Environmental Quality:
Monitoring and Analysis
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Lecture No. 30
Vapor – Part 1

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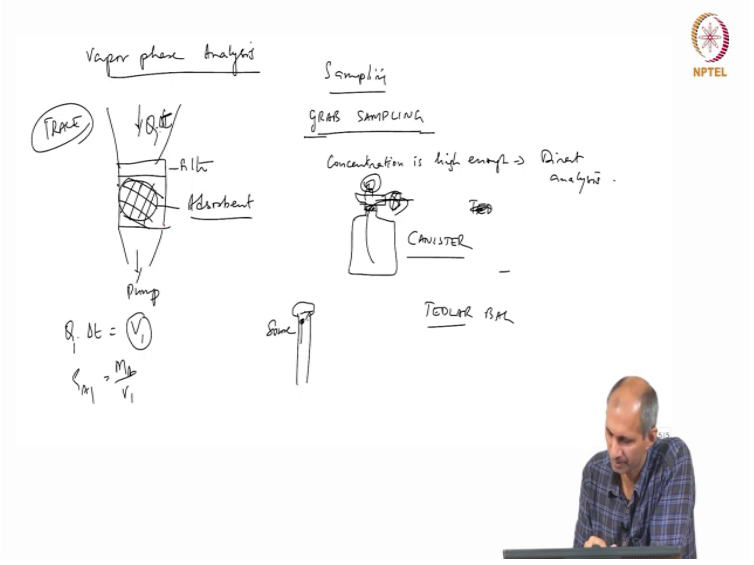

This is for PM. What about vapor? So there is a bunch of things we talked about for sampling of PM using impactors and all that. How do we do vapor phase analysis? Vapor phase, but in the atmosphere we have everything vapor phase and PM, we only want vapor phase, the first thing we need to do is cut off the particles. So, you need a filter so, vapor phase at the downside of the filter paper usually. And so, we use an air stream we have a pre filter here we take out all the particulate matter here and then we have we use an absorbent typically.

Before we go to the absorbent, now in vapor phase there are 2 kinds of vapor phase analysis that is done. Suppose, what is the simplest method when you are sampling, when you want to sample. Why are we sampling in a filter paper in for PM what is the basic reason. The sampling material in a filter paper over a period of time and the reason we are doing that is, what is the main reason we are doing it that we have instruments like real time instruments.

But that is one way but if you are doing with PM method, why are we doing the PM method with the filter and this thing composition. Why are we doing over a period of time? Why do we need to accumulate sample we are accumulating sample because quantifiable mass we need to measure it. The mass is measure so below detection limits, so it is not easy to measure. So, preferably I would like to just take this vapor sample as it is and measure it.

So, sampling, one method of sampling is what is called as grab sampling. This is what you do in water also, in water, you take samples you take you grab a sample in a container. I can also grab a sample of air in a container. What is the problem? So you have to talk about again, sampling all the way to the instrument. What prevents me from doing it if I can do it, I will do it. But if I cannot do it, what is what is preventing me from doing this? What is my constraint?

Grab sampling essentially means I take some volume of sample and I analyze it as it is, so if I am doing grab sampling, I have to define a volume there is a certain volume, I take gas or vapor in that volume and I directly go and take a sample and inject it into a GC or HPLC or something and get some signal or I have a sensor that will directly, if I can put a sensor directly I am I do not even have to grab something.

I am just directly measuring it. So, but we do not many times we do not have those sensors. So, we have to do this sampling. So, a grab sampler is done when concentration is high enough, to directly for direct analysis no processing required. Which are the, you know, which are the possible candidates for this. Concentration of something of interest is fairly high. And you do not even have to do any processing.

By processing we mean concentration or any such thing. We do not have to worry about increasing the concentration in the sample in the instrument directly reasonably high. So, which are candidates for this? Which sources are candidates for this? What sampling? Can you think of anything that we can do grab sampling? We can do grab sampling for anything but which do you think will work which where do you think we will have high concentrations? Near to a source very source.

Can you give an example? Stacks very close to industrial chimneys, do you know a stack that is accessible to you easily? Stack means we are talking about a combustion exit. Automobile so you have automobiles. I want to measure what happens to an automobile stack, So, what happens to a stack very close to a stack the concentration is high, it is coming from here. The moment it gets out, it is mixing with atmosphere and dispersing concentration rapidly decreases.

So, if your stack is emission source is here. This is a source here, if you want to measure, I can use grab sampling, it may work. But if I am using somewhere far away, I am finding in the middle of the road and I am trying to do grab sampling, chances are it may not work. So, this is a question of source sampling versus ambient sampling. Ambient sampling is general atmosphere; I want to know; what is the average concentration of some compound there.

So, grab sampling may not work, if I do grab sampling, I may get nothing. So, I will people can make the wrong inferences that there is nothing there. So, that is the biggest danger that we have. So, we will do when you can do grab sampling, we do grab sampling. Grab sampling is done for how do you grab sample an air volume? Whatever it is, you can open a container it will go nicely. How will you do that with air?

The biggest problem in the air and you can't see it; you can't see the sample is there. That is one of the main problems in air, ok, this is this is this is ah. So, there are ways to work around that. So how do you sample air? How do you grab some? How do you grab a piece of air? Vacuum pump. Hmm? You use a vacuum pump. If you want a fix the volume, how do you do it? If I want to say I'm giving you a sample, how will I give you a sample? Your vacuum pump is correct.

What can you specifically elaborate more? So your container itself so one what is one possible container for a grab sample? Need a container wait what containers, will you use. So you can use a cylinder for all gas storage everything we use a cylinder so we use a small cylinder, a small cylinder which has a valve well here is a cylinder. And, we also have a, some kind of a pressure gauge which shows that there is gas inside.

Otherwise you did not know the gas inside. So what we do is we evacuate the pull a vacuum on this testing and then they close the valve for the value the content of the container are in vacuum. When you want to sample, I open the valve air from outside we will go in and you let it equilibrate and you close the valve to sample. So as long as there is no leak in the valve here, your sample is secure. And you can see it by you need a very sensitive gauge.

Because it will be vacuum and then we go to atmospheric pressure it will be it will be our atmospheric pressure, almost atmospheric pressure when you are equilibrating and they will stay there. And unfortunately you cannot unless you are a very sensitive pressure gauge you cannot see the only way you can see it as if you pressurize it more than atmospheric it go up beyond that and then it will see if you see a leak it will start coming down but atmospheric period is usually the gauges are not very sensitive.

But anyway this is one way of doing it. And you take it to this thing and you from here you can there are ways in which you can take a sample into a syringe for a GC or there is other way of analysis and GC which I have not talked about. We will talk about it in the next I think today's class almost tomorrow we will talk about it and finish it off. There is another way which is called as this is called as a canister.

And there is another instrument which is called as a tedlar bag. Tedlar is the name of a material. This is like a plastic bag. So here same way you evacuated using a vacuum pump. And you can see this plastic bag like a balloon it will puff up. You can see that it has air samples as advantage of plastic bag but of course it is plastic so is always possible do have one of your chemicals are dropping on plastic and you are losing things.

So the canisters are usually stainless steel or some source material which did not organic analysis is simpler. But the plastic bags are nice because you can see, if there is gas, there are no gas there and then you can put a small, I will have pictures of it. I will show you pictures of it tomorrow. And these things, so these are graph sampling. So if you did not have enough concentration, you have to accumulate that you cannot do grab sampling the concentration is not enough.

So you have to accumulate volume just like we accumulate mass so we use an absorbent in this case for trace analysis where grab sampling would not work, we send a volume flow rate for a certain period of time. So a certain period of time you have a pump and we have an absorbent and absorbent. You choose a suitable absorbent which is picking up trapping all the vapor component organic components that is of interest to you.

There are a lot of absorbent that are available in the market which are generic absorbent in which means that you did not know what is an atmosphere it is open, it will absorb a wide array of compounds and then you can trap it here. So, the absorbent that is used in line with the flow, so, after a certain sampling period, so, absorbent if you use an absorbent Q is the flow rate of the air multiplied by the time will give you volume of air sample collected.

Then you take the absorbent and you are just like what do you have to extract the organic material from the absorbent and the mass of extract divided by the volume will give you the concentration rho A1. But in the process of extraction again, there is a chance of lot of losses that can happen, especially if you are looking at volatile organic compounds. If you are looking at compounds like benzene and all those things are fairly volatile.

So, in the process of extraction, they will come out there. You may have significant amount of losses in many of these things. So there are ways in which here as well as in water analysis. Now, this is the extra extended technique that advanced techniques that people use to not to do manual processing, manual extraction processing is automated extraction and processing, and how to do that, we will just look at those 2 cases and this tomorrow's class.