

Food Packaging Technology
Dr. Maya Raman & Dr. Jenny Ann John
Department of Food Science & Technology
Kerala University of Fisheries and Ocean Studies
Week – 08
Lecture – 40

Hello Every body!! Welcome back to the last session of the Food Packaging Technology course. We are in the week eight and the last session for this week is the packaging printing machines. Last few days, we had been going through the different packaging machineries like the retort pouches, bottling machines, the carton machines and in the last class we talked on the first part of the package printing machines. To continue with the same topic, we had gone through the different conventional methods. The first one we talked to was of the relief methods. We will go on to the next method which is the gravure or the intaglio method.

The gravure printing was also known as the intaglio method from the 'Italian' word which means incising or engraving. This technique was actually first used or practiced in Florence in 1446 by goldsmiths and engraver Finiguerra. So, here usually it is also known as a rotogravure printing because here unlike relief method which uses plates, they use rotary or cylinders as your printing press. This consists of a printing cylinder which is actually the image carrier.

Number two, you will have an impression cylinder which impresses the engraving on to your substrate and third, you have as all printing machines, you will have an inking system. Now, the printing cylinder that you have is usually made of chrome plated copper surface and here the image that you have to print is etched in a form of small cells. It has varying depths and that picks up the ink from the inking system. During printing the image carrier is immersed first in the fluid ink and then the image carrier will rotate, the ink fills into the tiny cells and it covers the cylinder. Here is a doctor blade which washes out or wipes out the excess ink from the non-image surface of the cylinder.

As the cylinder comes in contact with the impression cylinder, it presses the material in contact with the cells and the impression is made on to the substrate. So, this is actually a high quality printing method compared to relief method. So, this is a pictographic representation of a rotary gravure printing. Here you have the engraved cylinder, you can see the engravings, it is called A and this rotates through the ink. The doctor blade B will remove the excess ink but the etched recesses, the etched ones, the remaining ink is then impressed on to your packaging material by the cylinder C which is the rubber impression of the cylinder.

Now, just like flexographic printing, the gravure printing you can do it on a wide variety of materials including printing of cartons, films, foils, papers. The ideal substrate that you have is usually smooth. You have clay coaters, super calendared films or for papers or foils because effective ink transfer will depend on thorough cell contact with the substrate. So the cell has to come in contact with the substrate. Here it is recognized as an entire image area is usually dipped into the ink and used for printing.

So, you have a better quality, like I said and the preparation is usually more costly and time consuming. So, it is usually economical only in long printing runs. If it is for a smaller amount, it is usually not very economical but for a larger production run the gravure printing is actually good. The printing speeds are slower than that you get in the flexographic processes but despite the gravure printing is the high quality, multicolour, fine detail printing. So, we went through the relief, again divided into the letterpress, flexography and flexoprocess.

Second process which how was the gravure printing and the third we will go on is the offset lithography. The offset lithography printing is also known as offset lithography. This was actually invented by the Austrian artist in 1798. He wanted to print musical scores more cheaply by engraving. So, here what happens is a print of a drawing is done on a stone and the stone is usually limestone that is done.

And for 100 years lithography is used in print packaging. It is also used in cards, menus, book illustration and it is the major form of printing even today. You print on a flat surface. The image area is neither raised, it is raised in a letterpress and a flexogram nor is it lowered like in a gravure. So, it is just a flat surface on a stone.

It is based on the principle that oil and water does not mix together. So, what they do is they have oil based inks and that is applied through a series of roller to the offset plate cylinder. And then water is simultaneously fed through the rollers to the plate just before it enters into the or it makes contact with the inking rollers. That helps in making the impressions.

So, this is a picture of that. You have the offset lithography. The image as you can see it is neither raised nor is it lowered. And it is based on the principle that oil and water does not mix. The plate A, this is the plate cylinder.

B is the offset blanket and C is the impression cylinder. The material will go through the offset blanket cylinder and the impression cylinder and the image is etched onto the substrate. What happens here is the image on the plate, it is first transferred to an

intermediate blanket cylinder, that you can see, B. That is covered with a rubber blanket. And the material to be printed picks up the image as it passes between the blanket and the impression cylinder which is the B and the C.

The soft blanket will create a smooth sharp image unlike the other things. This is a very smooth sharp image and you can do it on a wide variety of materials. Especially used for illustrations required on packaging materials. You have pictures and illustrations, this is very useful. Offset lithography produces quality printing on both rough and smooth papers.

But coated paper is most often used because they use less ink and they give more brilliant SUB_TEXT colours. It is also used for printing labels and cartons and for decorating metal containers. It is much cheaper than Rotogravoils and it can be used to deliver Grawor Kulin print quality, though it is much cheaper. So I think we have got an idea right now. We went through the relief methods, the Grawor method, the offset lithography and the last Now the screen printing also is known as the porous printing method.

SUB_TEXT SUB_TEXT polyester or even metals are used. And that is supported by a stencil. Ink is first forced onto the screen by rubber blade. You have a squeegee and this ink can be either solvent, oil, rubber, water based. But usually drying oil type is used.

They are usually thick also, this paint is thick. It needs more drying time. The screen printing is versatile. You can use it on different types of materials, wide variety of materials including round or irregular.

It need not be flat. Your substrate need not be flat. You can have it round or irregular. For example milk or soft drink bottles. So this is generally ideal for short run productions. It is used for imaging glass, box wraps, folding cartons.

But it is low speed and the time required to dry is also much more. Here is a picture of a screen printing. You have the stencil. The squeegee ink is passed through it and the image on that stencil is made onto your substrate. This is another picture where you have the same thing represented in a different method.

So with that we have completed the conventional printing methods which was relief methods which was again divided into the letterpress, flexography and the flexoprocess, the gravure method, offset lithography and the screen printing. We will now move on to digital printing which is quite different from your conventional method. Now in digital printing, the printing is from a digital source directly to a variety of substrate. And this

is for large volume laser or inkjet printers or electrographic. Here unlike your conventional method, they do not use any physical master.

That is they do not have any printing cylinder or printing plates here because all the graphical content is in the digital form. So the benefit is number one, consecutive copies can be different from each other. So you can actually personalize or customize for different types. That is not really possible in your conventional method. Secondly, the printing process is much faster and simpler compared to the traditional printing because of elimination of master production.

In the other cases in your conventional method, the master type cylinders or plates, they had to first be etched, then the printing had to be done. This is not needed here which makes it much more feasible. Like I said, the digital printing was first divided into the inkjet printing. Now we are all familiar with the inkjet printing.

This is an impactless printing. Impactless is there is no contact between the substrate and the inking. It's also known as pressureless printing process in which the tiny drops of the inks is directly projected onto the surface. You don't have to push it onto or engrave it onto or press it onto it. It's just dropped directly onto the surface for printing without physical contact between the printing device and the substrate. Each drop is controlled electronically.

Each drop that you fill or pass onto the substrate is controlled electronically. That's why it's known as impactless because there is no mechanical pressure, impact pressure to transfer the ink to the receiving substrate. And so there is no platen required to support the receiving substrate also. This can be used to print on cans, bottles and objects and other objects also. Two main methods are you have either continuous or the drop on demand.

Usually the ink by non contact it is passed on to the substrate. This passing on can either be continuous or drop on demand. So drop on demand, it is a software that directs the head to apply 0 to 8 drops of ink per dot. So each dot you will add 0 to 8 dots wherever it's needed. So the drop on demand is again divided into the piezoelectric and the thermal drop on demand.

In piezoelectric, like the name suggests, the droplets are formed when an electrical signal causes the piezoelectric crystals to expand. And this creates a pressure wave and that forces the droplets onto the substrate. While on the other hand, the thermal drop on demand inkjet, it's also known as the bubble jet. It works in the same manner except that the pressure wave that is generated is by heat. And that vaporizes a small quantity of ink

and that causes a large pressure increase and it makes the droplet of ink fall onto the substrate.

So mostly they use the piezoelectric printheads in the inkjet printers. The other type other than the drop on demand was the continuous inkjet technique. Here the ink droplets are continuously generated by pumping liquid ink into the chamber and at high pressure, acoustic pressure waves using the piezoelectric, they are moved onto the substrate. Here they require higher volume and medium quality and this is needed, usually used for marking and coding of products and packaging. This is a pictographic representation of the inkjet printers where the printing device has no contact with the paper.

The ink is dropped from 0 to 8 drops per dropping and it is controlled either by electricity or by heat. Another pictographic representation of the inkjet printing. So we have now on the inkjet printing of the digital printing and the second one is called the electrography method. Now in the electrography method, it is one of the oldest non-impact printing technologies that was invented by Chester Carlson in his New York laboratory. This is also referred to as xerography which is one of the most common methods that is used nowadays or laser printing.

So electrography is also very well commonly known as laser printing and that is specific light exposure technologies used in the process. The electrography method is used in copy machines, laser and LED printers and it is one of the most complex digital printing technologies that is available today. It is a plateless printing technology. It is based on image carrier surface that is electro-conductive which is very important. Here there is no etching, neither is there any ink droplets.

Here the carrier surface is photo-conductive and it can be charged electrically. In this method, you use a laser or an LED and a negative of the image is beamed onto the drum cancelling the charge and leaving a positive replica of the original image. In this method, using a laser or LED, a negative of the image is actually beamed onto the drum cancelling the charge and leaving a positive charged replica of the original image. Okay, this is much quicker and an economical method. So, this is a pictographic representation of a digital electrography.

Unlike all the other methods, the quality of the image is high enough and it is used for packaging. The advantage is possibility of using variable data, on-demand manufacturing, much cost effective and within the short runs. But there are few limitations that include smaller colour gamut compared to the traditional method, format size, productivity. For traditional print, you can use a number of different substrates.

That is much less in this electrography method. So, since the mid 1980s, the colour EP printing has been very popular by businesses and it has been used in almost all fields. Coming to the last method, which is the hot die stamping and the gold blocking. Here the print dies are raised but there is no ink receptive area like your letterpress. You have these raised areas but you don't have an ink receptive area. The carrier is usually a plastic like polyester and that is coated with a foil or a pigment and under pressure you can transfer it to another surface.

Advantage is there is no drying or surface filtration, quick for colour changes and there is no cleaning down. The plates may be of silicon rubber and soft plates. It is important that soft plates are usually used for kiss transfer. You can transfer it or make an impression on another material and metal plates are used, they can give a distinct impression.

It may be clear from the picture that is shown. Can either make an impression here in a hot stamping or you can have by kiss transfer, you can transfer it to the material or the substrate. The metallic foil consists of, there is a carrier, there is a release coating, a lacquer, metalized layer which is deposited by a vacuum and hot melt type adhesive. The carrier that you have is either glassine, cellulose film or the polyester. You cannot do it in any of these packaging materials while PET or polyester is the most common base that is used in hot stamping. Now, let's look at the important factors that influence the choice of the printing process.

Number one, it is the material that has to be printed, whether it is a metal or glass or paper or board. That determines the process. The quality of the print that you require, the quantity that you require to be printed, the form in which you want the printing material and number five, special requirements like potential toxicity, rub resistance, freedom from odour, all this will determine what kind of printing process you will use or choose from the ones that were mentioned till now. So we'll conclude. We went through different printing methods, both conventional and digital.

Conventional, we went for the relief methods, the gravel, offset and the screen methods. Digital, we went through both inkjet and the electrography method. Inkjet, we talked about drop-on-demand and the continuous method. So, with that, we have completed the last week course and we have come to the end of the Food packaging Technology course.

Really wish that you have enjoyed the course. We went through different topics in the different modules. In module one, we talked about the different materials that were used, paper, the plastics, metals and glass, how these are made, what are their properties. We went on to talk about how the different forms of packages can be made and the

application of this in different food systems, whether it's vegetables or meat or fish products, cereal products. In module three, we went on to talk about different tests and the transport worthiness tests that were done and different machineries that were used in the packaging industries. So, I think with that, you'll have a fairly good idea of the different aspects of food packaging.

It should be very useful in the future too. You'll have your exams coming up in the forthcoming weeks. I wish you all the best in everything. Thank you once again for attending this class and participating wholeheartedly. Thank you.