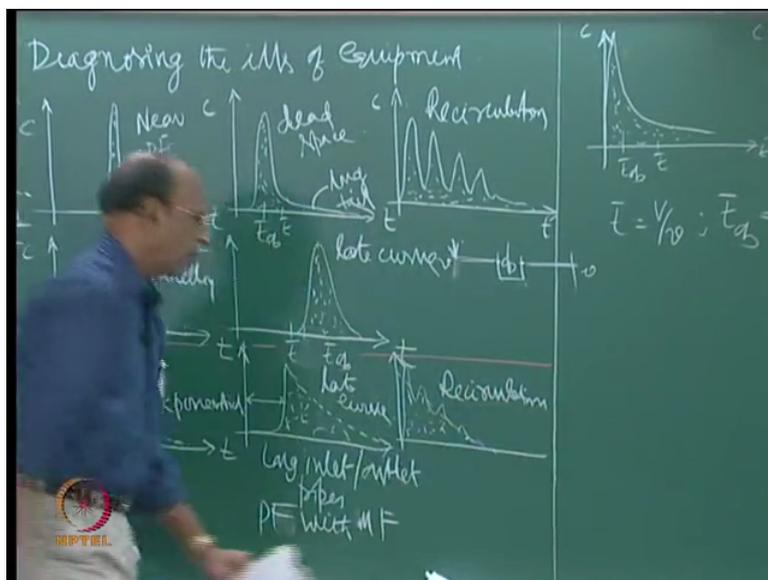
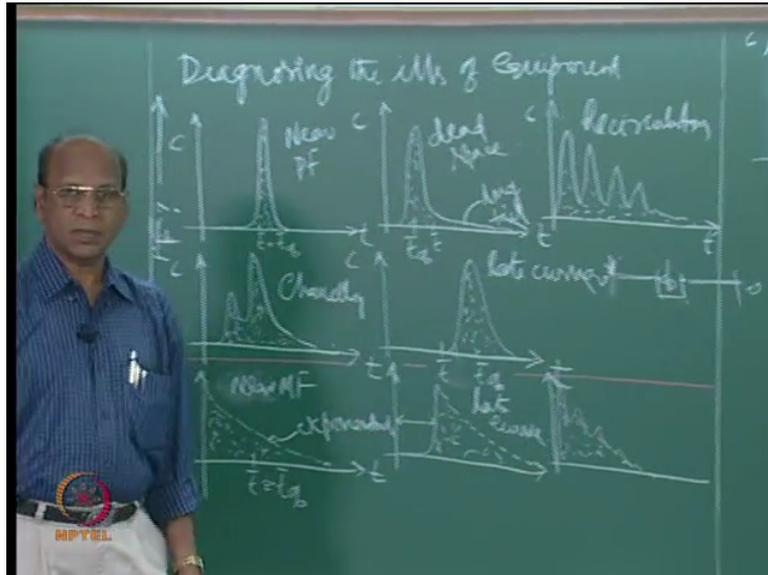
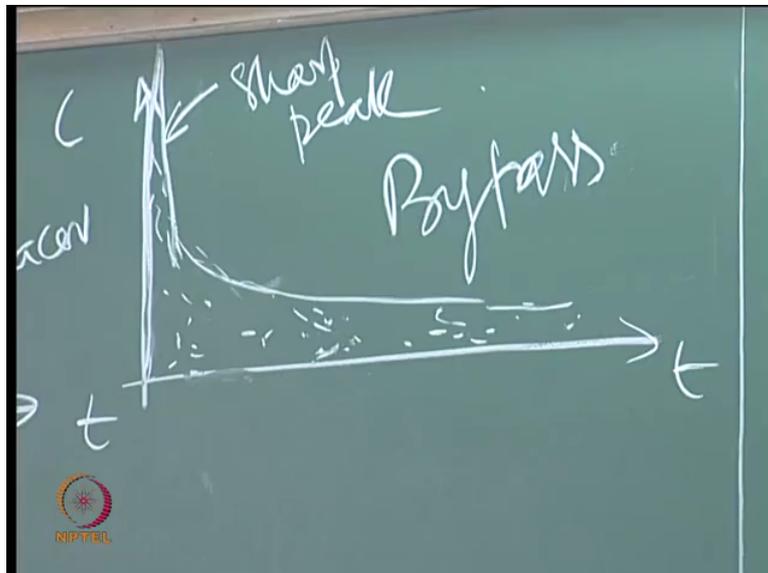
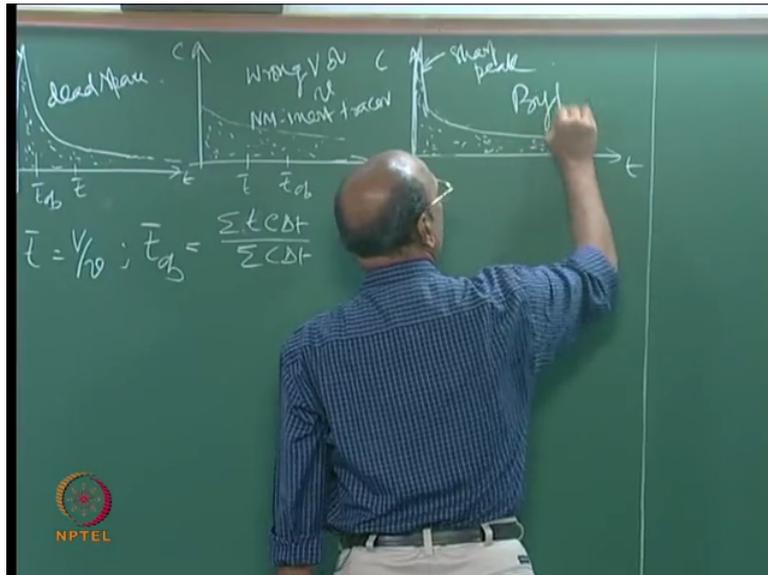


**Chemical Reaction Engineering 1 (Homogeneous Reactors)**  
**Professor K. Krishnaiah**  
**Department of Chemical Engineering**  
**Indian Institute of Technology, Madras**  
**Lecture 54**  
**Diagnosing the ills of equipments and Various RTD Models**

(Refer Slide Time: 0:15)





Okay so you could have seen the title diagnosing the ills of equipments, okay. Now you are acting as if you are a doctor doctor for equipment, okay doctor equip, right. So what we have done is whether you have done or someone else has done I think you know they have brought this data, they have conducted RTD test, okay not converted the data into ET not required in fact the shapes will not change only thing is you are normalizing by ET so that the area under the curve equal to 1 so that any fraction you will find out from 0 to 1, 1 to 2, 2 to 3, 4 to 5 know all that fractions and to calculate corresponding conversions and all that that is different.

But C versus t data itself can be used to find out what is the problem with this particular equipment, right like I found out from you what is the problem with you in the first class itself 0th class, okay 0 test I gave the test and I saw the results then I know how much

knowledge we have. So like that this also I think someone conducted and then he has brought and you are expert of now RTD and in the last class we have seen all the definitions and you know for ideal reactors what it should be you know the shapes and equations all that, good okay.

So this one and as I told you also we have only two extremes one is mixed flow, other one is plug flow. So that means whatever equipment you have or whatever reactor you have if you are talking about reactors definitely you have only that two extremes, one extreme we also know that we are very near to plug flow that means it must be only long pipe with small diameter like plug flow, okay or it may be at tank where continuously things are coming and continuously going out that is normally we take it as mixed flow, right.

So this data is okay this data are collected over this kind of you know long pipes that means supposed to be plug flow and then you got this kind of different shapes, okay for different equipment all are all are plug flow or very near to plug flow. So what is the first one I think you know if you look at this all these graphs you should be able to tell what is the disease, like for example here what is this corresponding to it is almost like a PFR because we expect that actually ideal PFR will be a spike here there delta function that is what is what you expect but in reality we know that there is no ideal plug flow anywhere in the World. So that is why we will say that okay slight expansion because of axial mixing is fine so that is why this is almost near plug flow near PF and also  $t_{bar}$  and  $t_{bar}$  observed.

So  $t_{bar}$  is volume by volumetric flow rate and  $t_{bar}$  observed is what observed means you experimentally calculated  $t_{bar}$  how do you calculate experimentally observed  $t_{bar}$ , Swami?  $t_{bar}$  is volume flow ya mean how do you calculate mean so that equation  $\int c \Delta t$  divided by  $c \Delta t$ , okay that is what  $t_{bar}$  observed, right. So here both are same so it is okay I bthink behaving properly okay like normal student, okay good so this one next one.

Next one we have  $t_{bar}$  coming earlier sorry  $t_{bar}$  observed coming earlier and  $t_{bar}$  later and also it has long long tail think think Abdul ya he says channelling you have to convince him what will happen if you have channelling, first of all what do you mean by channelling what do you mean by channelling where is it coming before,  $t_{bar}$  observed is coming correct, argument is right know ya those people who told that it is bypass.

Normally what is the condition condition is that we have very near to plug flow, what do you mean by channelling what do you mean by channelling in a plug flow reactor ya so when you

have separate path what will happen you should get 2 rupees, okay and why I mean those people who have told that it is dead space why they are right is that there is dead space what is  $t_{bar}$  did I write wrong no correct ya what is how do you calculate  $t_{bar}$  effective volume only what you have to take, okay and that is volume by volumetric flow rate and this one is  $t_{bar}$  observed  $t_{bar}$  observed is only from that, right.

So what happens is that your when volume by volumetric flow rate volume by volumetric flow rate the actual volume is less, right so I mean to give an example I have 10 litres but only 5 litres are active the other 4, 5 litres are dead, okay  $t_{bar}$  observed will be less or  $t_{bar}$  is less ya that is why because you are thinking that outside 10 litres that is why you calculate 10 litres by volumetric flow rate as  $t_{bar}$  but actually it is only 5 litres inside effective.

So that is why only that will reflect in the data, right because you do not know how much is dead there so that is the reason why this is dead space, okay. So then next one how can you have channelling so many channel recycle you can have a recycle reactor or in you know packed beds and all that if the packing is not properly put, right sometimes you know you use large packing and small packing and the  $(\tau)$ (6:55) will be different, somewhere you will have the recirculations and then they are moving somewhere and suddenly one recirculation will come that is corresponding to this one region, okay and also  $L/D$  should be not very very long if  $L/D$  is very very long it may not be reflecting.

But normally even if  $L/D$  is sufficiently long you know it is like  $(\tau)$ (7:16) I do not know now you can see I think everywhere you have lot of water now, particularly Andhra is under water, okay earlier I think I think last week we were under water. So if you go and stand on the bridge and then look at the river flowing you will have that big you know  $(\tau)$ (7:32) moving like that here also in packed bed whenever you have large  $(\tau)$ (7:38) somewhere because of improper packing possible that improper packing.

So then it may be rotating there but suddenly at one point of time it will be thrown out that is what happens also if you look carefully on the bridge and then see it will be moving, moving, moving suddenly it will appear there and suddenly again something will come and then moving, moving suddenly it appears somewhere there you know that  $(\tau)$ (8:01) I do not know that is why you should be in life you should be more observed than anything else I say and you can be observed only when you have brain, you have brain but the only thing is we are not using that is the problem, okay.

So with all that observations we can say that this is recirculations when you have so many peaks or if you take actual recycle reactor and then try to do RTD you will get exactly like this beautiful, right because you are taking tracer some amount of you know it is a recycle, you have injected tracer some amount and this is collected only in the outlet, okay so before outlet you also sent back so some tracer will come back and again that is the second peak, the first peak will come in the beginning, then the second peak afterwards again you are continuously taking out and it is a plug flow almost ideal plug flow so you know what is the  $t$  bar there for one pass one pass, right.

So like that you will have number of peaks coming because some small amount of tracer will be first thrown out that is the one it is not small amount I think initially more may come and then afterwards you are recycling continuously so some more tracer will come and afterwards again another small tracer will come, another tracer like that you know it goes all dying down because you only put for ya by the way what is the input which we have given for all these experiments that we have to remember first because I did not tell that because it is continuously going and then staying constant at some point will be only step, okay so that is why this is recirculation.

And this one this is channelling ya and this one this is axial mixing, what do you mean by this axial mixing you see here  $t$  bar is somewhere ya  $t$  bar is somewhere in Hyderabad and this is in Madras  $t$  bar observed in Madras what is the meaning ya it can be improper measurement of flow rates or volume that means wrongly, okay so and also another it may not be that much convincing for you but other thing is the most important thing in packed beds when you are using a tracer, okay so particularly for gas phase reactions this tracer will go and get adsorbed on the particles that will come late, actually this is called late curve correct know you expect around  $t$  bar, it is not changing much the shape is almost axial mixing but only thing is it is coming late ya and in fact we use in science and engineering this technique only for finding out separating out chemicals, what is the name of that (11:04) each each gas has its own adsorption characteristics and also adsorbed you take and first SO<sub>2</sub> you send depending on what adsorbent you put there SO<sub>2</sub> will come late and O<sub>2</sub> will come later like that you know different peaks depending on area of the peak we will find out what is the total amount of you know that particular chemical what you are measuring there, okay so that is what, this is good.

So this is MF for now all this is over now I think you know the moment you see these kind of graphs but  $\bar{t}$  and  $t$ ,  $\bar{t}$  and  $t$  is also very important for us and here I have not written  $\bar{t}$  because  $\bar{t}$  we can write here but  $\bar{t}$  observed does not have any meaning with so many peaks where is the mean, normally mean we say when you have one peak, right when you have so many peaks where is the mean so that is why we have not written but  $\bar{t}$  would have been there somewhere, okay good so this is MFR.

In MFR ya this one is almost exponential ya almost exponential curve what is this I mean if you look at this what do you find out and  $\bar{t}$  is also approximately equal to  $\bar{t}$  observed so this is ideal almost ideal, okay instead of ideal I say that near MF almost near MF, okay is this one sorry dead space, okay dead space when do you say it is dead space I have not given  $\bar{t}$  there or  $t$  there but see this is a very clear trend dead case will not give you that kind of trend because the curve is starting late, this is again late curve ya so that means there must be something which is giving that time delay time lack, right.

So what should have happened this is how (13:17) we can conduct our experiments also will affect all this how (13:22) in the sense that if I have okay this is small one reactor, right and I have the feed pipe here and also feed pipe here so I introduce feed here I mean tracer not (13:38) tracer this is  $v$  this is  $v$  and I measure here, where I am supposed to measure, where I am supposed to introduce here, here this is commonly done mistakes when you are conducting RTD and in mixed flow very frequently this is done, in plug flow you will have the same diameter, okay throughout and you know where it is entering and normally we do not miss that but in plug flow without knowing sorry in mixed flow without knowing what we can do is we can take this tank this length may be 1 feet here and also another foot there so 2 feet delay that is why this delay will come, okay.

So what we have to write here is that long inlet and outlet pipes long inlet or outlet pipes. So that means there must be some kind of plug flow in series with mixed flow, okay PF with (sorry I am writing PM) PF with mixed flow, okay good so what about this one several peaks recirculations but not the way very clearly like this because this may be you know very near to the stirrer it is moving and then throwing out and all that, okay good this is recirculation, okay recirculations near the particularly it is a tank where you will have recirculations most of the time near the stirrer if it is (15:26) design and most of the time we know how to (15:28) design the stirrer, okay so that is why, okay.

Next one  $\bar{t}$  is earlier and sorry  $\bar{t}$  observed is earlier and  $\bar{t}$  is later that you are experts and also this will go for long time, this is dead space, next one next one is very very very late curve anyway I think it is difficult to find out this may be wrong  $V$  capital  $V$  or small  $v$  otherwise you do not get that kind of  $(\bar{t})$ (16:02) curve, okay or non-inert tracer that means the tracer is going and sticking somewhere to the walls, okay non-inert non-inert tracer I am not telling about reacting tracer okay non-inert tracer may be even tracer which is getting adsorbed on the walls walls of the equipment tank and also can be stirrer and then slowly it may come it may come whenever it wants it is very very small, good okay.

So next one this is a very sharp peak suddenly one peak comes and afterwards and that peak is almost at time  $t$  equal to 0 bypass that is what is bypass is very good nice. So over I think this is the first section of RTD what we have done was I introduced you introduced you to RTD, what is RTD, what is non-ideal flow okay and then we have the definitions and most important thing is that this RTD can be should be for each and every phase, if I have 2 phase reactor I have to worry about both the phases you know when they are moving particularly which phase we are talking about is very important and for each phase you may have either plug flow or mixed flow one example  $(\bar{t})$ (17:34) where there is plug flow and mixed flow in the reactor there are two phases, reverse question I am asking earlier we were asked okay in packed bed how many phases how they are moving now the reverse question give me example of a reactor where I have a mixed flow and plug flow, okay give me an example where there are two plug flows two phases in plug flow, okay  $(\bar{t})$ (18:01) last okay non merit people anyone is there?

Fluidized bed both will be plug flow when do we say solids will be in plug flow, rotary kiln, moving bed, okay fast fluidized bed not fluidized bed, fast fluidized bed, okay next question same thing plug flow with mixed flow ya which is plug flow, which is mixed flow, solids are in  $(\bar{t})$ (18:39) gases in what? Bubbles are raising so you may say that and another beautiful example is bubble column reactor itself in bubble column you have gas and liquid, liquid will be most of the time mixing continuously also continuously you can put continuously you can normally  $L$  by  $D$  may be 2 times, 3 times but still it will be in good mixing because bubbling the gas will be bubbling like anything that creates sufficient agitation and that creates sufficient mixing so that is example, okay so all these things one has to do that good.

So that is what what we have done now and we understood what is the meaning of ET, FT and also IT, IT is only joining for material balance and definitions and for ideal reactors also

what is ET, IT and all that we have drawn and then we have derived the equations, right we have done a lot in the last class but now that is the first portion that means definitions for RTD, okay including the definition of ideal reactors, okay what is RTD for ideal PFR, Abdul? RTD for ideal PFR, okay what is the equation describing that if I have if I have a ya ET, ET for plug flow (20:08) what is that louder you are always very very nice I think very very calm, very very cool louder no this thing is required sometimes you have to shout because you know tomorrow you will have you are going to have your Husband and also children and first person we have to scold is only Husband and ofcourse Wife also scolds Husband and Husband scolds Wife this is the first one and second children they cannot show anger on anyone they cannot show on you and me okay so except my Wife otherwise cannot show that is why you know you have to louder tell me, direct delta function, okay what is equation direct delta function is name you have given, equation quickly quickly time ya ET equal to  $\Delta t$  minus  $t$  not where is  $t$  not,  $t$  minus  $t$  bar because ET is exit age distribution function, okay ET is exit age distribution function, okay.

What is E theta for PFR (21:24) okay those who want to do ya E theta equal to for PFR sorry for MFR, Arya Arya also is very calm I say you are married or not yet married, not yet oh you have to practise then try to shouting E theta E theta for MFR mixed flow reactor ya I think louder louder I say e power minus theta that is one of the simplest equation that is why I am asking you to remember otherwise I am not asking LFR I am a fail fellow, okay LFR is again difficult, right even though nice equation for E theta.

Okay, Ramkrishna difficult things for you E theta by LFR easy to remember that I say you remember, Gopi ya  $1 - 2\theta$  cube, okay so these are the simple things good and all these things you have to remember at the end of any course atleast the simple things you have to remember, okay good. So that is the first part what we have done in fact RTD can be divided into three parts, first one is definitions and ideal reactors definition of ET, FT and all that, okay.

The second one is now if I have this data, how do I now model my reactor using RTD information that means if I have this kind of I mean data or C versus t curve that can be easily converted to E versus t curve or E theta versus theta curve, shape will not change it will be exactly same, okay only this scale will change because here and here so that will give you E theta or ET whatever.

Now if I have an equation for ET like here axial mixing, if I have an equation for ET equation so that means I have to now derive an equation that is the model, okay what is the model by the way all of us know that models you know that people who walk on the catwalk or ratwalk something they will do know. So I think now I am not talking about those models, okay in fact those models I think get a lot of money that kind of very awkward walk they get Crores and Crores this is what is life.

I think there was one dance it seems in YouTube where millions and sometimes I mean yesterday there was this Kaun Banega Crorepati that KBC they were showing that dance it seems millions hits where there for that, it looks so awkward and when you put Bharatnatyam no one sees, okay and that Kolavari Kolavari Kolavari I think entire world was Kolavari at some time I think beautifully that Jawed Akhtar Jawed Akhtar you know know, who okay right he was telling that you know there are no lyrics in that song, there is no music, right and I think there is no meaning when we do not have so many non-idealities with so many non-idealities it was one of the best songs atleast for one week, okay not one week even one month that is what is the status of present generation they do not know what to like exactly they do not know what is beauty, what is not beauty, they do not know what is wonderful you know that only beauty is the correct one, right either in music or in painting or if I draw I think two lines you may be appreciating wonderful painting, wonderful painting, wonderful painting because again there is no meaning there is nothing there in that two lines, okay.

So that is what I think you know World when you are getting more and more intelligent I think we are becoming worse and worse in appreciation that is what the problem, okay that is why always you know in TV the Bharatnatyams will be after 12'o clock no one will see, or there will be excellent discussion about philosophy, about life all that usually 10:30, 11'o clock, okay right.

So that no one should see know because I think they also took that rating and all that since no one was seeing when it is put around 9'o clock, 8'o clock, 5'o clock because nowadays in every language serials you know stretching stretching stretching stretching stretching I think nowadays it has become fashion to show the face camera and there are 10 people on the screen you know each one 3 times half an hour over, tomorrow out of that 2 people will go 8 people will be there again that is the kind of thing you know that is why those people who see serials you do not have to worry at all after 5 years you come back it will be those 5 people will be staying there that is how no story, okay that is what stretching stretching stretching

stretching, okay and that people see very happily they see I do not know how happily they see I think it is kolavari, okay anyway.

So that model I am not talking about those models I am talking about mathematical models, okay mathematical model is required to ya to indicate the physical phenomena to describe the physical phenomena that is what is the mathematical model description, okay mathematical model gives the physical phenomena in terms of equations in terms of equation that is why my simplest you know wonderful example what is asked is  $E_{\theta} = e^{-\theta}$  that is a wonderful model, simplest equation very simple equation but that is a model what is a model? Mixed flow reactor, unless I have that ideal model for mixed flow I will not get this equation, right or if I get this particular curve exponential decay and when I want to test that whether my reactor is really ideal or not I have to put my equation here and then put those experimental points, if experimental points and equations both tally very well then we have ideal mixed flow reactor so then you can calculate conversions and all that but first we are proving whether you have ideal mixed flow, right.

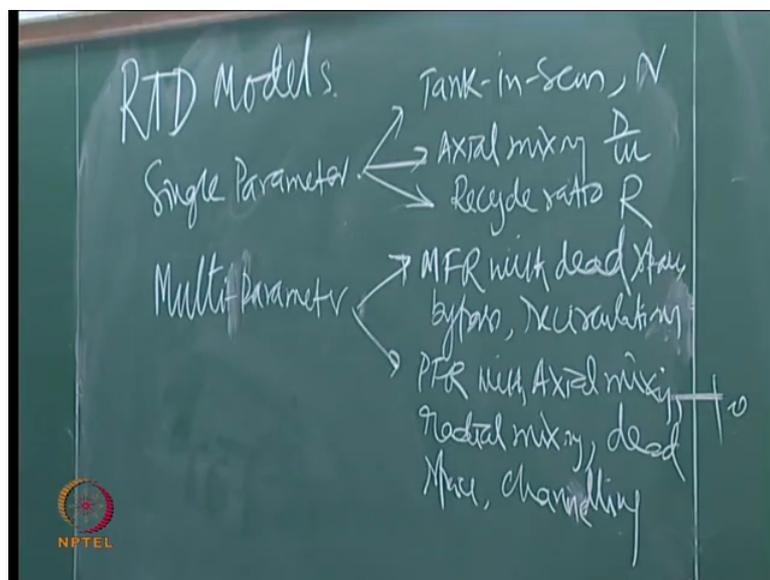
Similarly when I have plug flow if I get almost like Dirac delta function this is almost like delta Direct delta function very nice very very lean distribution because that is naturally you cannot avoid that but on the other hand if I put conveyor belt without any vibrations and then suddenly introduce okay sand is going suddenly wide sand and suddenly I replaced in the beginning some sand with red colour very short length may be one layer of sand molecules, if there is no disturbance at all the sand molecule that red strip will be going beautifully and then at the end you will get the red strip that is what what you mean by our Direct delta function or otherwise if you put step input so (white fluid) white sand was going on the conveyor belt at some time suddenly I think you know it magic also you can do shik entire thing will be red, okay.

So then because without disturbing you have to do it know otherwise by adding and all that it may disturb. So then red will suddenly enter because there is no disturbance this red you can see at 50 percent of the mean residence time you will see 50 percent red and 50 percent white this is how you have to imagine in your mind, right. So that is FT, what is FT equation for plug flow  $C = C_0 e^{-t/\tau}$ ,  $C = C_0 e^{-t/\tau}$  and again condition you have to tell ya that is very important, if you simply say 1, I cannot expect 1 to be there at  $t = \tau$  or  $t = 2\tau$  or  $t = 3\tau$  that is 0, okay so that is all.

So that is what is the models now we are trying to find out okay I think I will we will take only two models the model can be either single parameter model or multi parameter model, right models can be single parameter or multi parameter that means if I am able to describe the phenomena with only 1 parameter then I will call that one as single parameter, okay. So an example can you give ya tanks in series model for describing what tanks in series model (( ))(30:14) only to describe what? I have n number of tanks and then each tank is n I think that is not actually good representation, but n also we use ha PFR.

So then what is that you are trying to model there? The phenomena of plug flow you are trying to imagine in terms of mixed flow reactor the phenomena of plug flow you are trying to imagine in terms of axial mixing, when you get axial mixing  $D$  by  $L$  equal to very very very very small  $D$  by  $L$  is the number you know that is one parameter but inside that there are three parameters  $D$ ,  $U$ ,  $L$ , right okay so entire that is why dimensionless number if this number equal to 0 then you have plug flow in fact I told you this, I draw one line here  $n$  equal to 1,  $n$  equal to infinity,  $r$  equal to 0,  $r$  equal to infinity,  $r$  equal to 0,  $D$  by  $L$  equal to infinity,  $D$  by  $L$  equal to 0 this is plug flow, okay all these are single parameter models.

(Refer Slide Time: 31:48)



Two parameter models example you know that two parameter model also why I say what is this what is happening in the brain, no storage capacity, Sushmita you are saying something why you are so quite I think you know you are M Tech, you are B Tech, you are P Hd one parameter only you could tell, another parameter you could not tell, two parameters? Tanks in series, axial mixing and then recycle correct know if I know  $r$  I will try to find out you know where I am, whether I am in plug flow or whether I am in mixed flow or in between

somewhere which are equivalent to number of tanks, which are equal to  $D$  by UL this is  $N$  as parameter, this is  $D$  by UL as parameter,  $D$  also can be parameter in fact  $D$  is 0 and  $D$  equal to infinity, okay and recycle ratio  $R$ , okay.

I think Sushmita you are telling something multi parameter model multi one more parameter you are not able to add, what are the two things we describe for plug flow? One the axial mixing equal to 0 then not second parameter, if you have both non-idealities you have axial mixing and also radial non uniformity so your model should take care of these two, how much is the radial non uniformity in the lateral direction and how much is the axial mixing both are same, apart from that if you have the axial mixing and radial non uniformity and also dead space somewhere then how many models you have? 3, how many models can be described for humans how many parameters?

Diabetes is one, okay heart attack is one than any other things BP ya I think these are all complementary, okay ya BP so all that you know these are all non-idealities where if you want to develop a model all these things should come, how much sugar you have, okay how much BP you have and whether these valves are open or almost everything close, okay. So all that kinds of things only know that is multi parameter models, okay.

Tell me the multi parameter for mixed flow Bypass, dead space, recirculation ya these are the multi parameters, okay I think my God, MFR with ya I think absolutely no expansion of the brain I say only contraction dead space with dead space, bypass, okay and ofcourse recirculations all that then PFR with with axial mixing ya radial non uniformity we generally call radial mixing also that means we have to understand that radial mixing is not perfect that is all, okay radial mixing then ya you may have dead space here also ya one more channelling you see channelling (nn double n), okay channelling ya so like this we have you know so that you know you should not forget.

See in fact our Indian marriages are multi parameter models, you know that anytime, not heard you heard tell me ya I think that I told someone already okay you see how many people have to go and see the girl or the boy, okay first mother first father will go or father may send his brother in law or someone also, okay so then Mother should go, Father should go, Brother should go, Sister should go and some more relatives should go so may parameters that is why system is unstable, okay it is not easy to choose know whenever you have more parameters it is not that easy to converge, right.

So that is why best model is single parameter model for marriage, what is that single parameter model? Most beautiful girl or boy on this planet that is one parameter so you search you search you search you search when you get you get married, okay very simple know only one objective, okay otherwise whatever I think now girls may start asking dowry after 20 years now. So either girl or boy only dowry, whether the boy does not have head or legs or nose does not matter for me only money, okay same thing boys also can go and tell that okay whether girl has anything or nothing I want only maximum amount of money, okay.

So like that you know your own I think you should have that you know they should have the biggest Bungalow on the planet, okay does not matter whether it is girl or boy or whatever, okay okay. So what you are looking at is only Bungalow with Asian Paints, okay that advertisement is coming know you know I think they go for marriage and then the girl is asked how is the boy, beautiful house She says okay so one parameter She needs only one parameter there that is all boy does not matter, boy's father does not matter, boy's mother does not matter, okay.

So like that choose one parameter those who are not married, okay. So that is why here multi parameter models I am not doing because we do not have time. So single parameters what we take is axial mixing okay and another model is tanks in series model these two parameters we will take and one multi parameter model I will do with CSTR with bypass and dead space that is two parameters, okay so these three we will do.

So then I think the third part this is modelling that means what we do is you first develop the equation and now after developing the equations there will be parameters if it N number of tanks in series depending on N equal to 1, N equal to 2, N equal to 3, N equal to 4 you have to plot ET or FT whatever okay you convert that one equation into the other either E theta or F theta or ET into FT, right then you plot ET versus T for N equal to 1, N equal to 2, N equal to 3, N equal to 4 simulation that you are experts, okay.

So then you will get so many curves, right N equal to 1, N equal to 2, N equal to 3 and all that. Now take the experimental data and then try to plot that data as ET versus T, so on one line it will be the closest it may be N equal to 3, N equal to 5, N equal to 6. So when it is almost touching one line so now you have to say that the system has equivalent to 6 tanks in series. Same thing with D by UL, okay when you have the equation ET versus T the parameter will be D by UL you start with D by UL equal to 0 you can also end with D by UL equal to infinity those two extremes CSTR and plug flow, right.

So in between D by UL equal to 0.01, 0.001, 0.005, 0.1 I told already, 1, 20, 100 you plot various lines of ET versus T curves RFT versus T curves. Now again data what you collected from the equipment take that and then try to plot on that, right. So this is manual plotting method very simple straight forward you can find out. Now you have another way of doing it once you have the model, once you have the data go to Bill Gates Windows computer, okay MATLAB otherwise so give the data give the model and ask to you know how to do it, do not know you have to learn, okay matching the data with model in the in MATLAB you are doing you have lab now some computational labs you have that is what I mean all those labs are only to help you not to spend some time without understanding anything, okay so the idea is only that, right.

So give the data I mean choose the model and only thing is each and every point the model will calculate the actual model value and that will check with the experiment corresponding to that point let us say 1 second, 2 seconds, 3 seconds like that model will calculate at 1 second and then for 1 second correspondingly what will be the ET experimental data both will be matched and you give the difference the difference must be 0.00001 you know 1 minus the other, right.

So you specify some matching technique that means 10 to the power of minus 6, 10 to the power of minus 10 like that. So when all the points on the average when they are matched very well then finally that will give you this is the D by UL for this particular run experiment and you have to learn that I mean but you pose as if all of you are very much (41:46) simulation and all that, okay.

But I think nothing is known, okay I think all these things you have to do I think the idea of lab MATLAB and also general laboratory computational laboratory is only to tell you all this, right. So you know the procedure now but what is the use I think you know tomorrow morning when I ask you are not able to tell like that atleast procedures I say like stories first remember that, right you have the experimental data C versus T or ET versus T, you have a model where this equation is a function of E as a function of or ET as a function of T with a particular parameter if it is a single parameter, if it is two parameter you have two parameters.

So how do you choose these two parameters also is through MATLAB one can do it you have to give only thing is when you go to MATLAB and then go to matching you have to give what is called some initial guess, if you wrongly give it will never match. So that means you are actually in Hyderabad but I am searching in Chennai what is the use impossible know I

can never find you, right. So that matching will never occur if you have that kind of wrong guesses. For correct guesses you have to actually plot with your hand, try to find out approximately what will be the parameter D by UL values that can you can give as a guess value then you are refining data matching technique will be very very quick otherwise 0 to infinity you cannot search, right. So this is what is the procedure in all these models, okay good.