Electronic Systems for Cancer Diagnosis
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Lecture – 53
Demonstration of Cleanroom Equipments:
Biosafety Cabinet & Ultrasonic Bath

Hello everyone, welcome to the course on Electronic Systems for Cancer Diagnosis. Today all we would do is let us just understand the different equipments which we would be using when we are working with biology specimens and when you want to integrate them with the fabricated sensors. So, there are a few specific equipments which would be used in general and hence let us have an overview of the devices starting with the Bio safety Cabinet, I will take you through different equipments which are used while you are carrying out the biology specimen and when they could be applied, where they could be applied and how are they used is what will be briefed through this module.

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So, starting with this, here this is the biosafety cabinet. When we when I; when am talking about biosafety cabinet as you can see the entire setup is an enclosed structure.

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So, this is enclosed and it has an environment within itself. So, the workstation is going to be beyond this the glass window which I am holding here so the entire workstation is going to be within the enclosure. So, when do we use a an equipment like this a biosafety cabinet? This kind of environment or an enclosure is provided when you are dealing with hazardous cell or tissue culture which could release aerosols and these aerosols can be harmful when you inhale or when you come in contact with them.

In order to avoid any such contamination due to aerosols, you use an equipment called the biosafety cabinet. So, these are classified based on the bio containment. When I say bio containment, it is about the protection level so it could provide personal protection. The device could be designed to provide the environment environmental protection and it could also be designed to protect the product or the specimen that you would be using while you are working with this station with the workstation like this. So, based on the containment they are classified into class 1, 2 and 3. This here is a class 2 biosafety cabinet. So, it provides personal protection, the environmental protection and also the product protection can be facilitated using this cabinet.

Now, let us have a general, even before we start meddling or trying to deal with how to work with the station, let us have a careful look upon using how to look, how to work and how to understand the working procedure because the source of light which would be used inside the cabinet is UV, the ultraviolet which is very harmful when we are

directly exposed to UV, it could even cause harmful disease like cancer. So, always make sure when you are trying working with an equipment like this understand what are the different sources and this is entirely a setup which is used to prevent contamination.

So, there is a lot of harmful the virus which would act, which would be inside and the environment would be polluted and how do you declines, how do you; how do you cleanse the entire environment from all of this. So, you use UV light and always ensure when you are working with sources like UV light do not expose any of your hands or face or when you are working always remain away from it. And, hence you have a hood like structure the entire workstation isolated so that, you could work you know just with your hands inside and finish your work without being exposed to the harmful light source.

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So, this is the biosafety cabinet and here as you can see which says the sticker here reads safety line. So, here one part of the cabinet here says danger safety line. So, this is a warning symbol which is here. So, when you say safety line, this is the limit through which the entire hood here could be lifted.

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So, you can slide through this up to only this level while you work in the while you work with this workstation, always ensure you do not cross the safety line and let this another caution keep the sliding sash on the safety line door during operation and do not impact the glass to avoid damage.

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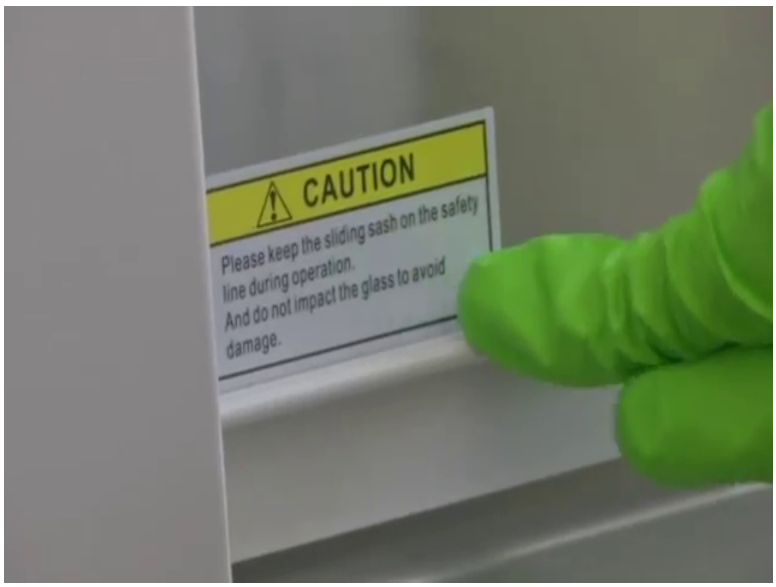

So, let us see I will show you how to lift through the glass because it would roll back and it would hit you do not want any kind of damage that can happen. So, always understand and read through the operation, read through the guidelines even before you start

working with the cabinet here. And so, protect eyes while UV light is in use, right now I do not have my safety glasses like I mentioned in the first few modules while you are working in a cleanroom environment there are you know mandatory steps the strict guidelines have to be followed while you are working. So, here we are working with UV light and it becomes very important, mandatory for me to put on the safety glasses.

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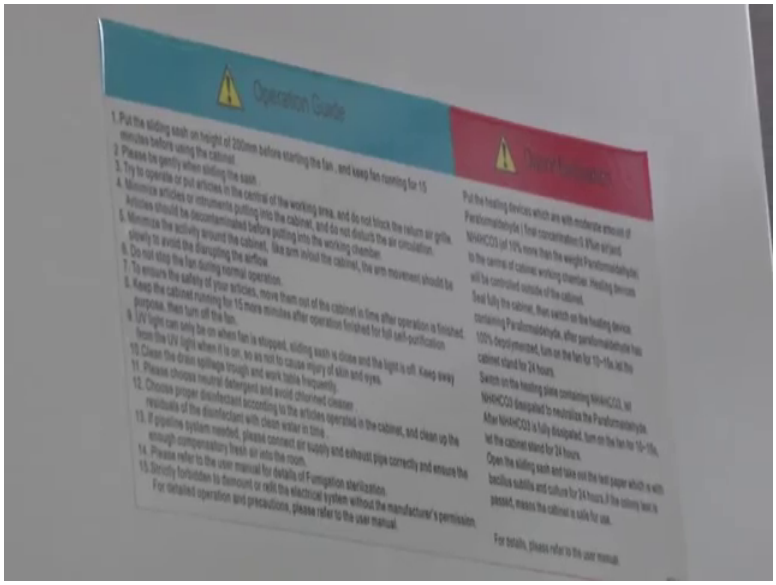

So, now, that I am just demonstrating it how the device works, once this is done I will put on my safety glasses and show you how to operate, how to sit and work using a biosafety cabinet. And reading through there are operation guidelines which are here clearly mentioned and then decontamination, the procedure to decontaminate the entire system here has been demonstrated here clearly. So, let me just read through a few of the operation guidelines.

So, this here is the sliding sash. So, what it says is put the sliding sash on height of 200 mm before starting the fan. So, when there is a fan, an exhaust fan which is running inside for air circulation; like I mentioned this is a class 2 biosafety cabinet they have HEPA filters which are inside. The HEPA filters which are already mentioned the high efficient particulate air filters are used to remove the particulate contamination within the environment.

So, in this case so there are HEPA filters in order to eliminate the particulate contamination inside and then there is constant air circulation with the help of these fans

and keep the fan running for 15 minutes before using the cabinet. Why do you want to turn the fan on even before you start working with the cabinet? What happens is while the fan runs there is circulation and any kind of contamination. So, there the process of sterilization even before you start working becomes important.

So, the first step is sterilize the entire system even before you work. So, how do you sterilize? Turn on the fan and keep it running for 15 minutes even before you start working with the station and be gentle while you use the sliding sash as I already mentioned. So, make sure you do not slide through beyond the safety line and then the operation guideline also reads, try to operate or put articles in the centre of the working area do not block the return air grill. So, if you I would also show you there is a grill here.

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So, as I slide through the window here, you can see there is air grill through which air circulates inside the cabinet. So, do not block this area, do not cover it up or do not object the flow of air because it becomes very important during the process of sterilization for when the fan is blowing there is a lot of air which has to be circulated inside and purified. So, in order to ensure your working safe and to make the best utilization of the 15 minutes for the entire sterilization to happen thoroughly and properly, make sure you do not block these air grills which are provided here in the beginning and it is always advisable to work in the centre of the work area.

So, let me use both my hands and close to hood safely and then what does the guideline read? Do not stop the fan during normal operation and to ensure safety of your articles move them out of the cabinet in time after operation is finished. So, once your job is done remove them and make sure you sterilized the entire environment. UV light can only be on when fan is stopped, sliding sash is closed and the lightness of keep away from UV light when it is on. So, as to not cause any injury to the skin or eyes so, always make sure do not have your fan on while you are working in the environment like this.

So, if the UV light can only be on when the fan is stopped. So, make sure you do not expose yourself while the UV light is on and choose proper disinfectant according to the articles operated inside the cabinet and clean up the residuals of the disinfectant with clean water in time. This entire setup, the main aim and goal of this is to ensure there is no contamination that could spread to you because of the aerosols that could cause damage to the can the environment were you are working. Say the equipments what you are using are contaminated. So, this does not solve the purpose.

So, even before you use the equipment which will be going into your cabinet make sure they are sterilized, make sure you use them with clean them with you know autoclave or the ultrasonic bath which I would also explain you their purpose, so you make them they as may make sure they are sterilized and clean even before you start you use them during your work. If pipeline system needed please connect air supply and exhaust pipe correctly and ensure enough compensate fresh air into the room. So, when we are talking about pipeline system for air.

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So, say I lift the cabinet now that it is off.

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So, here there are 2 nozzles with valves here. So, in case you need to connect them to air supply or an exhaust pipe or it could be a di water. So, you could always use the pipeline system correctly and ensure there is enough fresh air which flows into the room and make sure the fixture is right while you fix into the 2 nozzles. So, these are the additional systems which are provided inside the biosafety hood.

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And then there are even power cods here, there 2 power cods which if required can be used because there they are times when you use the entire setup say the desiccator or any other device would be put inside and then you want them operational as well as sterilized the entire work environment. In such cases, these are additional features which can be used inside the biosafety cabinet.

Now that we have seen that different the strict guidelines which has to be followed while you are working with the biosafety cabinet and let us see there are other decontamination procedure on a regular basis the entire system has to be decontaminated sterilized even before you start working with the environment. So, let us say I switch it on. Now, that I have turned on the mains to the system.

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Here the safety cabinet has a unit which say which gives an option to set the fan. So, this is the fans speed, this is the normal light the work in order to work you use the regular light and then this is the UV light which is use for sterilization. And, then this is the power cod the symbol here and only when you turn this on the like I mentioned there were 2 ports where you could connect your power supply so only when this knob when you press this the other 2 pots could be used inside the cabinet the supply can within the cabinet can be used and then this is the alarm.

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Now, that we have seen different features, let us say I turn on the UV light even before you turn on make sure the window the slide the sliding door is completely closed and then I turn on the UV light. Always ensure when there is UV light, do not expose yourself or your hands do not work this could be harmful and dangerous.

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Now, that I have told you how important it is say I have the UV light on and sterilization is in process what happens when I lift the safety hood? As you can see, the minute it opens up the light has turned on automatically, turned off automatically.

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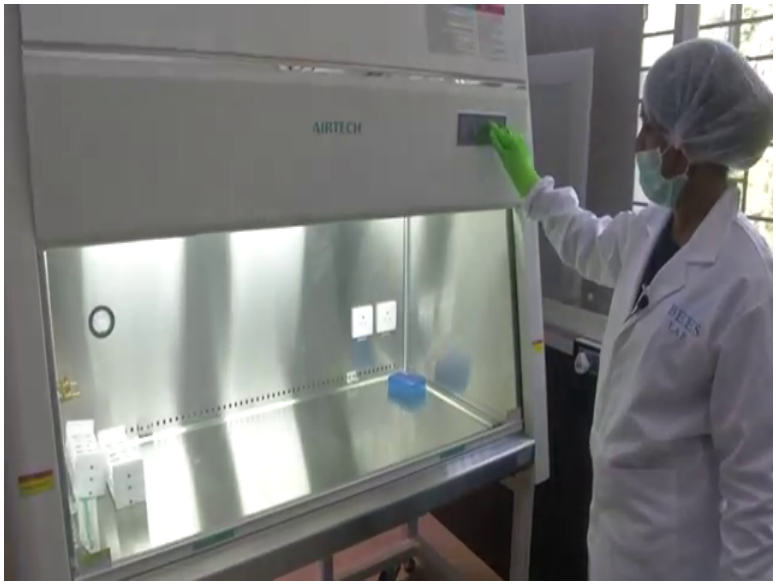

So, this is very important and hence now that a precautionary measure has been taken by the system by itself, it is always important for us also to follow strict guidelines while working with devices like this. And now that we have seen how UV light can be used for entire sterilization and this is the normal working light where you could sit and work in your workstation say the entire system is sterilized for 15 minutes and then you have turned on, turned off the UV light and then you now you want to operate.

So, you switch on the normal light and then lift the sliding door only till the level what has been mentioned and then you sit and work. So, this was the entire setup of a biosafety cabinet, the importance of it how and when it has to be used in order to avoid any sort of contamination, in order to prevent inhaling of aerosols which could be emitted while you are dealing with harmful cell cultures, it becomes very important to work in a cabinet like this which is highly protected sterilized environment becomes very important in order to protect oneself and also avoid any sort of contamination.

So, this was a brief intro to how a biosafety cabinet becomes important when you are working in a biology lab when you are dealing with cell and tissue cultures and how these can be furthered utilized for your studies based on how they can be integrated onto your sensor device. So, when you are dealing with all the biology samples make sure you use the biosafety cabinet as mentioned in the guidelines.

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Let us go to the next device or the next equipment in the lab.

Yes.

Another important device of the equipment which is used in a lab like ours which deals with biology specimens and with various surgery with various tools and equipments which needs to be cleansed after experiment or after research work. So, this becomes important equipment, here is the ultrasonic bath. What do you mean by ultrasonic bath? So this entire equipment here like it says water level indicator.

So, this is mainly used to clean equipments what has been used, clean equipments from contamination it could be any sort of contamination, it could be general dust or it could be any kind of blood or any other kind say it could be fungus or it could be rust, it could be anything so you need to get rid of them. How do you get rid? You need to clean them, sterilize them and just putting them in water or hot water does not solve the purpose. So, this ultra what special about using an ultrasonic bath here is it does not there is no temp there is no heater as such what happens is there is a lot of agitation which is provided in an ultrasonic bath.

Agitation is provided using ultra zone that is the sound waves, say you want they say if the solvent you have an equipments a surgical tool which has to be cleansed and then you have your device which will which you would put inside this bath the tool the surgical tool it has to be cleansed is put inside and then you want to clean them with water. And, then how is the agitation there is a lot of agitation which is provided the source of agitation is nothing, but the ultrasound the sound waves which flow through the bath.

Now how are these sound waves? The entire process of sound wave generation and the agitation is called cavitation. So, cavitation is most commonly used the working principle of bath like the ultrasonic bathtub which way which we having here. Now what is cavitation? It is you know the formation of a lot of vapours or bubbles which would over the period of time act on the equipment of the tool which you have put the term by itself cavitation it is nothing, but a forming of cavities or bubbles inside the solvent or it could as it could be as simple as di water for an example to be considered.

So, let us say we have di water and then there is a phenomenon called cavitation. So, what happens is a lot of bubbles get formed due to the high frequency pressure waves which are generated. So, there are three things, one during the process of wave generation there is nucleation growth nucleation when you say a lot of bubbles are

formed they grow and then they implode the all the bubbles get exploded and this could cause a shock wave and this intensity of wave with hit the tool, the surgical tool in this case for an example we have an surgical tool within the water which is kept.

So, this shock wave would implode and then any kind of surface contaminants so this entire process is mostly surface treatment. Any kind of contamination that happens on the surface of your device which is supposed to be cleaned will be which is adhered, say the contaminant is adhered on to your surface. So, the shock wave which is formed due to the propagation of the wave and high pressure would hit the surface and caused the release of the contamination in turn causing cleaning of the surface. So, it removes all the kind of contaminants which are present on the surface of your device.

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And while you put your equipment say there is a level like in this device it is only here it is only up to this point, what happens is you do not want to put your you do not want that device to touch the bottom of your bath that is because there like I mentioned it is a surface phenomenon the surface treatment process happens. And, then when there is an object which is touching the surface at the bottom of your bathtub then this part will not be exposed. Hence, you always ensure this entire setup would be filled with liquid, the solvent; the solvent could be di water or it could be anything depending on the type of contamination which you want to overcome.

So, say we have di water make sure the surgical tool which you want to clean would be somewhere would sit somewhere in the middle and does not touch the surface at the bottom in order to ensure a uniform cleaning of the entire device what you what is put inside the bathtub. So, there could be multiple things which would which you could put, but always remember the type of solvent you choose always depends on the type of contaminant what is there on the tool which you want to clean or sterilize. So, the right choice becomes important. The right choice between the solvent and the and how it would affect the can release the contamination over the device.

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Now, that we have seen this So, this has a temperature knob which through which you could a set your temperature, there is an inbuilt heater, but otherwise in general the ultrasonic bath they do not have an inbuilt heater for the main reason that the high frequency waves that generate could cause internal heating. So, all when you have this in process, ensure you do not put your hand into the device you turn it off wait for some time and then remove your device because the heat that could be generated within the container could be could injure your fingers. So, make sure you do not use them while they are on and while they are being operated.

Now, that the temperature is set so, you have that time. Usually the entire cleansing process in the ultrasonic bathtub could take around a few minutes say 5, 6, 7 minutes just a couple of 10 minutes depending on the type of contaminant it could even go on up to

20 minutes in case there is severe contamination or in case the process of you know the that decontamination takes a lot of time the type of solvents what you have chosen is it is a slow process then in that case it could go on up to 20 minutes or so.

So all of this you have the temperature setting and the time for which the entire so the entire the equipment which is here is mainly used to sterilize the devices equipments like we already use microscopes, even the microscope lenses can be used to clean so the application is vast. All of this can be used the all the tools which you are using in lab can be sterilized using the ultrasonic path and the working principle remains very simple like it is the ultrasound, the sound waves which are usually 20 kilo Hertz to 400 kilo Hertz these waves create agitation the entire process is called cavitation.

The phenomenon where bubbles are being formed the process through the sound wave propagation happens through nucleation, growth and then implode of the bubble and how shock waves are generated and how the agitation, the impact of the shock wave falls on the surface and the contaminant will be released from the object. So, this is the principle behind using a ultrasonic bathtub in a cleanroom environment like ours.