# MODULE 25 - LECTURE 12

# Introduction to Digital Textile Printing

So, till now we have been, talking about one printing methodology, which was called the, 'Transfer Printing'. And we are going to be talking for a few, next few lectures. On another fascinating technology, which shown a lot of promise and that is,

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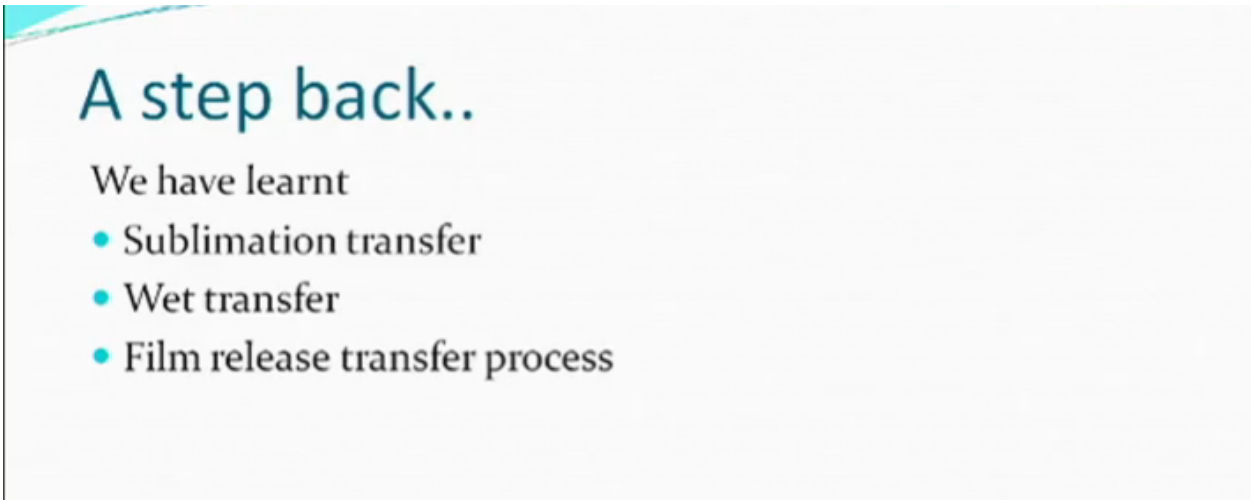


what would will work it out? So fair transfer printing we've seen the, sublimation transfer printing is the most successful, transfer printing method. The wet transfer and fulfillment heat transfer also, are possibilities, but not necessarily, commercially very successful processes.

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So today, we will look at, what we call as a introduction to digital printing, just the concept to begin with and in subsequent lectures, we will take, specific issues, related to digital transfer textile printing, digital textile printing. so this, in some sense is an extension or a nice way to changeover, in a thought process from paper, transfer to directly printing the textiles, the way the printing industry went on, to increase speeds and could print anything, on the paper. So, people wanted to see, why can't we directly use, the technology to print textiles, by the time textile people got really interested, paper industry already had in one way or the other, use the digital printing on paper's, like you see, inkjet printing or paper which is being done, quite conveniently. so people, wanted to see, why whatever is being first printed in a paper and then being transferred, why can't we use the same technology, to print textile directly. that is one motivation, which is led to this industry, interestingly the initial people, who got interested in making machines, were very different people, than those who are making textile printing machines, people like Epson, who were making printers, for paper printing, they got interested in this business. And so, things are progressed and we believe that, they're going to progress further.

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So today what we'll look at is, what is the market trend approximately? And how do we say analog and digital printings are two different sets and methods. And possible advantages of digital printing, some other thing which from the term point of view will try to understand, what we call is a spot and process colors? So, difference between spot and process colors, some essential steps, an inkjet printing process of textiles. let me just tell you, for paper printing we have laser printing also, so textile printing till now, there is no laser printing, unless you make the textile behave like a paper, so it's not happening, so basically inkjet printing, when we talk about digital printing? we basically are talking about processes, which are called the,' Inkjet Printing'; sometimes you will see these things. And any pre or post treatments, that may be needed, we just introduced, will not be discussing this in detail.

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this is a fact, which is generally very discouraging for anything, which is a novel, the transfer printing that we discussed till now, particularly the sublimation transfer printing, just about5%, of the market it holds. roller printing, if you remember with the machine, discuss, taught in so many ways, also is similar and approximately 5%, everything that is bent it today textile is screen printing, so either you have a flatbed or you have a rotary, if you add them all, what remains. so people, can either see an opportunity or may like to get discouraged, why go for a technology, which hardly anybody seem to be using, all right. so what it means, as an opportunity that, if it can offer things with the others cannot, then you can obviously account for it, one the reasons has been, that the people who were printing paper, got initially involved it was good. But, they did not know, textile requirement .so, textile printed fabric has to be washed time and again, exposure is different, printing of paper only meant everything is in the dark rooms, all pictures are dark, if you try to expose any printed paper to sunlight, it won't take more than a few hours, to few days, before you see the change. While you expect in a textile that, years of use also would not change much of it. it's not a zero change, but people still wear, garments which are very old, then the width, general width of printing of textiles is very large.

So, you have 1meter, 1/2 meter, fabric which continuously are used for printing purposes, paper printing people particularly, the inkjet people were not really using such heavy, width. So, machines were costly, selection of ink as to, what kind of ink one should use? Which would actually do? Whatever job that does? became a problem and inkjet printing by itself, had a concept, which believed in four colors only, if you see your printing cartridge, it's got three colors and a black .so, they believe in four colors I'm creating everything, which means, whatever you see you will be able to see, whatever is see on a screen, will you should be able to print it on the textiles. That means, the kind of dyes, that you have to generate, they have to be so standard, so standard, that if you mix them, you will get exactly same response, which you get on a screen. Which was a challenge? First the challenges, making such a big printing machine and then, making dyes, which will reproduce exactly. So, the process became costly, the dyes are also very costly, they are not available in sewer are, you have to really it's all standard, very standard companies are the only ones, who can hope to make such eyes. So, it became a costly process. So people started using it only for sampling purposes, rather than production, that's why it looks as if not many people, the period of interest but, now things are changing.

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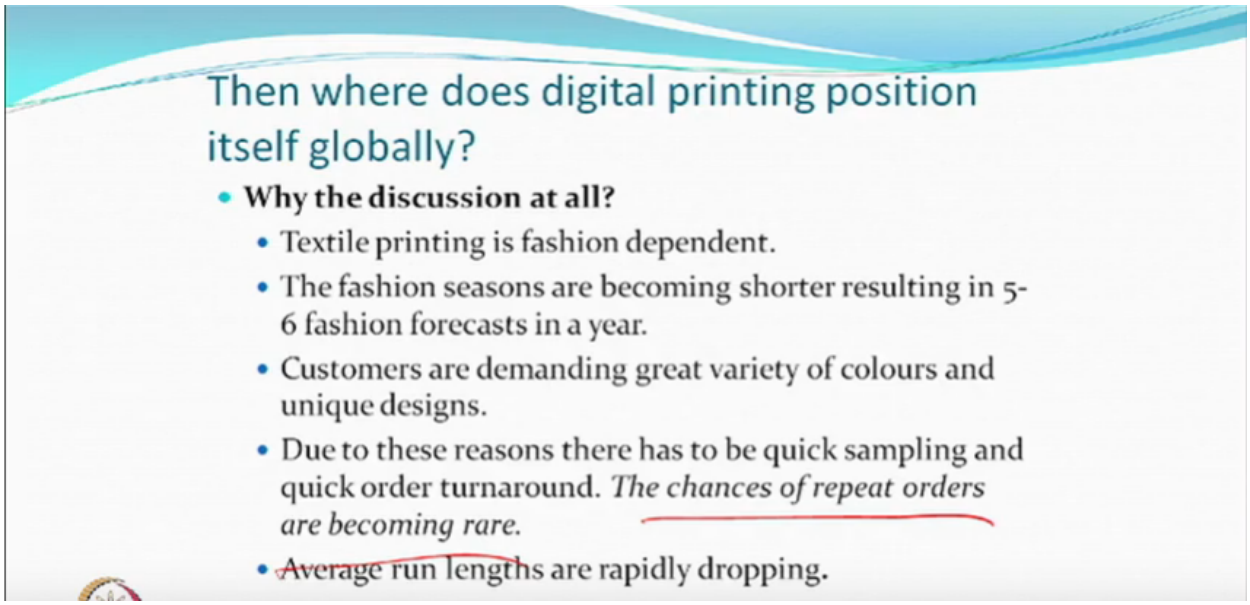


So, this is what we're saying? Why do we the discussion at all? On digital printing, of textiles. This is one reason, which people think could be interesting, that is printing is basically a fashion dependent process. And fashions are changing these days pretty fast, and that would mean, that somebody will not like to use your design, which you produced six months back, which means that your change is coming fast? Five to six forecasts in one year, across the globe, that's the kind of design you're looking at, so that means ,you want more flexibility. Unique designs great variety, now somebody says well, I want this print only for myself, for example, your own photograph, on your t-shirt. Does that mean ,there is no much order. so you can't, make screen or rollers or anything else, just because all somebody has prefers, the design is if this design nobody else would get it or I want the next one is very different, it may not be possible, with the conventional methods. And because of this, the chances of repeat orders are becoming rare, if this is actually true, in the fashion industry, then obviously you have to have a technology, which can do this, at the click of the mouse, as they say. Average run lengths are rapidly dropping, so if somebody say, I please give me 50 meter sprinted, no other technology will try to give you 50 meters.

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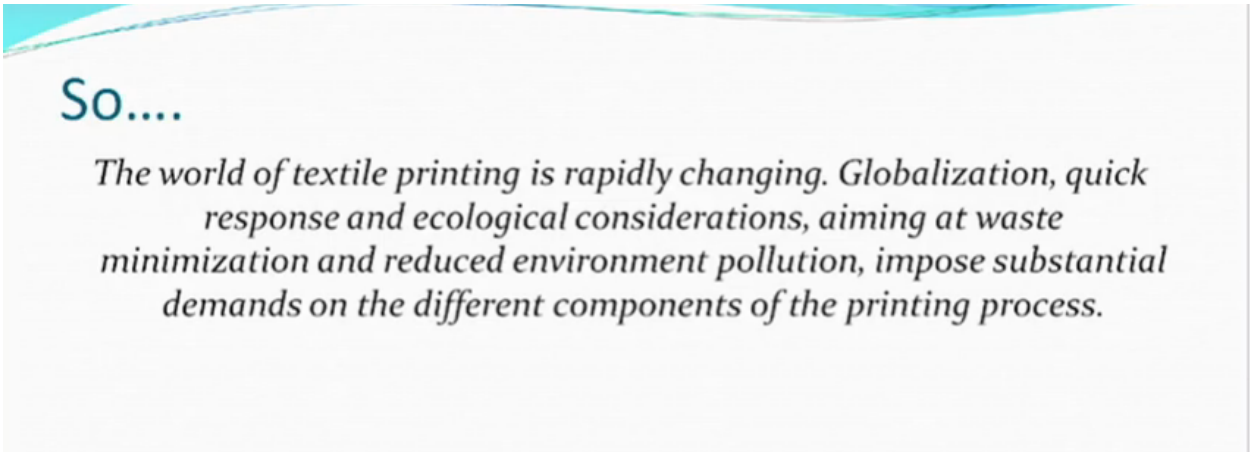

So, we have a hope. The hope is that, the textile printing is rapidly changing globalization, quick response ecological considerations, if everything is done nicely, let's say you can print, through inkjet printing, pigment based system. So any, kind of a blend of a textile or any nature, it gets done, what it means is? Maybe you don't have to wash it also. One go, you have finished and so, ecologically may be, an attraction and that is why ,you may still think that, we can discuss digital printing.

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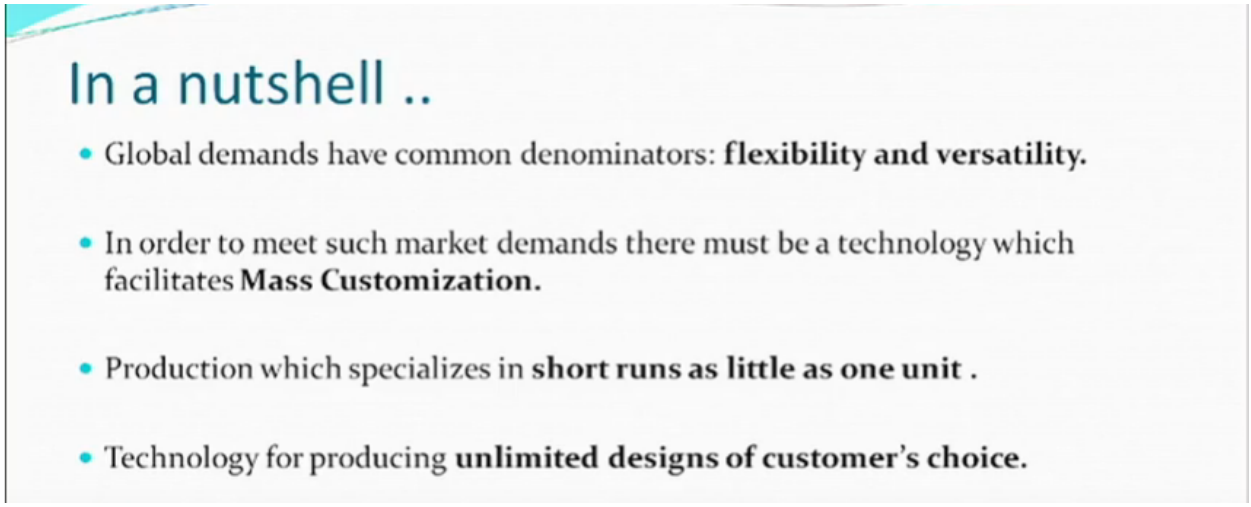


Flexibility and versatility, these are two terms which are used these days. How fast you can change? And how many things can you do? So this technology has the option of providing this type of a flexibility and versatility. People were talking earlier of mass production, mass production is done, to reduce the cost of any production. The fashion industry, actually believes in mass customization, that I want something for myself, I don't matter whether somebody else wants or not depends on, how much money you have? But, this technology theoretically can offer to anyone, anything that you want, so printing is concerned. So, it's a mass customization. thousand people want, thousand different things you, say I'll give you, no other technology can provide you, unless and until you got really big orders, you don't want to change your design ,as we mentioned before although short runs, I said, has little as one unit only, this no other technology can even think of offering, an unlimited design, designs there is no limit, well I can give you ten, I can give you twenty designs, whatever you want I can give you, that kind of thing.

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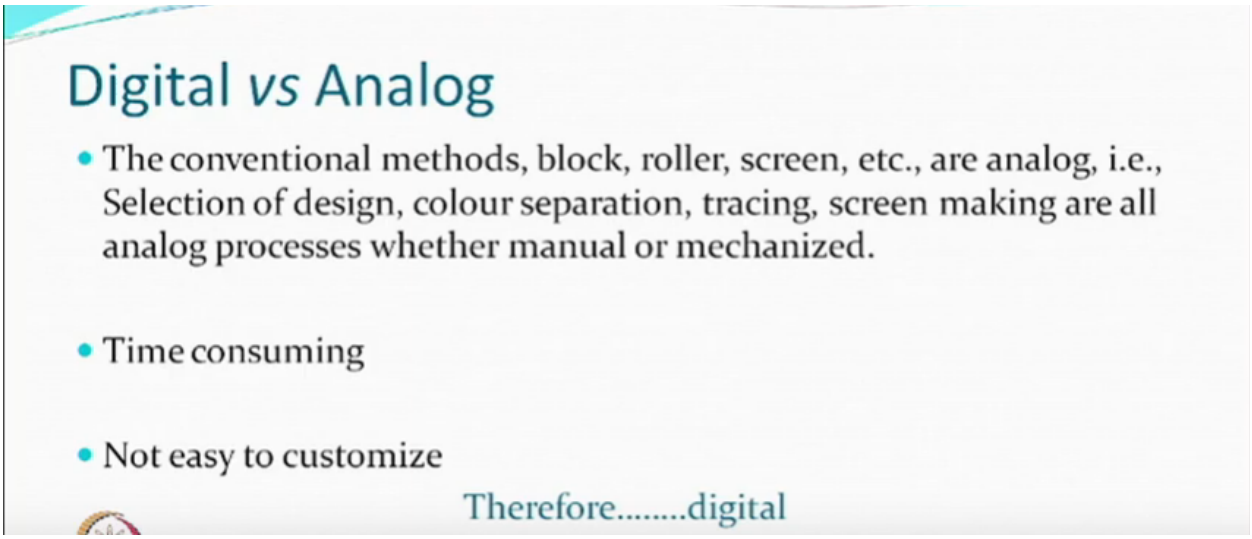


So we have, a comparison as they say, in the electronic word ,digital versus analog. So from our purpose, the conventional printing method, can be considered analog method. where you do block making, roller making, screen making and do, manual ,separation of colors, then you make tracing, which are manual, screens are made, all these take time, whether they are manual or mechanized . And not easy to customize, unless your customer is big. And your order, big order then you customize but it's not individual customization and therefore, we said,

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it's a digital, which means, allow short runs at economical cost, short runs and economical costs, larger runs, will always be more economical, if somebody gives you a digital printing, with design order of ten thousand meters, you will probably make more money, but the interesting part is the machine cost, remains fixed, which could be quite high, the ink cost, will also not change, when you use more meters to be printed, if suppose you require 20% area being covered in the design, per meter and you whether you print one meter you print20,000 meter, the percentage of ink required to cover the 20% of the area will remain the same. and so, the electricity and other costs that you have infrastructure, that also remain

same, so this is one technology, it does not say that if you have large order that your cost is going to come down, unless and until, you also have a pre and post processes needed, to do that, then the larger orders will become more cheap. So, in some sense particularly a few type of printing systems, obviously will be created in green image, very ,very expensive methods, of screen preparations are avoided, changing from one color scheme to other and one design to other is simpler and cheaper and less time-consuming.

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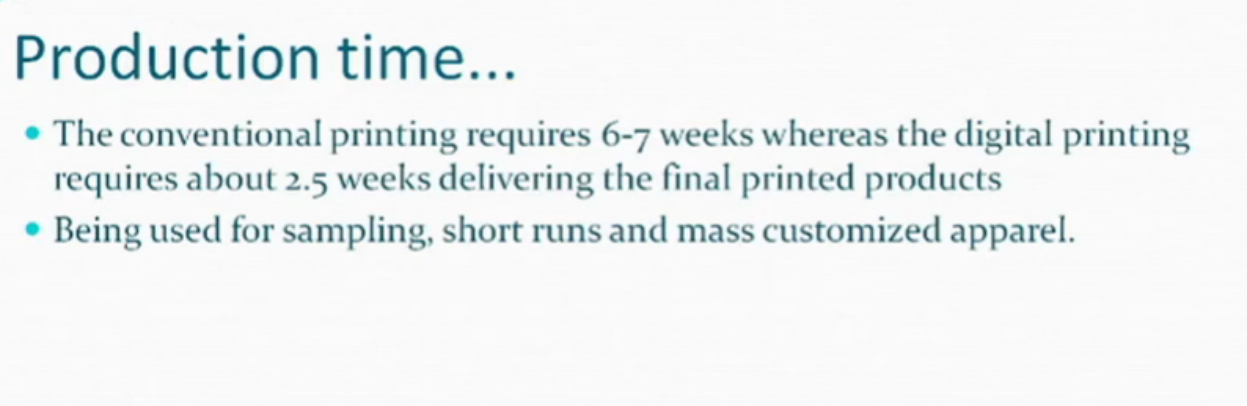


When somebody used to say initially, that well this is the kind of a design please, make and designs and show, before approval. Six to seven week is the minimum time that was required. So which obviously, in a textile seam could be reduced to two ,two point, two and a half weeks? So, you can have more chances of getting orders, definitely for sampling, short runs and mass customization that is what we're looking at.

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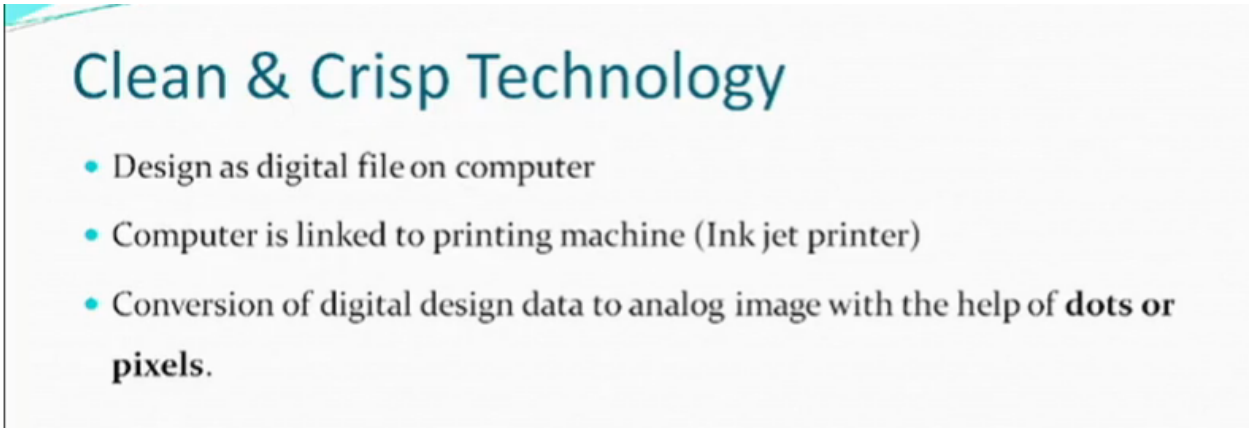


So, it is crisp and clean technology. So, all you require is a file on a computer and if you link to a printing machine, which is called a. 'Inkjet Printer'. The design data or the image, is basically pixels or dots. Pixels on the screen and dots on the textile. Like we did talk about dots, in paper printing, the paper printing is now coming to the textile. So, you are actually printing dots.

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Of course, you have to distill selected design, with somebody likes it or you will ensure that somebody will like it. Or a design somebody gives you have a scanner, you can scan and if, you have good scanner, you will get good design. and then, connect to a software, the software's are becoming smarter also, for example, let's say it will be very difficult for us, to think of inkjet printing, with discharge printing and soon for, what you will do is a direct printing, only because it'll be very difficult to use all kinds of chemicals, in the ink, of a printer. so that is, the answer is a simple link, which is there, the color separation here takes place automatically, because computation is taking place, looking at with color and dividing into four colors, every design is separated into four colors. And so you have, standard dyes, which are going to be used and once it is separated then, printing takes place. And it's an on-contact printing, the printer does not head, does not contact the surface of the fabric. Unlike our normal printing, where surface of the textile comes in contact with the screen or a roller or anything else, here it does not come and guards a non-contact printing this is.

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So, there is something called a, ‘Spot Color’. As pot color is, what we use in conventional printing. You need a green, so you mix two or three colors ,to get aright green. And then use that, to print. So you initially, mix colors, before and then do, the printing and hopefully, you will be able to match the shade. Shade matching and printing as we said is a difficult job. Because, there are so many elements there ,so these are called spot color. Spot colors means, you have already made a color, which is going to finally be appearing as it is, on the fabric, mixing taking place.

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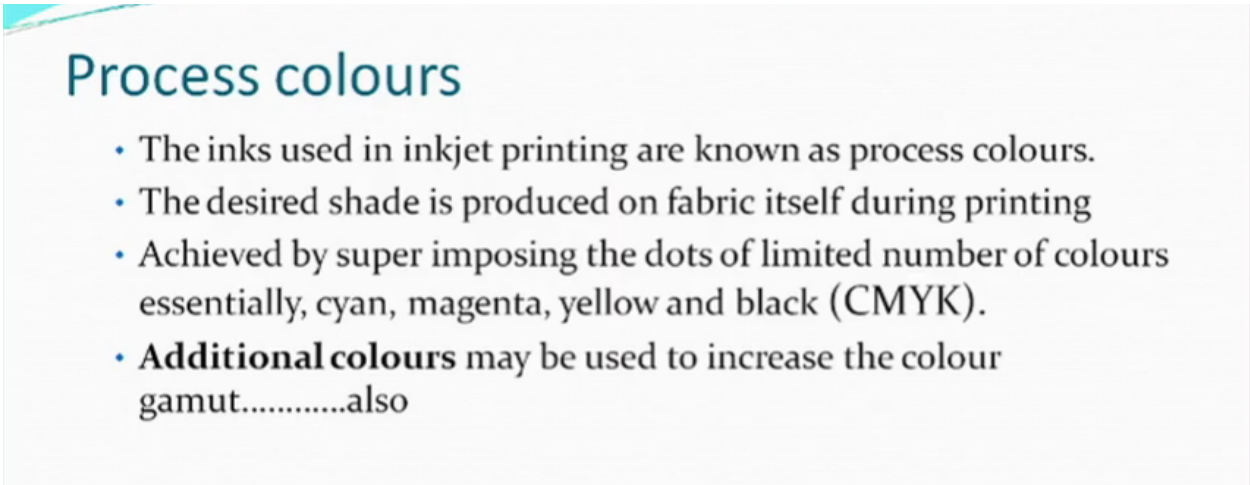


The process colors are the ones, we you don't mix before. So the process that is used ,in exact printing is called the, ‘Process Colors’. So desired shade is produced, on a fabric itself, during printing. So, superimposing the dots, in the limited number of colors, which is CMYK? So, these are the four colors are there, one can use additional color, sometimes in textiles, one of the colors could be white. But, generally four colors could be there, which can produce any color, infinite shades and colors.

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So, what you require is a computer, software, digital printer and textile substrate. Suppose you want to print, some design on a let us say a dark black t-shirt which is varying. And you want to use a light lemon on this, if you print, it will you see anything there, so how do we print that? so what people have been doing is? Making printing everything, with white. In the block, so print with block, after printing with the white block, then print on that the color, then it becomes visible. So, you make a square or a circle or whatever and then in between then you make all design, so which meant ,that it is not the thing that you wanted, I mean, you just want the design, then suddenly what you say, you know, we have to somebody has modified the design, bigger printer now, if you want to print this, you got to print a white, on this before, your design will be visible.

So this was one of the limitations, that you have to print light colored material, till the software were designed in a manner, that yes we can print white, so that ,the light colors also look good. But, it will print exactly, the white where the overall design is, so you actually calculate where the design is and exactly print only those areas, where the design and the white will never come out, of that part, so accuracy levels are very high. so one thing, which is here is the accuracy, you cannot afford, to have a situation, we're fabric, vibrates, shifts his position and expect the design to be same. Because, this is a non-contact tail. so the drop, will be thrown wherever the head is and so, if your fabric a shifted, so dot will be somewhere else. And therefore, the software obviously, does so one of course has to make sure that the fabric goes away, it is supposed to go. And today the software can print the white, exactly where the over complete design is? Wherever there is a no design, there is no white. and then, and the second stage you print the design and so, hardware is very important here, this is a printer, the costliest material, you have choking of normal screens and you say, we'll wash it everything and and then clean, if a printer head chokes, you have to basically change, there is no nothing, cleaning, of a printer head. So, I said costly, so you have to maintain things and this probably, will be also a technology, which would like the printer to have an environment, which is almost air-conditioned. if you run a machine24/7, in a dusty environment, you never know what will happen? and what will happen on a print is a separate story? what happens the machine is a greater concern ? that despite everything else, the printer is costlier, simply because the printer head if you have seen the inkjet printing machine, it is the printer head which moves from one end to the other, it takes time for something to move from one end to the other, before the fabric gets further or pushed out. So, the speeds are slow, so suddenly if somebody said that if you have a printed paper, I can run transfer printing machine at almost 500 to 1000 meters, per minute. or per hour, here those kind

of things, per hour, you'll not be able do it. Okay? But, that's okay? but now what they're doing is, in the hardware segment, that one it moves, the head moving together, may not be one, there'll be a block of heads moving together. and so, in one go, they print quite a lot when they come back also the print, it's not like going and then returning, so returning to the station, means, twice it has printed. and one can think of, having four heads, running together ,big machines may even want eight heads running together. and which would mean that, the per meter, printing speed, should increase.

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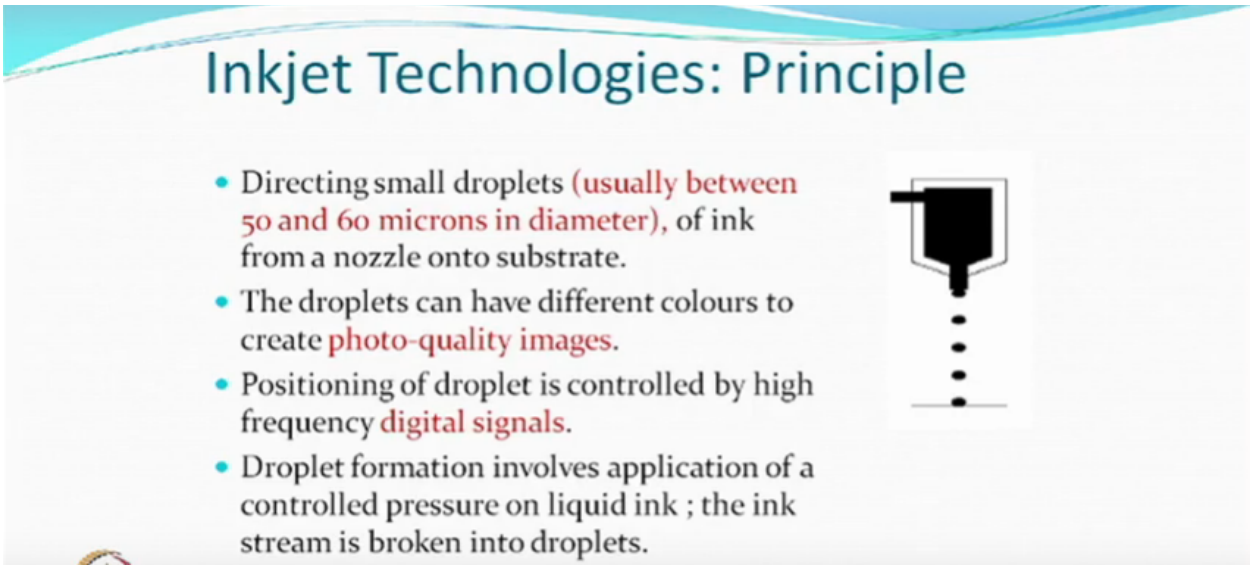


So inkjet technology, you're looking at some drops being generated. and thrown, so different principles are there, which will of course talk in more detail, whenever we meet next time. So, but think of this, what you are looking at? is 50 to 60 microns in diameter. photo quality image can be created here as well, alright. So, these four colors will do. so what exactly happens in this process color is? That, the green is not made by putting, one drop over the other, what you are doing is, a drop next to it, no drop falls overreach other, but if the size is small, the perception in the eyes, looks like as if the continuous shade, if you have less green and more yellow, then give you apperception. Because, there's so many of them if you have large, dots then you can see the dots separately. But, if the dots are very ,very small ,you see is a continuous color ,if you magnify you can see that and so, it's a perception and who is supposed to be satisfied is us, as a human being we are supposed to satisfy with the shade and color and so if that is what our resolution is, so that's what you have to beat that resolution and you get it. Right? So, you can produce millions of shades, so high-frequency signals, pushing the drops at a very very fast rate. and that, means, at some command given somewhere, something happening, somewhere. So, this whole process of transfer, of signals, creating a signal and finally this transducer throwing, a drop out, obviously is the sophisticated process. and so, it has taken time and some costs are probably high, how do you create a droplet? somewhere by, some method, you will be pushing, some chamber where the liquid is and unlike for example, the paper printing that we see, in an exit printer, there is a cartridge got a small little chamber here you can have a continuous supply also, of ink from somewhere else. so there will be pipes running and which will also move along with the head, so that you have more2 larger reservoir, because you're

gonna be printing more and hopefully, you will be printing, more because, you want this, particular ink to diffuse bit also, so that you are also interested in wash fastness, is not just on the surface.

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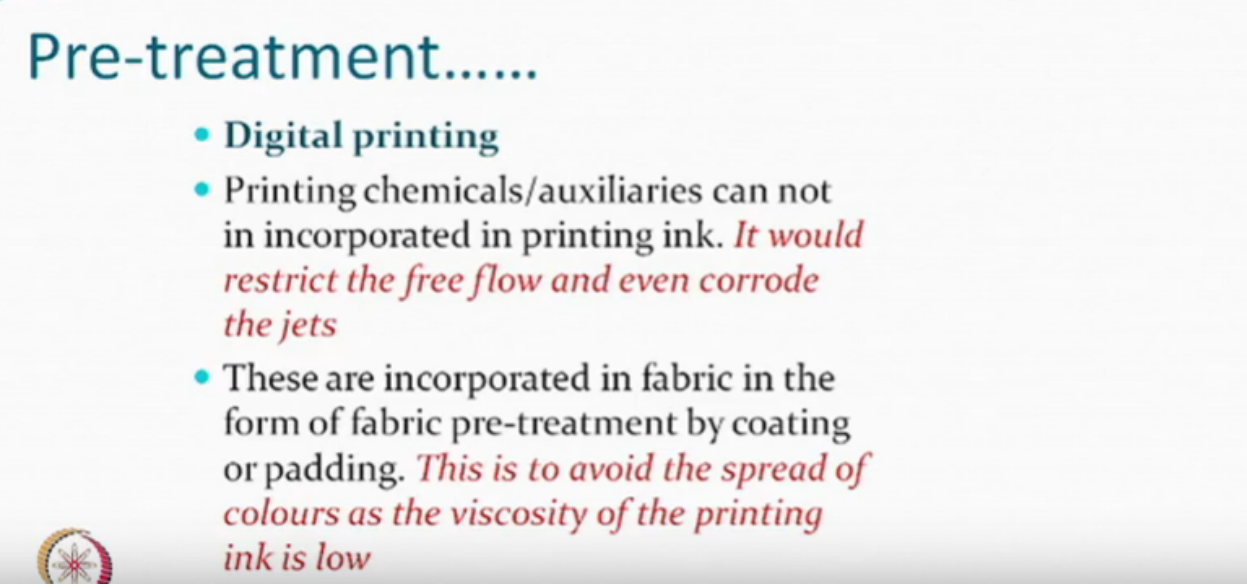


Do we require a pretreatment? conventional printing required all scouring, bleaching, etcetera, etcetera. So, mean if you require a bleached fabric, you will require a brief fabric, if you call it a, 'Pretreatment'. Yes, of course you can't take a gray fabric and start printing and say well nobody likes, you can print it, but who like it. so from that point of view yes, so you will get bleached or dyed fabric, which are used for conventional printing. So, you in a conventional printing, you have the bleeds dyed fabric of course, you require chemical of the rays for fixation, taking air urea alkali, acids ,deforming agents in the print paste, it is discuss, but here, in the digital printing, chemicals, auguries, cannot be incorporated in the ink, which comes out from the printer head. and therefore, you get restricted. what can you print? and what you cannot print? it would restrict the free flow and even corrode the Jets. So, all those things will not be there therefore, some of these things if required, will have to be put on the fabric first. you may like to do a bit of a coating, so that there is no spread, which can be done. So, some fabric preparation may be, required. so that the, hairs that you see, on the surface of fabric, which you don't see on a paper, can obviously if a hair is jutting out and the drop falls in the hair, so all your accuracies finished. So, you may like to first do that, so some pretreatment could be there, in case you actually think that you have an ASA dye to be printed, then you may have to do some pretreatment, so that that gets fixed, if you think is a reactive dye then you have to do pretreatment reactor dye, maybe required.

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post-treatment also may be required, depending on the type of the fabric and the ink, that you are using. so unlink, unlike, the transfer printing, where you only had a choice of dispersed dye. Here, people are now, looking at pigments, reactive, acids and all such type of dyes, so there is a choice of substrate also has changed. otherwise you said, only polyester maybe other synthetic fibers, but again, only polyester. so that, transfer printing in a way is limited, to a particular dye and a particular substrate, in the inkjet, you are not so much limited ,because the inks of different types are available now. and so, different type of fabrics also can be printed. which means, that well silk, wool, cotton, nylon and blends? Because, this pigment is there, without the problem.

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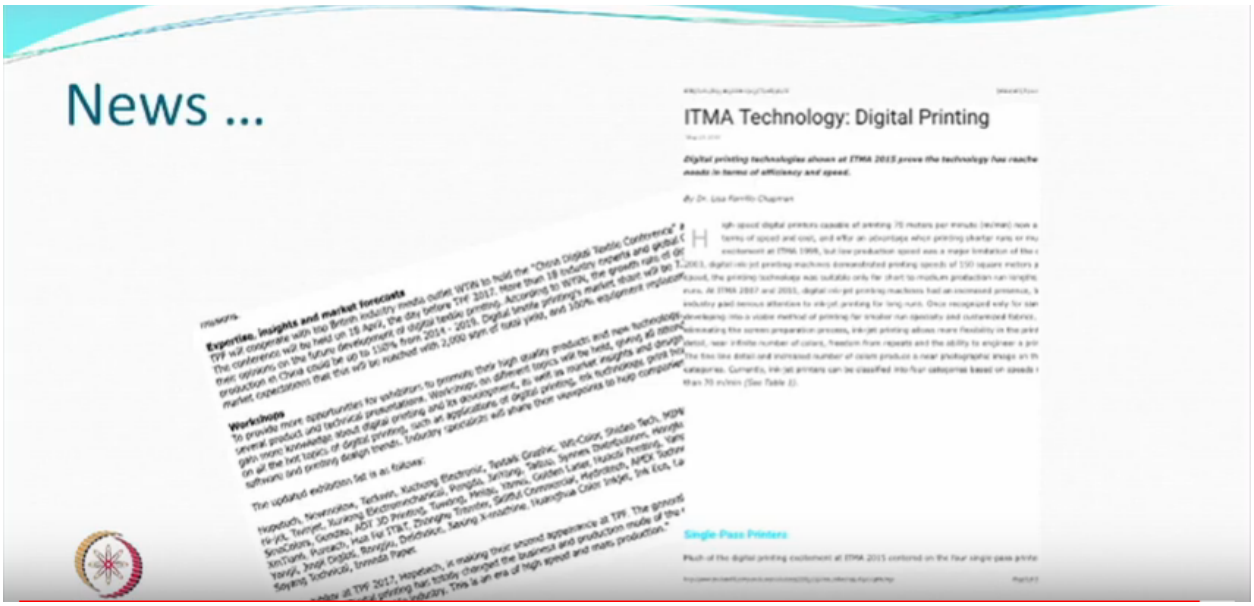


So, looking at what is happening at the it ma, it appears the interest, in the this printing technology is growing, at a faster pace. if you get a chance, we may visit one of the textile, digital textile printing houses here. and see, how they are, but of course you are doing, if you are printing, hydrophilic fibers,

then obviously, the washing and other steaming fixation also have to have done. So, printing is only one part then, if you are doing pigment, then there's the last process, you can go straight.

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I think, that's what? Would be, what we call as introduction. which means, we know, where do we stand, we understand, what is digital analog printing ? spot and process colors, basic steps. and why, pre and post-treatment, may be required in this dual printing as well, that's it stop.