IMPACT OF FLOW OF FLUIDS IN FOOD PROCESSING AND PRESERVATION

Lecture03

LECTURE 03 : FOOD PROCESSING OPERATIONS

Good afternoon my dear students and friends. We have taken two classes for this new course that is fluid flow and we have started with the background of some food, because food processing and preservation, if we are not aware of it, then fluid flow, its application is difficult to understand in food processing. So, that is why we are still continuing as the introduction part, that is introduction to food processing and preservation.

So, in that case, we have already said that whatever is there, we have already said whatever is there in food, as its part of energy and different storage systems, right? So, if we continue in that, we can say that in the food processing and products preparation, out of agricultural and animal husbandry, several operations are undertaken. Right from the raw materials, its gain or loss of weight and exchange of energy supply, surroundings, all these are under the

umbrella of food processing and preservation. Now, commonly used food processing operations are like this, size reduction. At home also you have seen in many houses, they still use that pounding, hand pounding, your making the sizes reduction of the spices. Like many cumin, this, that, many are there, right?

So, they pound it and then make a movement like this, this is called shear action, right? you are shearing. So, shear action and also impact, impact and shear both. So, that is in house, at by hand, right? but, many size reduction operations are there. Obviously, we are not going into in detail of it, but just to give idea that you see different industries have come up for many spices. I do not want to take typical names because, yeah, they are commercial products.

So, many are available and in that they use different types of meals, right? Like somewhere it is hammer meal, something is hammering, right? Somewhere they

use, like in atta chakki, that is one of the best example commonly you come across. You go to the market, you see atta chakki, right?

So that is both. It is having shear mostly because there is no impact. It is shear action, right? shear like this. This action, it is happening, and generally, we get that atta from the raw material, and there is, maybe in commercial scale, there is not only atta that is maida. I hope you know it that where the brans are not there, it is separated and pure white is there and size is also small, very small unlike atta where you have the brans also.

This is primarily for size reduction not only in atta or maida, but also spices and many other products, they are reduced in size. That is why it is called size reduction, size is reduced from the original. That reduction could be depending on what is your end product, Right? Very small, medium, large, depending on. And this comes under the unit operation called crushing and grinding,

Right? This is also available not only in food, but also in chemical, maybe in civil, maybe in also mechanical and many others, Right? This is one unit operation. Another one could be separation.

You have made the sizes. I hope, if you are in food engineering or food processing or food science, then you might have done, after size reduction, you might have done the sieving, right? sieving of the products. So, you get different sizes of, if you start from the raw material, you get wheat, from the wheat, you get bran, you get endosperm, right? You get different sizes like one of the product is also suji and atta, maida, they are seeds. And you might have done the series analysis also,

Right? So that is nothing but separation of the product of different sizes. This is one. This one, size separation again is a very, very big, big unit operation, big in the sense that, it is, not only you are separating these small particles or bigger particles, bigger sizes, but you may also separate, say, you are given water and sugar solution.

Then you have to separate sugar from water. So, what do you do? You boil and by distillation also you can separate. Similarly, in different distilleries, who are making brewing industries. So, they also do separate like that, alcohol and non-alcoholic part.

So, that is also under separation, there could be another separation, at home also, you do this separation, you take the drinking water, right? in most of the houses, nowadays, RO machines are available, that is reverse osmosis, right? So, in that reverse osmosis process we are forcing reverse osmosis, so that the unwanted, undesirable materials are separated from the drinking water, right? So, that depends on how much purity you want. Accordingly, more sizes are or separations are being performed.

So, after the size separation, after the separation, in separation also, there are many other, not only this, in many, many villages, nowadays, there is a problem of contamination of ground water, which is undesirable. So, there, you are separating again by either filtration or may be, by micro pores through that you are separating. These are commercially also available. Then, your mixing, yeah, mixing. I gave in earlier class example of ice cream. Ice cream has many many ingredients, solid, liquid both.

So, solids are first mixed separately, then mixed with the liquid, so made a slurry. So, this kind of mixing and many other mixing also is there. So, people are also doing that. Then, you are doing cooling. You are doing cooling.

I gave the example of refrigerator at home. So, that is one great example. Then, pasteurization. I also give this example of milk, but other than milk also, many many drinks, like soft drinks, they are available, many soft drinks they are available.

Then, after this packaging, storage. These are again small small unit operations. Then conveying In big industries, you have to convey materials from one end to another end by different methods, different conveyors are available, different types of conveyors are available and you convey materials from one end to another end by pumping. You have seen that in many places the water is pumped out from one place to other. Similarly, many other things can be pumped either in or out.

So, you may use it for your work or you may discard it to separate something. Then, heating, yes, is a major thing. As we said, pasteurization is one of them, sterilization another, right? or concentrating, concentration or drying, all are coming under either heating or cooling process, right? So, it involves both mechanical and thermal operations.

So, mechanical operations like size reduction, separation etc., thermal operations, we have said that heating, cooling, pasteurization, sterilization, concentration, drying etc., right? So, analysis of these processing operations, this involves development of mathematical relationship between independent and dependent variables. I hope you understand what is said by independent and dependent variables, right? So, independent variables are obviously, those, which does not depend on time or

based on which some other products or other things are obtained, that is called dependent variable. For example, in size reduction average size of comminuted particles, yeah. So, this is a dependent variable. Why? Because, this is dependent on

at what rate you are rotating as we gave the example of Atachakki, right? you will see, it is rotating at a constant speed. So, if the speed is increased, then the sizes could be even further reduced, if the speed is reduced then sizes could be again higher. So, this is that, the speed is independent variable and this size of comminuted particles that could be the dependent variable. Surface area created, again, it is dependent variable, then energy required for comminuting. Again, it is dependent, why?

Because, energy is definitely dependent on the earlier, how much sizes you are making, how many surfaces you are producing? etc. right? For packaging and storages, depending on shelf life of the food that kept inside the pack. So, this is a dependent variable. In many cases this storage or packaging, control or modified atmosphere storage conditions are induced, right? So, there, carbon dioxide and oxygen concentration, which is controlled both for control atmosphere or modified atmosphere.

So, they are dependent variables, because at how much you want depending on that it is required. Then time required for attaining equilibrium gas concentration, though, it is a time, but again it is a function of the concentration of gases. So, again a dependent variable. In sterilization, the degree of micro population reduction. that is definitely a dependent variable. How much microbes you want to kill?

So, that is degree of micro population reduction. There are many many such theories, such equations available for reducing the number of population. So,

degree of food quality reduction, how much you want to allow the quality to be reduced Freezing, in freezing there could be time required to attain a definite temperature, that is again dependent variable. Amount of heat required to be extracted, again it is depending on how much temperature you are lowering.

So, it is again becoming a dependent variable. Then, in the process of drying, moisture content attained and energy required for drying are also dependent variables, as well heat utilization efficiency or air velocity they are, right? Air velocity how? Because, depending on what temperature you are requiring, your air velocity is accordingly maintained, accordingly controlled, right?

So, from this we can say that you can go through these books for references, right? I think ten such, yeah, given, out of which, food chemistry by Fenema is very very popular and very well written. It has two parts, part 1 and part 2. So, you can do that you can look into it. Food processing operations analysis, it was written by my teacher, late Professor H. Dasi is no more, of our department of course.

Then spices and seasoning of food technology handbook by Tenter and Greenish, outline of Dairy Technology, one of the Indian writers, Sukumar De, his old book. Milk and Milk Products by Eccles and Combs and Mackey. Foods, Facts and Principles by Manet and Khadaksh Swamy, it is also an Indian writer. Food Processing Biotechnological Applications by Marwala, Marwa and Aurora, J. K. Aurora.

And Food Processing and Preservation by Shiv Shankar. And another two very good book, one is Element of Food Technology by Desrosier. And also the Technology of Food Preservation by Desrosier and Desrosier. So, these are some of the references, which you can look at and which you can refer for whatever we have already said. And whatever we will be saying obviously, I will give for this typical course some other thing.

Before that, one more thing, I would like to highlight as the preamble that is for drying. In the next class this class time is up. So, in the next class, we will do that. Okay. Thank you.