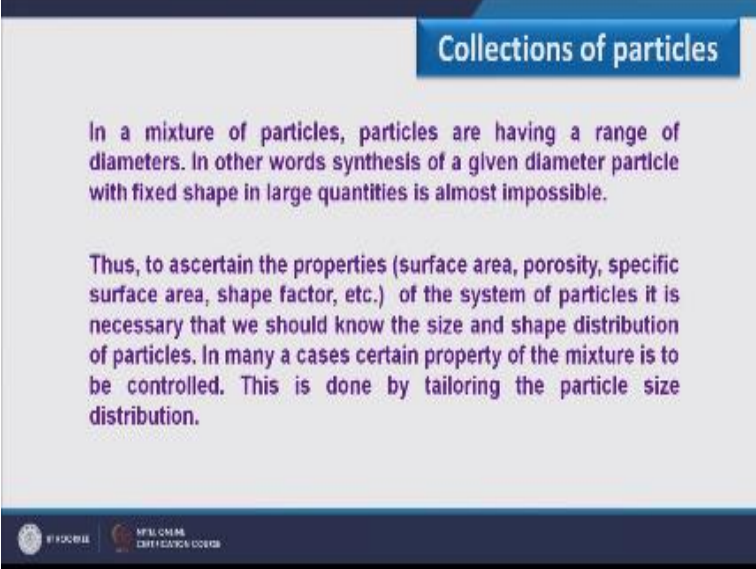
**Collections of particles**

In a mixture of particles, particles are having a range of diameters. In other words synthesis of a given diameter particle with fixed shape in large quantities is almost impossible.

IPFOUR  
MATERIALS RESEARCH CENTER

In a mixture of particles, particles are having a range of diameters, in other word synthesis of a given diameter particle with fixed shape in large quantities is almost impossible, therefore to ascertain the properties such as surface area, porosity, specific surface area, shape factor etcetera of the system of particles it is necessary that we should know the size and shape distribution of particles.

(Refer Slide Time: 01:19)



**Collections of particles**

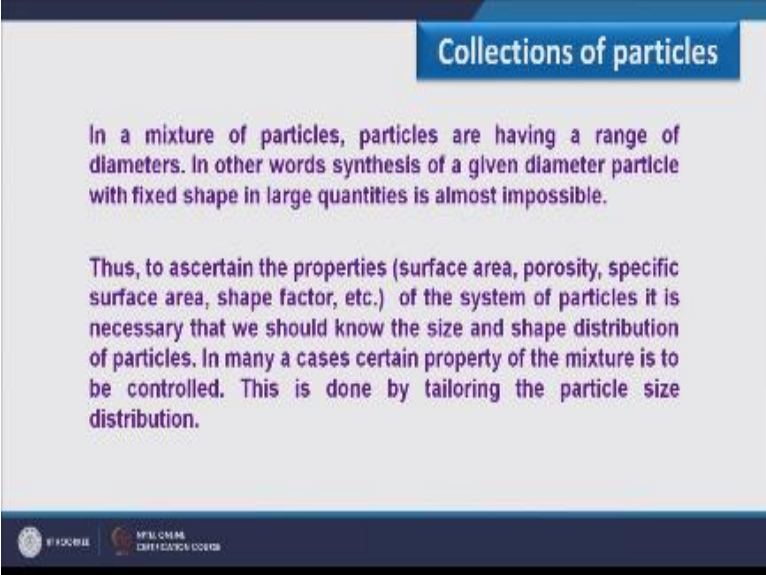
In a mixture of particles, particles are having a range of diameters. In other words synthesis of a given diameter particle with fixed shape in large quantities is almost impossible.

Thus, to ascertain the properties (surface area, porosity, specific surface area, shape factor, etc.) of the system of particles it is necessary that we should know the size and shape distribution of particles. In many a cases certain property of the mixture is to be controlled. This is done by tailoring the particle size distribution.

BY FACULTY    NPTEL ONLINE CERTIFICATION COURSE

In many a cases certain property of the mixture is to be controlled, this is done by tailoring the particle size distribution.

(Refer Slide Time: 01:29)



**Collections of particles**

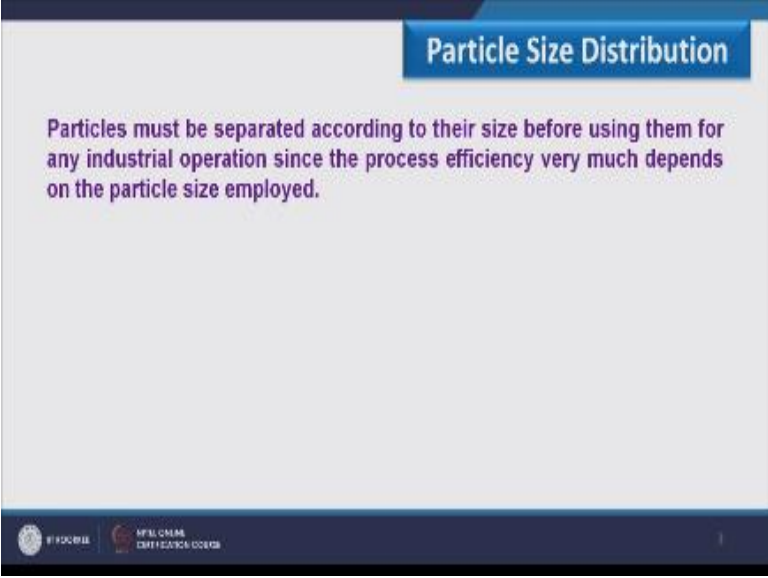
In a mixture of particles, particles are having a range of diameters. In other words synthesis of a given diameter particle with fixed shape in large quantities is almost impossible.

Thus, to ascertain the properties (surface area, porosity, specific surface area, shape factor, etc.) of the system of particles it is necessary that we should know the size and shape distribution of particles. In many a cases certain property of the mixture is to be controlled. This is done by tailoring the particle size distribution.

AFSCM 11 AFIL CMR DIFFUSION CODES

So the particles must be separated according to their size before using them for any industrial operation.

(Refer Slide Time: 01:36)



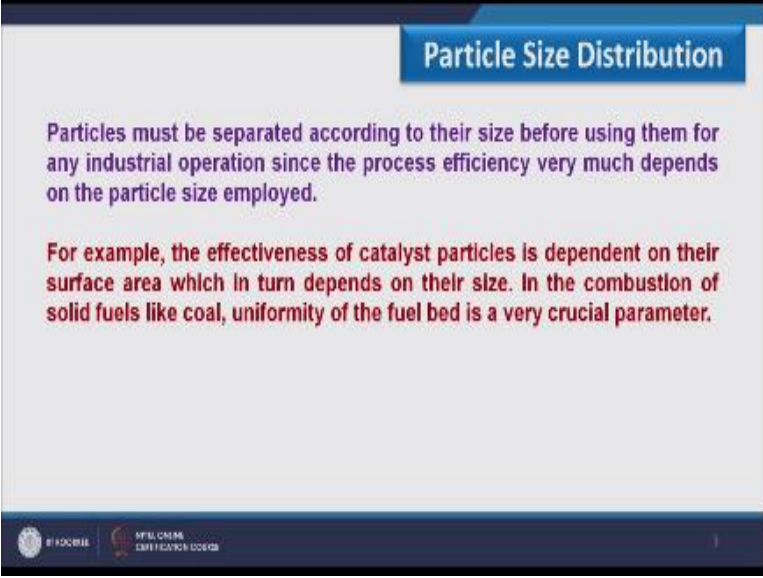
**Particle Size Distribution**

Particles must be separated according to their size before using them for any industrial operation since the process efficiency very much depends on the particle size employed.

UNIVERSITY OF CALicut  
NIPUN CALICUT  
TECHNOLOGICAL CENTER

Since the process efficiency very much depends on particle size employed, if you remember the first lecture of this course that is the introduction where we have discussed that success and failure of the product depends on particle size, therefore to measure the particle size or to separate the particles according to their size is important for the industrial operations.

(Refer Slide Time: 02:03)



**Particle Size Distribution**

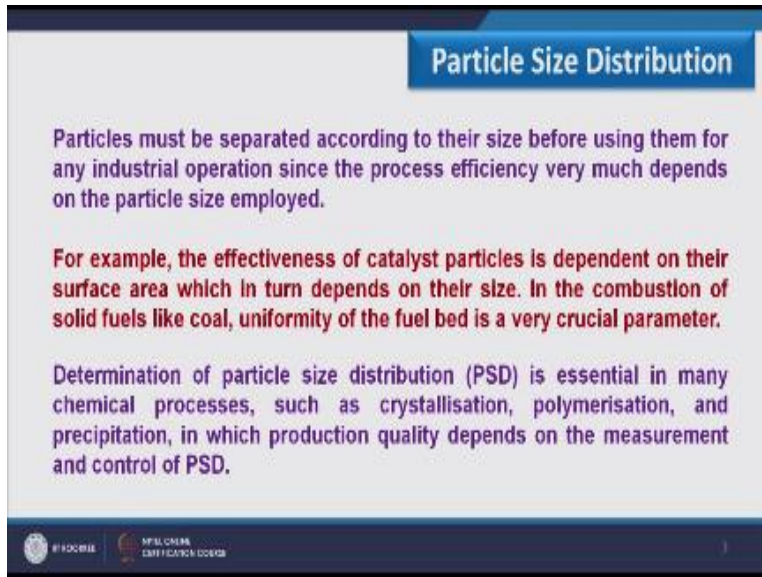
Particles must be separated according to their size before using them for any industrial operation since the process efficiency very much depends on the particle size employed.

For example, the effectiveness of catalyst particles is dependent on their surface area which in turn depends on their size. In the combustion of solid fuels like coal, uniformity of the fuel bed is a very crucial parameter.

IPROBIL IPTEL ONLINE SAFETY HAZARD COURSE

For example the effectiveness of catalyst particles is dependent on their surface area which in turn depends on their size; in the combustion of solid fuels such as coal uniformity of fuel bed is very crucial parameter. So you see the size is important as far as any application or as far as any industrial application is concerned.

(Refer Slide Time: 02:27)



**Particle Size Distribution**

Particles must be separated according to their size before using them for any industrial operation since the process efficiency very much depends on the particle size employed.

For example, the effectiveness of catalyst particles is dependent on their surface area which in turn depends on their size. In the combustion of solid fuels like coal, uniformity of the fuel bed is a very crucial parameter.

Determination of particle size distribution (PSD) is essential in many chemical processes, such as crystallisation, polymerisation, and precipitation, in which production quality depends on the measurement and control of PSD.

MPIL ONLINE RESEARCH COURSE


Therefore determination of particle size distribution is essential in many chemical processes such as crystallization, polymerization and precipitation in which production quality depends on the measurement and control of PSD that is particle size distribution. Particle size is determined by a number of methods such as.

(Refer Slide Time: 02:51)

**Particle Size Distribution**

PSD is determined by a number of method as:

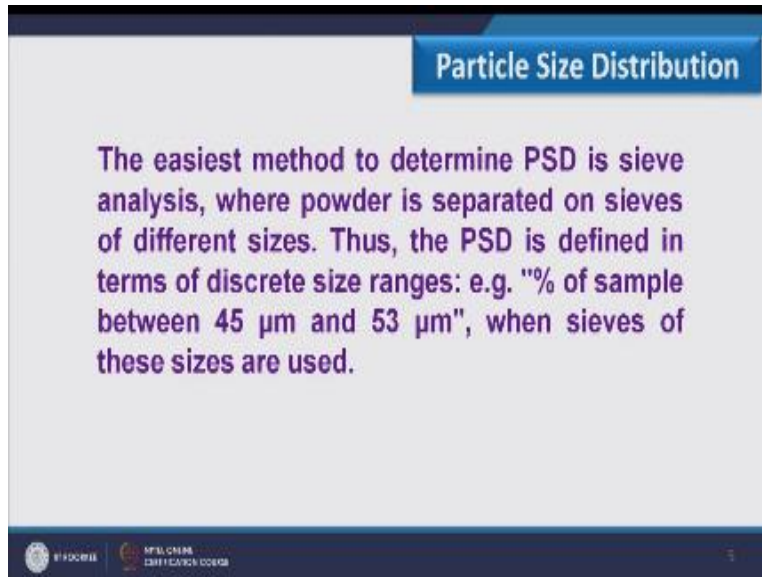
PSD method	Particle size range
Sieve analysis	Above 40 $\mu\text{m}$
Gravity sedimentation	1-100 $\mu\text{m}$
Centrifugal sedimentation	0.005-3 $\mu\text{m}$
Elutriation under gravity	5-100 $\mu\text{m}$
Centrifugal field	1-60 $\mu\text{m}$
Ultra microscopy	0.005-0.2 $\mu\text{m}$
Electron microscopy	0.0005-5 $\mu\text{m}$
Light scattering	0.1-10 $\mu\text{m}$
X-ray scattering	0.005-0.05 $\mu\text{m}$



Here if you see this table in the first column we have PSD method by which different method we can determine the particle size and here I am having the particle size range measured by each method. So here if I consider sieve analysis it measure the particle size above 40  $\mu\text{m}$ , gravity sedimentation 1 – 100  $\mu\text{m}$  and so on we are having different methods. In this particular lecture we discuss sieve analysis to measure the particle size distribution, so from here onward what is sieve analysis and how particle size distribution will be done using this that we will discuss.



(Refer Slide Time: 03:34)



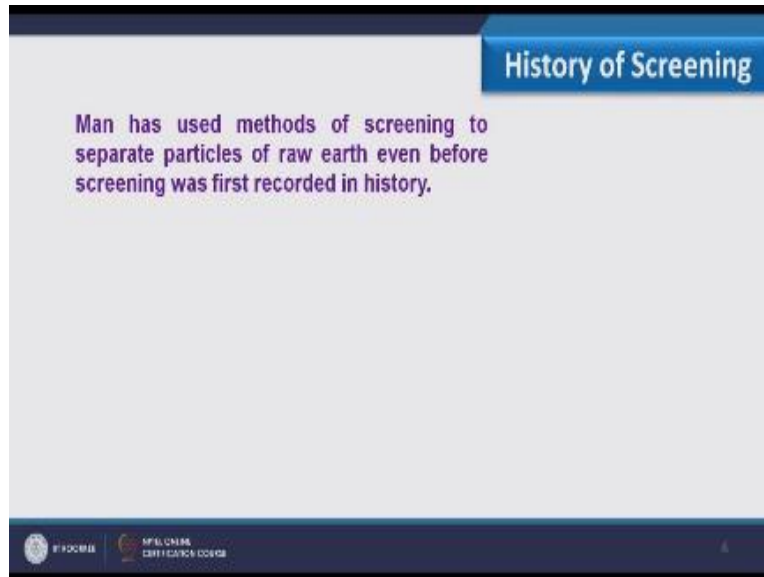
**Particle Size Distribution**

The easiest method to determine PSD is sieve analysis, where powder is separated on sieves of different sizes. Thus, the PSD is defined in terms of discrete size ranges: e.g. "% of sample between 45  $\mu\text{m}$  and 53  $\mu\text{m}$ ", when sieves of these sizes are used.

At the bottom of the slide, there are two logos: on the left, a circular logo with the text 'FACULTY OF ENGINEERING' and 'UNIVERSITY OF CALicut'; on the right, a circular logo with the text 'MATERIALS ENGINEERING DEPARTMENT' and 'UNIVERSITY OF CALicut'.

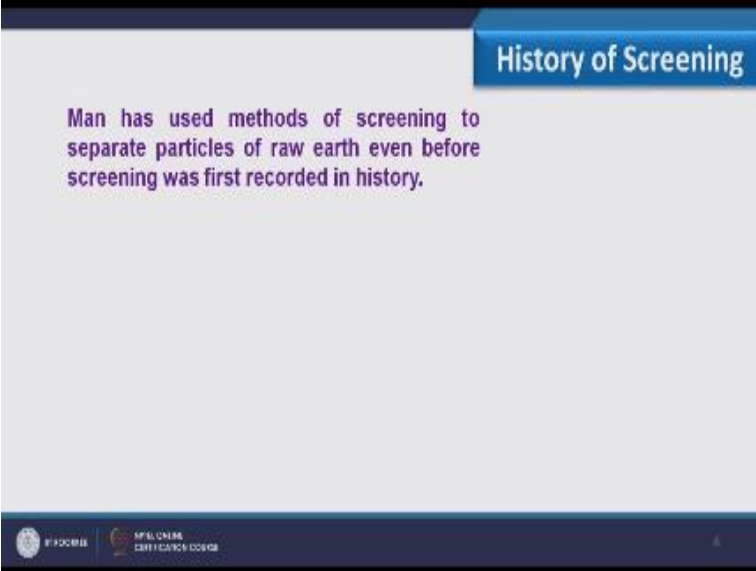
So the easiest method to determine PSD is sieve analysis where powder is separated on sieves of different sizes. Thus the PSD is defined in terms of discrete size ranges, for example percentage of sample between 45  $\mu\text{m}$  and 53  $\mu\text{m}$ , when sieves of these sizes are used. So here you see it is collection of particle on particular sieve we can obtain so it comes under discrete analysis.

(Refer Slide Time: 04:05)



So here I am discussing the history of screening where whatever we have used in past days that I will show over here.

(Refer Slide Time: 04:17)



History of Screening

Man has used methods of screening to separate particles of raw earth even before screening was first recorded in history.

AFCEM  
AFCEM  
CHITRANJAN KOLLEGE


So man has used methods of screening to separate particles of raw earth even before screening was first recorded in the history.

(Refer Slide Time: 04:23)

### History of Screening

Man has used methods of screening to separate particles of raw earth even before screening was first recorded in history.

The first "recorded" reference to screening dates back to 150 BC when Greeks and Romans described using crude sieves of woven horse hair for separating minerals and clays.



Sieve KM 3434  
Roman Karanis, Egypt

FOODS & NUTRITION  
FACULTY OF AGRICULTURE  
MANSOURA UNIVERSITY

So if you see this figure it is the very old screen which I have also shown in introduction lecture, so it is the first recorded reference of screening dates back to 150 BC where Greeks and Romans described using crude sieves of woven horse hair for separating minerals and clays. So if you consider this particular screen it is made of horse hair, nowadays we use this screen made of metal.


(Refer Slide Time: 04:57)

### History of Screening

Man has used methods of screening to separate particles of raw earth even before screening was first recorded in history.

The first "recorded" reference to screening dates back to 150 BC when Greeks and Romans described using crude sieves of woven horse hair for separating minerals and clays.

In the 15th century, Germans used the first woven wire screens. These screens were stiff sheet screen that were shaken by hand.




Sieve KIM 3434  
Roman Karanis, Egypt

MPIL ONLINE  
MPIL ONLINE  
SRI LANKA LIBRARY

In the 15<sup>th</sup> century Germans used first woven wire screens, these screens were stiff sheet that were shaken by hand, so that is the history of screen. Now what is a screen and why, what I am calling as a sieve, if you see this figure from this figure you can understand very well.

(Refer Slide Time: 05:19)

Sieve (or Screen)



A screen can be called an open container usually cylindrical with uniformly spaced openings at the base. It is normally made of wire mesh cloth, the wire diameter and the interspacing between wires being accurately specified.

FFOQ 0118 MPIL ONLINE CERTIFICATION COURSE

That what is a screen, here I am having this particular screen where we have the uniform opening at the base so the screening can be called as an open container usually cylindrical with uniformly spaced opening at the base as shown in this figure.

(Refer Slide Time: 05:42)

Sieve (or Screen)



A screen can be called an open container usually cylindrical with uniformly spaced openings at the base. It is normally made of wire mesh cloth, the wire diameter and the interspacing between wires being accurately specified.

IPCC IITB    NPTEL ONLINE EDUCATION CENTER

It at the base of it we have uniformly spaced openings; it is normally made of wire mesh cloth, the wire diameter and the interspacing between wires being accurately specified. So depending upon this opening.

(Refer Slide Time: 05:58)

Sieve (or Screen)



A screen can be called an open container usually cylindrical with uniformly spaced openings at the base. It is normally made of wire mesh cloth, the wire diameter and the interspacing between wires being accurately specified.

IPCC 2018 IPCC 2018  
IPCC 2018 IPCC 2018

The material which should be available over it or should be passed through it that we have to consider.



(Refer Slide Time: 06:04)



Therefore if you see this figure it has different screen, if you see these two screen it has larger opening in comparison to this, so larger particle can pass through this and a smaller particle can pass through this. Along with this in this particular figure we have another container which has no opening at the base so we call it as a pan. So if you consider the screen it has three basic component, first is the screen itself.

(Refer Slide Time: 06:37)

Sieve (or Screen)



A screen can be called an open container usually cylindrical with uniformly spaced openings at the base. It is normally made of wire mesh cloth, the wire diameter and the interspacing between wires being accurately specified.

MPSC ONLINE  
SRI LAKSHMI COLLEGE

Second is the pan which is placed below to the screen and third we have the cover which place at the top of the screen so that during operation fines should not take off from the system.

(Refer Slide Time: 06:50)

Sieve (or Screen)



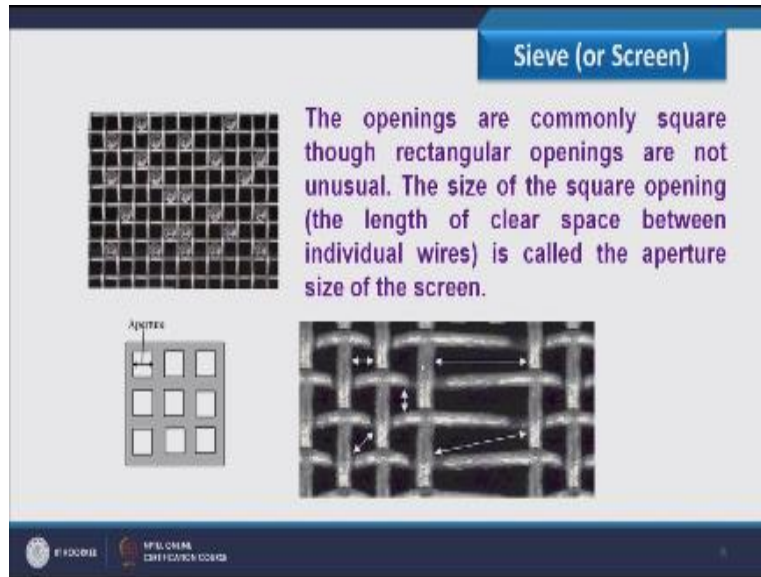
A screen can be called an open container usually cylindrical with uniformly spaced openings at the base. It is normally made of wire mesh cloth, the wire diameter and the interspacing between wires being accurately specified.



At the bottom of the slide, there are logos for IIT Bombay and the Department of Chemical Engineering, IIT Bombay.

And in this figure if you see the, this particular component it is basically called scoop to feed the material at the screen.

(Refer Slide Time: 06:59)



So the openings of a screen are commonly square though rectangular opening are not unusual, the size of the square opening that is the length of clear space between individual wire, if you see this figure it has the opening as I have shown over here also. So this particular square opening is called the aperture size of the screen, therefore depending on this particular size the material which should be passed through it can be decided.

And in this particular figure you see here somewhere I am having the square opening and somewhere I am having the rectangular opening, this we used when we are dealing with needle kind of or rectangular kind of material, for example if I want to screen the mica. So screens are usually designated by their mesh number, what is mesh number?

(Refer Slide Time: 08:01)

Screens are usually designated by their mesh number. The mesh number indicates the number of apertures per linear length. For example, a screen having 10 square openings per cm may be called a 10 mesh screen and in that case, the aperture size of the screen will be 0.1 cm minus the wire diameter. Clearly, higher the mesh number, smaller will be the aperture size of the screen.

This is the practice followed in British standard screens (BSS), American standard screens (ASTM and Tyler standard screens), German standard screens (DIN 1171) etc.

The slide features a blue header with the title "Sieve (or Screen)", a main text area with a light blue background, and a footer with logos for IIT Bombay and IIT Madras.

Mesh number indicates the number of apertures per linear length. For example if I consider in a screen 10 square opening so 10 would be the mesh number of that particular screen, so how we define the opening of that? Suppose I am considering linear length as 1cm and 10 mesh screen I am considering. So  $1/10$  that is 0.1 cm minus the via diameter would be the aperture size of the screen, so therefore higher would be the mesh number, smaller would be the aperture size of the screen because length would be uniform, that is 1cm. If I consider 100 mesh screen  $1/100$  so obviously aperture size will keep on decreasing as we increase the mesh number.

(Refer Slide Time: 08:49)

**Sieve (or Screen)**

Screens are usually designated by their mesh number. The mesh number indicates the number of apertures per linear length. For example, a screen having 10 square openings per cm may be called a 10 mesh screen and in that case, the aperture size of the screen will be 0.1 cm minus the wire diameter. Clearly, higher the mesh number, smaller will be the aperture size of the screen.

This is the practice followed in British standard screens (BSS), American standard screens (ASTM and Tyler standard screens), German standard screens (DIN 1171) etc.

MPAL ONLINE COURSE

So this practice is followed in British standard screen, that we call (BSS), American standard screen (ASTM) and Tyler standard screens, German standard screen (DIN 1171) etcetera. So here what we have seen the mesh number, mesh number directly indicates the number of opening and using this mesh number we can calculate how much would be the aperture size of a particular screen.

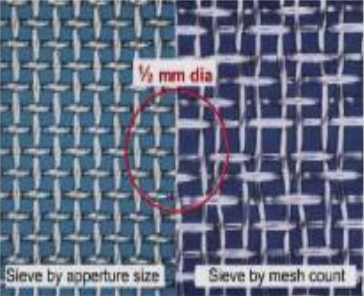
(Refer Slide Time: 09:19)

**Sieve (or Screen)**

Screens are usually designated by their mesh number. The mesh number indicates the number of apertures per linear length. For example, a screen having 10 square openings per cm may be called a 10 mesh screen and in that case, the aperture size of the screen will be 0.1 cm minus the wire diameter. Clearly, higher the mesh number, smaller will be the aperture size of the screen.

This is the practice followed in British standard screens (BSS), American standard screens (ASTM and Tyler standard screens), German standard screens (DIN 1171) etc.

Two woven wire sieves with exactly the same 'mesh number'



Sieve by aperture size      Sieve by mesh count

MPIL ONLINE CERTIFICATION COURSE

Now here I am showing one figure to show what is the effect of mesh number on aperture size? For example if I consider the left figure and in this figure you can see the aperture size is quite uniform, however the right figure shows aperture size is not uniform. In the left figure if I am considering this particular section where I am having four mesh, for example from here to here if I consider 1, 2, 3, 4, four openings.

So four mesh screen is there for example, here in the same length if I am considering so again 4, 1, 2, 3, 4, four mesh screen, so both are having four mesh screen. What is the difference between the two? If I consider only the mesh count it means both should screen same material but if you see the right figure some openings are larger some opening are smaller, so obviously material will not be uniform which will pass through this particular screen.

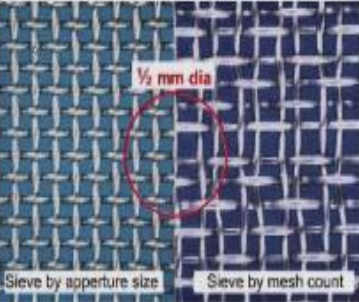
(Refer Slide Time: 10:27)

### Sieve (or Screen)

Screens are usually designated by their mesh number. The mesh number indicates the number of apertures per linear length. For example, a screen having 10 square openings per cm may be called a 10 mesh screen and in that case, the aperture size of the screen will be 0.1 cm minus the wire diameter. Clearly, higher the mesh number, smaller will be the aperture size of the screen.

This is the practice followed in British standard screens (BSS), American standard screens (ASTM and Tyler standard screens), German standard screens (DIN 1171) etc.

Two woven wire sieves with exactly the same 'mesh number'



1/2 mm dia

Sieve by aperture size      Sieve by mesh count

© FOUNDRY      METAL COUNCIL OF INDIA

However if I consider the left screen it has all material of uniform size which will be passed through it. So this figure basically speaks about that instead of mesh number do I have any other representation to show the screen? The answer is yes.



(Refer Slide Time: 10:44)

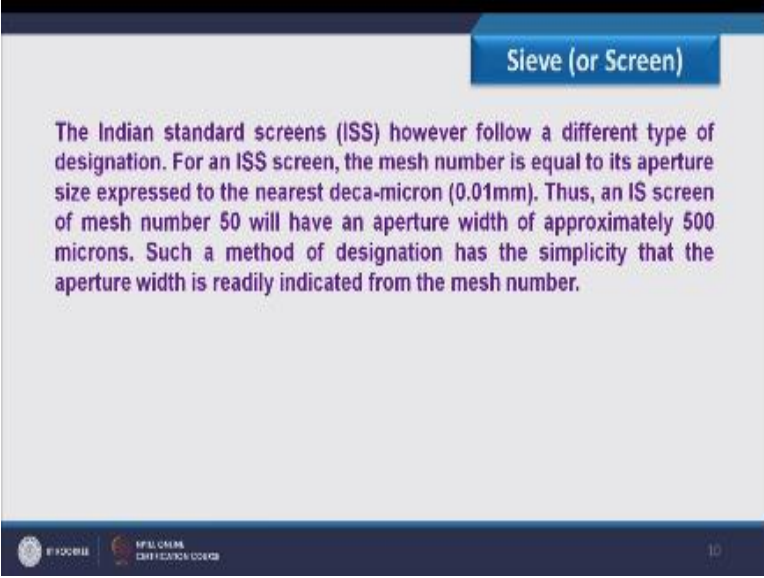
**Sieve (or Screen)**

The Indian standard screens (ISS) however follow a different type of designation. For an ISS screen, the mesh number is equal to its aperture size expressed to the nearest deca-micron (0.01mm). Thus, an IS screen of mesh number 50 will have an aperture width of approximately 500 microns. Such a method of designation has the simplicity that the aperture width is readily indicated from the mesh number.

IIT BOMBAY NPTEL NATIONAL EDUCATION RESOURCE CENTER 10

Therefore the Indian standard screens that is (ISS) however follow a different type of designation. For an ISS screen the mesh number is equal to the aperture size expressed to the nearest deca-micron, that is 0.01mm. So what Indian standard screen follow that we define a screen in terms of aperture size not as the mesh number.

(Refer Slide Time: 11:10)



**Sieve (or Screen)**

The Indian standard screens (ISS) however follow a different type of designation. For an ISS screen, the mesh number is equal to its aperture size expressed to the nearest deca-micron (0.01mm). Thus, an IS screen of mesh number 50 will have an aperture width of approximately 500 microns. Such a method of designation has the simplicity that the aperture width is readily indicated from the mesh number.

IPU  
INDIAN  
UNIVERSITY  
10

So that is the mesh number is equal to its aperture size expressed to the nearest deca-micron that is 0.01mm, therefore if I consider the screen of mesh number 50 the aperture size would be 50 x 0.01 mm that is 0.5mm which will convert into microns that would be 500 microns. So in this case as I am having increment in mesh number I will have more aperture size. So such a method of designation has a simplicity that aperture width is readily indicated from the mesh number.

(Refer Slide Time: 11:50)

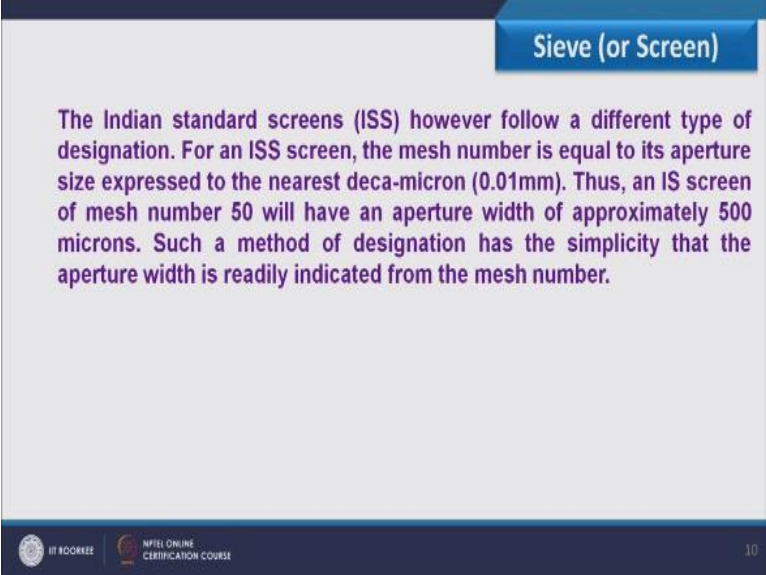
**Sieve (or Screen)**

The Indian standard screens (ISS) however follow a different type of designation. For an ISS screen, the mesh number is equal to its aperture size expressed to the nearest deca-micron (0.01mm). Thus, an IS screen of mesh number 50 will have an aperture width of approximately 500 microns. Such a method of designation has the simplicity that the aperture width is readily indicated from the mesh number.

IIT BOMBAY IIT MADRAS

If I consider British standard or American standard it is quite opposite, for example if I having the more number of meshes or mesh number will increase, screen size will decrease so that is quite complicated to remember. However in Indian screen if I am having more number of meshes it has more aperture size.

(Refer Slide Time: 12:18)



**Sieve (or Screen)**

The Indian standard screens (ISS) however follow a different type of designation. For an ISS screen, the mesh number is equal to its aperture size expressed to the nearest deca-micron (0.01mm). Thus, an IS screen of mesh number 50 will have an aperture width of approximately 500 microns. Such a method of designation has the simplicity that the aperture width is readily indicated from the mesh number.

IIIT ROORKEE NPTEL ONLINE CERTIFICATION COURSE 10

So it is easy to remember, so standard test screens.

(Refer Slide Time: 12:22)

**Sieve (or Screen)**

The Indian standard screens (ISS) however follow a different type of designation. For an ISS screen, the mesh number is equal to its aperture size expressed to the nearest deca-micron (0.01mm). Thus, an IS screen of mesh number 50 will have an aperture width of approximately 500 microns. Such a method of designation has the simplicity that the aperture width is readily indicated from the mesh number.

Standard test screens are usually made of phosphor bronze wires. Brass or mild steel wires are also sometimes used. It is always preferable to maintain a standard screen interval between successive test screens. An internationally accepted standard screen interval is  $(2)^{1/4}$  that is 1.189.

IIIT ROORKEE | NPTEL ONLINE CERTIFICATION COURSE | 10

Are usually made of phosphor bronze wire. Brass or mild steel wire are also sometime used. It is always preferable to maintain a standard screen interval between successive test screen. An internationally accepted standard screen interval is  $(2)^{1/4}$  that's I 1.189. So here you see this particular interval we follow between two successive screens, however sometimes we have some other standard also but usually we have  $(2)^{1/4}$ .

(Refer Slide Time: 12:59)

Sieves Mesh Chart									
Sieve Designation Number, ISS	Sieve opening/ aperture size mm	Equivalent Mesh Number of			Sieve Designation Number, ISS	Sieve opening/ aperture size mm	Equivalent Mesh Number of		
		ASTM	BSS	Tyler			ASTM	BSS	Tyler
570	5.660	3.5	-	3.5	60	0.592	30	25	28
480	4.760	4	3/16"	4	50	0.500	35	30	32
400	4.000	5	-	5	40	0.420	40	36	35
340	3.353	6	5	6	35	0.351	45	44	42
320	3.180	-	1/8"	-	30	0.296	50	52	48
280	2.818	7	6	7	25	0.251	60	60	60
240	2.399	8	7	8	20	0.211	70	72	65
200	2.032	10	8	9	18	0.177	80	85	80
170	1.676	12	10	-	15	0.151	100	100	100
160	1.600	-	1/16"	10	12	0.124	120	120	115
140	1.405	14	12	12	10	0.104	140	150	150
120	1.201	16	14	14	9	0.089	170	170	170
100	1.000	18	16	16	8	0.075	200	200	200
85	0.842	20	18	20	6	0.064	230	240	230
80	0.790	-	1/32"	-	5	0.053	270	300	270
70	0.708	25	22	24	4	0.044	325	-	325

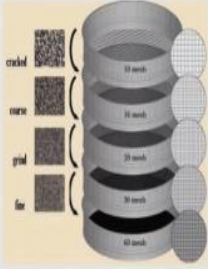
This particular slide shows or sieves mesh chart where you see here I am having the sieve designation number as per Indian standard and here corresponding opening is shown and equivalent mesh number of ASTM, BSS Tyler are shown over here, so here you can see very well that as we decrease the mesh number from 570 to 70 in Indian standard screen aperture size will keep on decreasing however the mesh number will keep on increasing, that is just opposite to the Indian standard.

So here we have the sieve from 570 to 70 then again from 60 to 4 and correspond to 4 the value is 0.044 so that is 44 microns. So if you remember the pervious slide sieve analyses gives the particle size distribution up to 40 microns or above to this, so this screen vary from 572 4 mesh number.

(Refer Slide Time: 14:06)

**Screen Analysis**

In a standard sieve shaker, test screens are stacked one above the other in the ascending order of their aperture size. That is, the top most screen will have the largest aperture size and the bottom most screen the smallest. A weighed amount of the feed material is fed to the top-most screen and the whole assembly is shaken continuously either manually or more preferably mechanically.



MIT COURSE NPTEL ONLINE CERTIFICATION COURSE 12

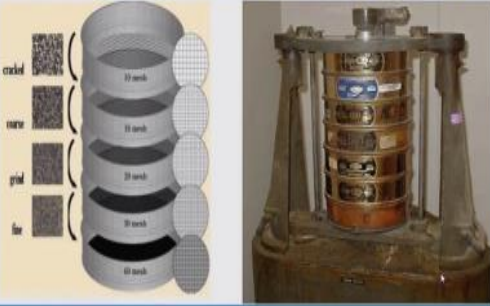
Now what is sieve analyses? sieve analyses is basically done using standard sieve shaker in which screens of different sizes are arranged one over another. In this test screens are stacked one above the other in the ascending order of their aperture size. If you see the top most screen it has the largest size because it has to retain the largest size particle and has to pass the practical lesser than this so therefore the largest opening screen is placed at the top and finest opening screen should be placed at the bottom.

Now below the finest opening screen we should place the pan and over the largest opening screen we should place the cover, so the cover different size of the screen and the pan will give the complete assembly of screen analyses. So here how we do the screen analyses, once this complete assembly is ready weigh the feed and that feed we keep at the top most screen and complete assembly.

(Refer Slide Time: 15:17)

**Screen Analysis**

In a standard sieve shaker, test screens are stacked one above the other in the ascending order of their aperture size. That is, the top most screen will have the largest aperture size and the bottom most screen the smallest. A weighed amount of the feed material is fed to the top-most screen and the whole assembly is shaken continuously either manually or more preferably mechanically.



The diagram on the left shows a vertical stack of five cylindrical screens. From top to bottom, they are labeled: 75 mesh, 60 mesh, 45 mesh, 30 mesh, and 15 mesh. To the left of the screens, four rectangular samples of material are shown, labeled 'crushed', 'sand', 'grit', and 'fine', with arrows indicating their respective positions relative to the screens. To the right of the diagram is a photograph of a physical sieve shaker, which is a cylindrical metal frame containing the same stack of screens, mounted on a base.

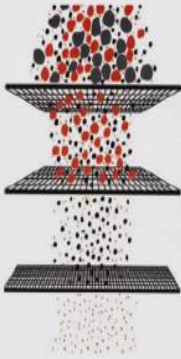
UJ ROOREE    NPTEL ONLINE CERTIFICATION COURSE    12

Is put into the shaker, this is basically the shaker here, you see this particular assembly it mechanically vibrates this particular set. So as for as movement is concerned it has gyratory motion, it has oscillatory motion and along with that it has the vibratory motion. How the vibratory motion is done? If you see that top most assembly it has a hammer kind of structure which keeps on hammering this particular set from the top so that the material which is clogged in between the screen that should be passed through the screen.

So here I am having gyratory, oscillatory and vibratory motion when we put this screen into the shaker. So after some time the complete feed which we have put at the top most screen should be distributed in these particular screen and whatever is passed from the finest opening screen is collected at the pan, therefore in this schematic I have shown what will happen.



(Refer Slide Time: 16:22)



**Screen Analysis**

Material retained on	Mass (gm)
480	0.0
400	$m_1$
340	$m_2$
320	$m_3$
280	$m_4$
240	$m_5$
.	.
.	.
8	$m_{27}$
Bottom pan	$m_b$

After a period of time, the vibration is stopped and the screens are disassembled. The material retained on each screen (including the material in the bottom pan) is weighed.

13

So if you see this particular screen it has largest opening and the, this particular screen has the smallest opening and material is distributed according to their size. So obviously top most has the coarsest material and below the finest we have the finest material which is collected at the pan.

So after a period of time the vibration is stopped and the screens are disassembled, the material retained on each screen including the material in the bottom pan is weight, so here if you see this in this way we represent the data of particle size which we have obtained from different screen. So here you see at 480, 0 mass is available however at 400 we have  $m_1$  mass and accordingly whatever mass is collected in different screen as well as pan that we have noted down in this table.

(Refer Slide Time: 17:22)

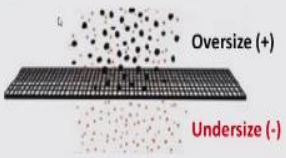
The slide is titled "Screen Analysis" in a blue box at the top right. The main text, in purple, states: "The material that passes through the screen is called the minus (-) material or the undersize and the material that is retained on the screen is called the plus (+) material or the oversize." At the bottom left, there are logos for "IIT ROORKEE" and "NPTEL ONLINE CERTIFICATION COURSE". At the bottom right, the number "14" is displayed.

So material that passes through the screen is called the minus material which we also call as undersize and the material that is retained on the screen.

(Refer Slide Time: 17:32)

**Screen Analysis**

The material that passes through the screen is called the minus (-) material or the undersize and the material that is retained on the screen is called the plus (+) material or the oversize.



Oversize (+)

Undersize (-)

NPTEL ONLINE CERTIFICATION COURSE

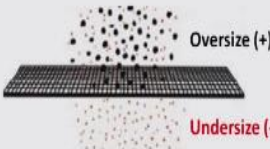
18

We call it plus material that is the oversize. So if I am having this particular screen whatever is available at the top that we call oversize and whatever is passed through it that we call undersize or minus, so while representing the data we will use two signs first is minus and second is plus. Minus shows material which is passed through the screen and plus shows material which is retained on the screen.

(Refer Slide Time: 18:02)

Screen Analysis

The material that passes through the screen is called the minus (-) material or the undersize and the material that is retained on the screen is called the plus (+) material or the oversize.




Oversize (+)

Undersize (-)


The average size of particles ( $d_{avg}$ ) in (-400+340) fraction:

$d_{avg} = (4.00 + 3.353) / 2 = 3.6765 \text{ mm}$

ISS mesh	Average size, mm	Mass fraction
+480	>4.76	0.0
-480+400	$d_{avg,1} (=4.38)$	$x_1$
-400+340	$d_{avg,2} (=3.6765)$	$x_2$
-340+320	$d_{avg,3}$	$x_3$
-320+280	$d_{avg,4}$	$x_4$
-280+240	$d_{avg,5}$	$x_5$
-240+200	$d_{avg,6}$	$x_6$
-8+8	$d_{avg,27}$	$x_{27}$
-8	< 0.075	$x_b$



IIT BOMBAY



NPTEL ONLINE  
CERTIFICATION COURSE

14

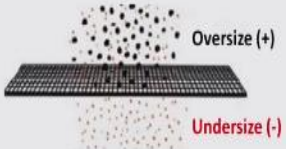
In this form we represent the complete data like if I consider this +480 mesh it means material which has to be retained on it that we have to represent over here which is in this case is 0. It has size greater than 4.76, how this value we have obtained, by referring the standard sieve chart. Therefore, if I considered the second data of this that is -480 +400 here you see the material which is passed through 480 and retained on 400 mesh screen we can write in this manner -480 +400 and its fraction is  $x_1$ .

What is this  $d_{avg}$  how we calculate this  $d_{avg}$  is the arithmetic mean of size correspond to 480 and 400 mesh. The average size of particle  $d_{avg}$  is -400 +340 fraction we have shown over here correspond to 400, the size is 4mm correspond to 340 mesh we have size 3.353, if we take the arithmetic mean the value 3.6765 mm would be the  $d_{avg}$  or would be the size of material which is available at the screen. And whatever fraction is there that is how we can compute this that is very simple total mass which is available.

(Refer Slide Time: 19:33)

### Screen Analysis

The material that passes through the screen is called the minus (-) material or the undersize and the material that is retained on the screen is called the plus (+) material or the oversize.





The average size of particles ( $d_{avg}$ ) in (-400+340) fraction:

$d_{avg} = (4.00 + 3.353) / 2 = 3.6765 \text{ mm}$

Mass fraction,  $x_2 = m_2 / M$

ISS mesh	Average size, mm	Mass fraction
+480	>4.76	0.0
-480+400	$d_{avg,1} (=4.38)$	$x_1$
-400+340	$d_{avg,2} (=3.6765)$	$x_2$
-340+320	$d_{avg,3}$	$x_3$
-320+280	$d_{avg,4}$	$x_4$
-280+240	$d_{avg,5}$	$x_5$
-240+200	$d_{avg,6}$	$x_6$
-9+8	$d_{avg,27}$	$x_{27}$
-8	< 0.075	$x_0$

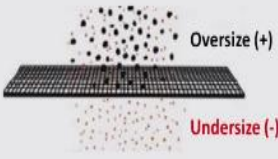


14

On that screen divided by the total mass which we have fed to the screen, topmost screen. Therefore, in this way we can represent the data of a screen analysis which includes mesh number.



(Refer Slide Time: 19:46)

### Screen Analysis

The material that passes through the screen is called the minus (-) material or the undersize and the material that is retained on the screen is called the plus (+) material or the oversize.



ISS mesh	Average size, mm	Mass fraction
+480	>4.76	0.0
-480+400	$d_{avg,1}$ (=4.38)	$x_1$
-400+340	$d_{avg,2}$ (=3.6765)	$x_2$
-340+320	$d_{avg,3}$	$x_3$
-320+280	$d_{avg,4}$	$x_4$
-280+240	$d_{avg,5}$	$x_5$
-240+200	$d_{avg,6}$	$x_6$
-9+8	$d_{avg,27}$	$x_{27}$
-8	< 0.075	$x_0$

 IIT BOMBAY  NPTL ONLINE CERTIFICATION COURSE 14

Average size and mass fraction of the material. Considering this we can derive the expression for a specific surface area of mixture of particle. For example, if I consider  $i^{\text{th}}$  fraction.

(Refer Slide Time: 19:59)

**Specific Surface area of Mixture of particles**

For  $i^{\text{th}}$  fraction: Specific surface area,  $s_i = \frac{6n_i}{\rho d_{\text{avg},i}}$  Assuming each fraction contains particles of the same size,  $d_{\text{avg}}$

BY BOBKEE NPTEL ONLINE CERTIFICATION COURSE 15

Specific surface area can be denoted by this that is  $s_i = 6n_i / \rho d_{\text{avg},i}$  this is a specific surface that is surface area per unit mass of the mixture, and if you remember this particular expression this we have discussed in lecture 3 where we were discussing specific surface ratio. Now in this  $i^{\text{th}}$  fraction I have considered  $d_{\text{avg},i}$ .

(Refer Slide Time: 20:29)

### Specific Surface area of Mixture of particles

For  $i^{\text{th}}$  fraction: Specific surface area,  $s_i = \frac{6n_i}{\rho d_{\text{avg},i}}$       Assuming each fraction contains particles of the same size,  $d_{\text{avg}}$


Surface area of  $i^{\text{th}}$  fraction,  $S_i = s_i m_i = \frac{6n_i m_i}{\rho d_{\text{avg},i}}$        $m_i$  is the mass of  $i^{\text{th}}$  fraction

Specific surface of the mixture  $S_m = \frac{\text{Surface area of all fractions (1---f)}}{\text{Mass of the mixture}}$       For  $f$  fractions

$$S_m = \frac{\left[ \frac{6n_1 m_1}{\rho d_{\text{avg},1}} \right] + \left[ \frac{6n_2 m_2}{\rho d_{\text{avg},2}} \right] + \left[ \frac{6n_3 m_3}{\rho d_{\text{avg},3}} \right] \dots \left[ \frac{6n_f m_f}{\rho d_{\text{avg},f}} \right]}{(m_1 + m_2 + m_3 \dots m_f)}$$

$x_1$       Where,  $m_1 + m_2 + \dots = M$

$$S_m = \left[ \frac{6n_1 x_1}{\rho d_{\text{avg},1}} \right] + \left[ \frac{6n_2 x_2}{\rho d_{\text{avg},2}} \right] + \left[ \frac{6n_3 x_3}{\rho d_{\text{avg},3}} \right] \dots \left[ \frac{6n_f x_f}{\rho d_{\text{avg},f}} \right] \quad S_m = \frac{6}{\rho} \sum_{i=1}^f \left( \frac{n_i x_i}{d_{\text{avg},i}} \right)$$


NPTEL ONLINE CERTIFICATION COURSE
15

And during this we have assumed that this particular fraction or similarly other fraction contains particles of same size that is  $d_{\text{avg}}$ . So surface area of  $i^{\text{th}}$  fraction how we can compute this, that is we have denoted with  $S_i$  so that would be small  $s_i$  that is nothing but this into total mass available in  $i^{\text{th}}$  fraction. So that is  $6n_i m_i / \rho d_{\text{avg},i}$  where  $m_i$  is the mass of  $i^{\text{th}}$  fraction. Specific surface area of the mixture is, we have denoted this with  $S_m$  it is equal to surface area of all fraction 1 to  $f$  / mass of the mixture where I am considering total  $f$  fractions. So this is the expression where this particular expression  $6n_i m_i / \rho d_{\text{avg},i}$  we have written for each fraction and similarly we have counted the mass of each fraction to calculate total mass.

So this  $m_1$  to  $m_f$  can be represented by  $M$ , now if I consider a small  $m_i$  and  $M$  that we can write very well with  $x_i$ , that we can represent with  $x_i$ , so finally I am having this expression for  $f$  number of fraction if we want to write this in a generalized form that is  $S_m = 6/\rho$ , because  $6/\rho$  is common in all because we are dealing with same material so density would be uniform, and here we have a summation where  $i$  move from 1 to  $f$ ,  $n_i x_i / d_{\text{avg},i}$  this is the expression for surface area of mixture of particles. In the similar line we can derive an expression to calculate.



(Refer Slide Time: 22:20)

Number of particles in a Mixture

**For  $i^{\text{th}}$  fraction:**



$$\text{No. of particles in } i^{\text{th}} \text{ fraction, } N_i = \frac{\text{Mass of } i^{\text{th}} \text{ fraction}}{\text{Mass of one particle in } i^{\text{th}} \text{ fraction}} = \frac{\text{Mass of } i^{\text{th}} \text{ fraction}}{\text{density} \times \text{volume of one particle in } i^{\text{th}} \text{ fraction}}$$

$$N_i = \frac{m_i}{\rho \times a_i \times d_{\text{avg},i}^3} \quad \text{Assuming each fraction contains particles of the same size, } d_{\text{avg}}$$

**Total number of particles per unit mass of the mixture**

$$\frac{N}{M} = \frac{\frac{m_1}{\rho \times a_1 \times d_{\text{avg},1}^3} + \frac{m_2}{\rho \times a_2 \times d_{\text{avg},2}^3} + \dots + \frac{m_f}{\rho \times a_f \times d_{\text{avg},f}^3}}{M} \quad \text{For } f \text{ fractions}$$

$$= \frac{\frac{x_1}{\rho \times a_1 \times d_{\text{avg},1}^3} + \frac{x_2}{\rho \times a_2 \times d_{\text{avg},2}^3} + \dots + \frac{x_f}{\rho \times a_f \times d_{\text{avg},f}^3}}{\frac{1}{\rho} \sum_{i=1}^f \frac{x_i}{a_i \times d_{\text{avg},i}^3}} = \frac{1}{\rho \times a} \sum_{i=1}^f \frac{x_i}{d_{\text{avg},i}^3}$$



16

Number of particles in a mixture, for example if I am considering  $i^{\text{th}}$  fraction the number of particles in  $i^{\text{th}}$  fraction denoted as  $N_i = \text{mass of } i^{\text{th}} \text{ fraction} / \text{mass of one particle in a } i^{\text{th}} \text{ fraction}$ . Further mass of one particle in  $i^{\text{th}}$  fraction can be written as density x volume of one particle in  $i^{\text{th}}$  fraction. Numerically  $N_i$  can be shown as  $m_i$  that is mass available in  $i^{\text{th}}$  fraction /  $\rho \times a_i \times d_{\text{avg},i}^3$   $d_{\text{avg},i}^3 \times a$  basically show the volume of a particle where  $a_i$  is the volume shape factor.

For this you have to refer lecture 3 of this course. Now for this particular fraction we can calculate number of particles so total number of particles per unit mass of the mixture we can write as  $N/M$  that is the total mass fed to the screen and here we are having different fraction. For one for first fraction it is  $m_1 / \rho a_1 \times d_{\text{avg},1}^3$  and similarly we can represent for other fractions also. and here we have total  $f$  fraction, all these values will be divided by  $M$ . So similarly if you remember the last slide  $m_1$  and  $N$  we have represented as  $x_1$ , so if I represent the expression in terms of mass fraction.

(Refer Slide Time: 24:00)

Number of particles in a Mixture

**For  $i^{\text{th}}$  fraction:**


No. of particles in  $i^{\text{th}}$  fraction,  $N_i = \frac{\text{Mass of } i^{\text{th}} \text{ fraction}}{\text{Mass of one particle in } i^{\text{th}} \text{ fraction}} = \frac{\text{Mass of } i^{\text{th}} \text{ fraction}}{\text{density} \times \text{volume of one particle in } i^{\text{th}} \text{ fraction}}$

$$N_i = \frac{m_i}{\rho \times a_i \times d_{\text{avg},i}^3} \quad \text{Assuming each fraction contains particles of the same size, } d_{\text{avg}}$$

**Total number of particles per unit mass of the mixture**

$$\frac{N}{M} = \frac{\frac{m_1}{\rho \times a_1 \times d_{\text{avg},1}^3} + \frac{m_2}{\rho \times a_2 \times d_{\text{avg},2}^3} + \dots + \frac{m_f}{\rho \times a_f \times d_{\text{avg},f}^3}}{M} \quad \text{For } f \text{ fractions}$$

$$= \frac{x_1}{\rho \times a_1 \times d_{\text{avg},1}^3} + \frac{x_2}{\rho \times a_2 \times d_{\text{avg},2}^3} + \dots + \frac{x_f}{\rho \times a_f \times d_{\text{avg},f}^3} = \frac{1}{\rho} \sum_{i=1}^f \frac{x_i}{a_i \times d_{\text{avg},i}^3} = \frac{1}{\rho \times a} \sum_{i=1}^f \frac{x_i}{d_{\text{avg},i}^3}$$



IIT BOMBAY  
 NPTEL ONLINE  
 CERTIFICATION COURSE

16

That would be  $x_1 / \rho \times a_1 \times d_{\text{average},1}^3$  and similarly we can represent for other fractions also. In generalized form we can write  $1 / \rho$  and  $\sum$  of  $f$  fraction where  $i$  vary from 1 to  $f$  and the expression is  $x_i / a_i \times d_{\text{average},i}^3$ . If  $i$  am considering all particle of same shape then  $a_i$  would be common so  $1 / \rho \times a \sum x_i / d_{\text{average},i}^3$  where  $i$  vary from 1 to  $f$ , this is the expression to calculate number of particles in the mixture.

(Refer Slide Time: 24:44)

Number of particles in a Mixture

**For  $i^{\text{th}}$  fraction:**



No. of particles in  $i^{\text{th}}$  fraction,  $N_i = \frac{\text{Mass of } i^{\text{th}} \text{ fraction}}{\text{Mass of one particle in } i^{\text{th}} \text{ fraction}} = \frac{\text{Mass of } i^{\text{th}} \text{ fraction}}{\text{density} \times \text{volume of one particle in } i^{\text{th}} \text{ fraction}}$

$$N_i = \frac{m_i}{\rho \times a_i \times d_{\text{avg},i}^3} \quad \text{Assuming each fraction contains particles of the same size, } d_{\text{avg}}$$

**Total number of particles per unit mass of the mixture**

$$\frac{N}{M} = \frac{\frac{m_1}{\rho \times a_1 \times d_{\text{avg},1}^3} + \frac{m_2}{\rho \times a_2 \times d_{\text{avg},2}^3} + \dots + \frac{m_f}{\rho \times a_f \times d_{\text{avg},f}^3}}{M} \quad \text{For } f \text{ fractions}$$

$$= \frac{x_1}{\rho \times a_1 \times d_{\text{avg},1}^3} + \frac{x_2}{\rho \times a_2 \times d_{\text{avg},2}^3} + \dots + \frac{x_f}{\rho \times a_f \times d_{\text{avg},f}^3} = \frac{1}{\rho} \sum_{i=1}^f \frac{x_i}{a_i \times d_{\text{avg},i}^3} = \frac{1}{\rho \times a} \sum_{i=1}^f \frac{x_i}{d_{\text{avg},i}^3}$$



16

For constant shape of all particles, so once I am having this particles size distribution I can calculate specific surface area as well as.

(Refer Slide Time: 24:54)

Number of particles in a Mixture

**For  $i^{\text{th}}$  fraction:**

No. of particles in  $i^{\text{th}}$  fraction,  $N_i = \frac{\text{Mass of } i^{\text{th}} \text{ fraction}}{\text{Mass of one particle in } i^{\text{th}} \text{ fraction}} = \frac{\text{Mass of } i^{\text{th}} \text{ fraction}}{\text{density} \times \text{volume of one particle in } i^{\text{th}} \text{ fraction}}$

$$N_i = \frac{m_i}{\rho \times a_i \times d_{\text{avg},i}^3}$$

**Assuming each fraction contains particles of the same size,  $d_{\text{avg}}$**

**Total number of particles per unit mass of the mixture**

$$\frac{N}{M} = \frac{\frac{m_1}{\rho \times a_1 \times d_{\text{avg},1}^3} + \frac{m_2}{\rho \times a_2 \times d_{\text{avg},2}^3} + \dots + \frac{m_j}{\rho \times a_j \times d_{\text{avg},j}^3}}{M}$$

**For  $f$  fractions**

$$= \frac{x_1}{\rho \times a_1 \times d_{\text{avg},1}^3} + \frac{x_2}{\rho \times a_2 \times d_{\text{avg},2}^3} + \dots + \frac{x_j}{\rho \times a_j \times d_{\text{avg},j}^3} = \frac{1}{\rho} \sum_{i=1}^f \frac{x_i}{a_i \times d_{\text{avg},i}^3} = \frac{1}{\rho \times a} \sum_{i=1}^f \frac{x_i}{d_{\text{avg},i}^3}$$

**For constant shape of all particles**

Therefore, once the size distribution is known specific surface area as well as number of particles per unit mass of a mixture can be predicted.

IIT BOMBAY
NPTEL ONLINE CERTIFICATION COURSE
16

Number of particles per unit mass of the mixture and considering these expression we will solve one problem in next lecture. Further I am having measures to calculate the mean particle size of a mixture, if you remember the  $d$  average what is  $d$  average is the particle size of a particular fraction. If I want to calculate the particle size of complete mixture how we can calculate this?



Refer Slide Time: 25:22)

**Choices of Mean Particle Size**

Once the number of particles in a mixture is known, one can compute the mean particle size of a mixture by following methods

**Arithmetic mean:**

$$d_u = \frac{\sum_{i=1}^j N_i d_{avg,i}}{\sum_{i=1}^j N_i} = \frac{M \left( \frac{\sum_{i=1}^j x_i}{\sum_{i=1}^j d_{avg,i}^3} \right) d_{avg,i}}{\frac{M}{\rho \times a} \left( \frac{\sum_{i=1}^j x_i}{\sum_{i=1}^j d_{avg,i}^3} \right)} = \frac{\left( \frac{\sum_{i=1}^j x_i}{\sum_{i=1}^j d_{avg,i}^3} \right)}{\left( \frac{\sum_{i=1}^j x_i}{\sum_{i=1}^j d_{avg,i}^3} \right)}$$



17

Now once the number of particles in a mixture is known one can compute the mean particle size of a mixture by following method. The first method is the arithmetic mean, we can write, we can compute the arithmetic mean of a mixture by this expression that is  $\sum N_i d_{avg,i} / \sum N_i$ . It means It number of particles  $\times$  avg diameter of all fraction divided by number of particles in all fractions. If we write the expression of  $N_i$  we can have the complete expression in this form, once I resolve this as all these value will be cancelled out, once I resolve it the final expression of arithmetic mean would be  $\sum I 12f xi d_{avg,i} / \sum i1to f xi/d_{avg,i}3$ .

So this is the expression for arithmetic mean, in the similar line we can have the quadratic mean, we also call it as.

Refer Slide Time: 26:30)

**Choices of Mean Particle Size**



Once the number of particles in a mixture is known, one can compute the mean particle size of a mixture by following methods

**Arithmetic mean:**

$$d_a = \frac{\sum_{i=1}^j N_i d_{avg,i}}{\sum_{i=1}^j N_i} = \frac{\frac{M}{\rho \times a} \left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \right) d_{avg,i}}{\frac{M}{\rho \times a} \left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \right)} = \frac{\left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \right)}{\left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \right)}$$

**Quadratic mean (Surface mean):**

$$d_q = \frac{\left( \sum_{i=1}^j N_i d_{avg,i}^2 \right)^{1/2}}{\left( \sum_{i=1}^j N_i \right)} = \frac{\left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \times d_{avg,i}^2 \right)^{1/2}}{\left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \right)^{1/2}} = \frac{\left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \right)^{1/2}}{\left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \right)^{1/2}}$$


IIT BOMBAY

NPTEL ONLINE  
CERTIFICATION COURSE
17

The surface mean diameter, so quadratic mean diameter that is  $N_i d_{avg,i}^2 / \sum N_i d_{avg,i}^2$  for all fraction this power  $1/2$ . If I put the expression for  $N_i$  and further resolve it we can have  $d_q$  that is quadratic mean as  $\left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \times d_{avg,i}^2 \right)^{1/2} / \left( \sum_{i=1}^j \frac{x_i}{d_{avg,i}^3} \right)^{1/2}$ . Further I am having the diameter as cubic mean or we also call it volume in diameter that is.

(Refer Slide Time: 27:10)

**Choices of Mean Particle Size**

Once the number of particles in a mixture is known, one can compute the mean particle size of a mixture by following methods

**Arithmetic mean:**



$$d_u = \frac{\sum_{i=1}^f N_i d_{avg,i}}{\sum_{i=1}^f N_i} = \frac{\frac{M}{\rho \times a} \left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \right) d_{avg,i}}{\frac{M}{\rho \times a} \left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \right)} = \frac{\left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \right)}{\left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \right)}$$

**Quadratic mean (Surface mean):**

$$d_q = \frac{\left( \sum_{i=1}^f N_i d_{avg,i}^2 \right)^{1/2}}{\left( \sum_{i=1}^f N_i \right)} = \frac{\left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \times d_{avg,i}^2 \right)^{1/2}}{\left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \right)} = \frac{\left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}} \right)^{1/2}}{\left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \right)^{1/2}}$$

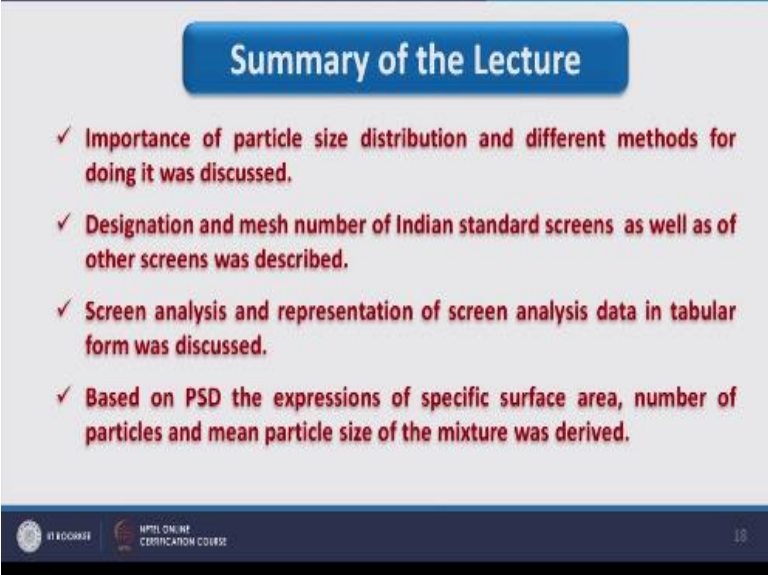
**Cubic mean (Volume mean):**

$$d_c = \frac{\left( \sum_{i=1}^f N_i d_{avg,i}^3 \right)^{1/3}}{\left( \sum_{i=1}^f N_i \right)} = \frac{\left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \right)^{1/3}}{\left( \sum_{i=1}^f \frac{x_i}{d_{avg,i}^3} \right)}$$



17

$d_c$  and here we have the expression  $N_i d_{avg,i}^3 / N_i$  power 1 over 3 writing the expression of  $N_i$  and resolving it the final expression I am having is  $\sum_{i=1}^f x_i / \sum_{i=1}^f x_i$  over  $d_{avg,i}^3$  1/3, so all these three methods are used to calculate the mean particle size of a mixture.

(Refer Slide Time: 27:42)



The slide features a blue header with the text "Summary of the Lecture". Below the header, there is a list of four bullet points, each starting with a red checkmark. The footer of the slide contains logos for IIT Roorkee and NPTEL, along with the text "NPTEL ONLINE CERTIFICATION COURSE" and the number "18".

**Summary of the Lecture**

- ✓ Importance of particle size distribution and different methods for doing it was discussed.
- ✓ Designation and mesh number of Indian standard screens as well as of other screens was described.
- ✓ Screen analysis and representation of screen analysis data in tabular form was discussed.
- ✓ Based on PSD the expressions of specific surface area, number of particles and mean particle size of the mixture was derived.

NPTEL ONLINE CERTIFICATION COURSE 18

And here I am having the summary of this lecture. The importance of particle size distribution and different methods for doing it was discussed in this lecture; secondly the designation and mesh number of Indian standard screens as well as other screens was described. Screen analysis and representation of screen analysis data in tabular form was discussed and finally based on PSD that is particle size distribution the expressions of specific surface area, number of particles and mean particle size of a mixture was derived, so that is all for this lecture, thank you.

**Educational Technology Cell**

Indian Institute of Technology Roorkee

NPTEL

**Production for NPTEL**

Ministry of Human Resource Development

Government of India



For Further Details Contact

Coordinator, Educational Technology Cell

Indian Institute of Technology Roorkee

Roorkee-247 667

E Mail – etcell@iitr.ernet.in, etcell [iitrke@gmail.com](mailto:iitrke@gmail.com)

Website: [www.nptel.ac.in](http://www.nptel.ac.in)

**Acknowledgment**

Prof. Pradipta Banerji

Director, IIT Roorkee

**Subject Expert & Script**

Dr. Shabina Khanam

Dept. of Chemical Engineering

IIT Roorkee

**Production Team**

Neetesh Kumar

Jitender Kumar

Sourav

**Camera**

Sarath Koovery

**Online Editing**

Jithin. K

**Editing**

Pankaj Saini

**Graphics**

Binoy. V. P

**Nptel Coordinator**

Prof. B. K. Gandhi

An Educational Technology Cell

IIT Roorkee Production

© Copyright All rights Reserved

WANT TO SEE MORE LIKE THIS

**SUBSCRIBE**