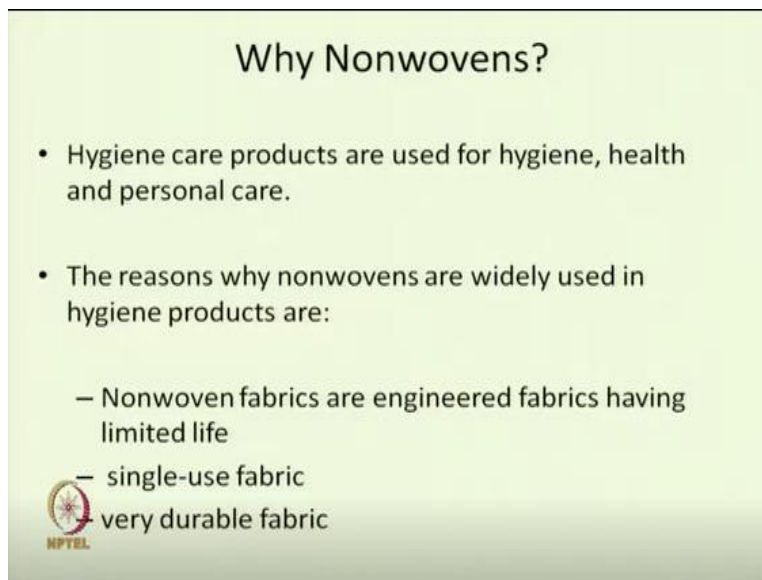


Technical Textiles
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Lecture No- 35
Textile in Hygiene


Hello everyone our last topic is textile hygiene products. So, in hygiene application we use textile materials to a great extent, where mainly nonwovens fabrics are used.

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Why Nonwovens?

- Hygiene care products are used for hygiene, health and personal care.
- The reasons why nonwovens are widely used in hygiene products are:
 - Nonwoven fabrics are engineered fabrics having limited life
 - single-use fabric
 - very durable fabric

 NPTEL

So why nonwovens in hygiene? Because hygiene care products are used for hygiene and health and personal care, the reasons why nonwovens are widely used in hygiene products are because the nonwoven fabrics can be engineered depending on the application. So, this hygiene products they have limited life and single use fabric most of the hygiene products are single use fabric and nonwoven fabrics are durable in nature.

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Properties of Nonwoven

Properties of nonwoven which makes it ideal to be used in hygiene products-

- Excellent absorption
- Softness
- Smoothness
- Stretchability
- Comfort and fit
- Strength
- Double fluid barrier effect allowing moisture to be absorbed and retained



So, the properties which make the nonwoven fabric suitable for the hygiene products are; in most of the hygiene products the requirement is that absorption. So, nonwoven fabrics due to their structure they are excellent in absorption of liquid. So, they are in contact with our body that is why we need the softness. Most of the products are in contact with our body. So, smoothness is also a requirement which nonwoven can provide. Stretchability.

Nonwovens are stretchable, comfort and fit, it provides strength, which is required in hygiene product and also the double fluid barrier effect allows the moisture to be absorbed and retained. So, it absorbs moisture and the moisture is retained within the structure that is the special characteristics, which makes the nonwoven fabric suitable for a hygiene products.

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Properties of Nonwoven

- Good uniformity
- High strength and elasticity
- Cost effectiveness
- Stability and tear resistance
- Opacity / stain hiding power
- High breathability



So, due to its good uniformity, high strength and elasticity, cost effectiveness, stability and tear resistance, opacity and stain hiding power. So, nonwoven has got stain hiding power and it is high visibility, so nonwovens are used widely in hygiene product. So, stain hiding power means, the stain getting absorbed inside the structure. So, the commonly available hygiene products are;

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Nonwoven hygiene Products

Some Nonwoven hygiene products are:

- Diapers
- Feminine hygiene products
- Incontinence products
- Nursing pads
- Toddler training pants
- Wipes, skin care
- etc



Diapers, feminine hygiene products, incontinence products, nursing pads, toddlers training pants, wipes, skin care, etcetera, these are the hygiene products. So, we will discuss one by one and their structures, their specific requirements, characteristics requirements and what are the fibers used?

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DIAPERS

- **Baby Diapers**
- **Incontinence Diaper**



So, diapers are mainly of two types one is baby diaper and another is incontinence diaper.

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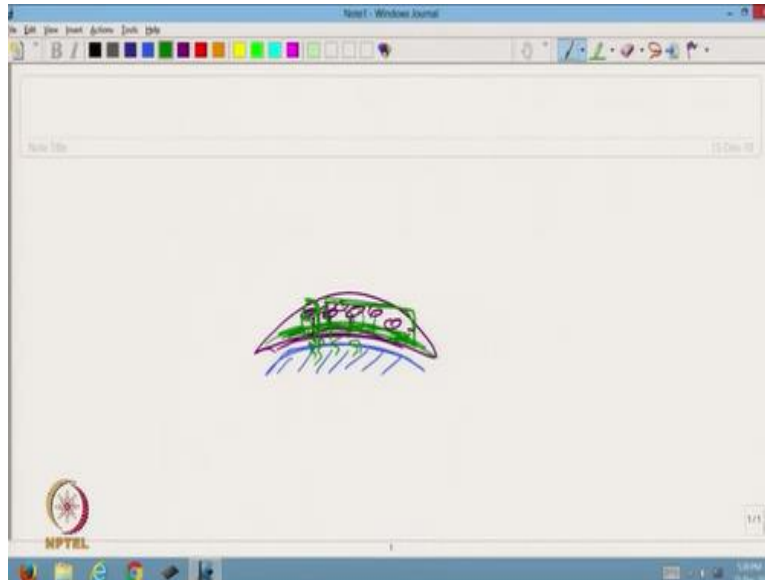
Baby Diaper

- All absorbent hygiene products are designed principally to contain body fluids such as urine.
 - The ability to contain faeces is also an important attribute in baby diapers and some incontinence products.
- Diaper should be designed such that the fluid must be readily accepted, distributed and absorbed by the structure.



So, the baby diaper if we see all absorbent hygiene products are designed principally to contain the body fluid such as urine. So, baby diaper's main function is to retain the body fluid and the ability to contain the faeces is also an important attribute in baby diaper and some incontinence products. So, it should be able to contain the faeces, these faeces should not come out. The diapers should be designed such that the fluid must be readily accepted, distributed and absorbed by the structure, that is very important.

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Because, suppose our skin this is baby skin and diaper is put here this is a diaper. Body fluid, whatever body fluid is coming out it should get transmitted to next layer and where the body fluid should get distributed among large area and then the next layer where the absorbent materials are there, they can absorb this body fluid uniformly, these are the absorbent materials and they absorb uniformly. Otherwise if the body fluid does not get distributed, it is concentrated in a particular area.

The main problem will be that that in other area the absorbent materials will not be used properly and here in particular place the saturation will reach quickly that is why the distribution layer, the function of distribution layer is very important.

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Baby Diaper

- All absorbent hygiene products are designed principally to contain body fluids such as urine.
 - The ability to contain faeces is also an important attribute in baby diapers and some incontinence products.
- Diaper should be designed such that the fluid must be readily accepted, distributed and absorbed by the structure.
- Layered constructions and various materials are used to engineer these in-use performance requirements precisely.
- Materials selected must have appropriate properties and skin contact materials should be suitable for prolonged intimate use.

So, this distribution is important and then after distribution, the structure the absorbent structure should absorb the fluid. So, there are different layers the layered constructions and various materials are used to engineer this product depending on the specific performance requirement. The materials are selected depending on the requirement and the skin contact material should be suitable for prolonged intimate use.

So, a skin contact material should be soft enough, so that it does not create any irritation and uncomfortable sensation.

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Principal layers in absorbent hygiene products

1st layer: Top-sheet or facing

2nd layer: Acquisition and distribution layer (ADL)

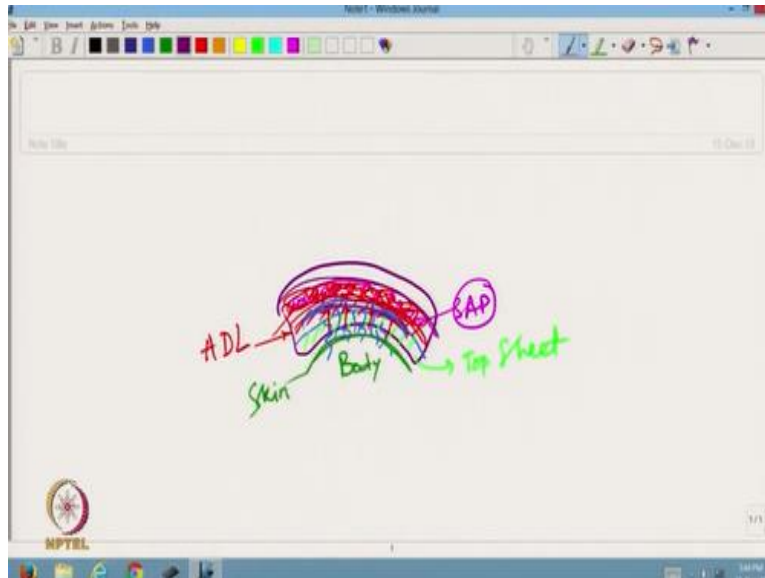
3rd layer: Absorbent core

4th layer: Back-sheet or outer cover



So, the basic principle layers of diapers are the 4 different layers are used; top sheet or facing, acquisition and distribution layer, absorbent core and back-sheet or outer cover. Now.

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So, this is skin and here it is a diaper. The liquid is coming out, the first layer which is skin human body here it is skin, the first layer which is known as the top sheet material. Now the function of this top sheet is that, it should immediately transfer or transmit the liquid to the other layer, it should not absorb the liquid. The next layer is that ADL which is acquisition and distribution layer. This is the acquisition and distribution layer.

Here its function is to absorb the fluid and distribute the fluid in whole area. And the next layer, this next layer is absorbent core where it is made of super absorbent material, SAP, superabsorbent polymer mixed with the pulp the fiber pulp and this is the place where the liquid is retained it absorbs moisture absorb liquid at high quantity. Here the liquid is retained and outermost layer which is back-sheet or outer cover which is impervious layer.

Which does not allow the liquid to come out, so the liquid is retained in the third layer which is absorbent core.

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1st Layer- Top-sheet or Facing

- The layer next to the wearer's skin must be capable of allowing fluid to pass readily through to the next layer.
- It is important that fluid is not retained within the structure of this layer so that the amount of time that moisture is in contact with the skin is kept to the minimum.
- Softness of feel is a critical attribute for skin contact material.

Now coming to the functions of individual layers and the type of materials used in these layers, this is the layer as I mentioned, it is a next to the wearer skin and it must be capable to allow the fluid to pass through that without wetting. So, that the wearer should feel dry always it is important that the fluid is not retained within this structure and it should get immediately transmitted to the next layer.

And this layer should be always dry, as these are always in contact with the skin, so softness should be there, which is the critical attribute of this layer and the absorption capacity of the layer should be 0, but its transmission characteristics should be very fast. So, the liquid should get transmitted to the other layer without wetting this layer.

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2nd Layer- Acquisition and Distribution Layer (ADL)

- Fluid passes through the top-sheet into the Acquisition and Distribution Layer where it is temporarily stored whilst capillary action causes it to spread over a larger area.
- This facilitates maximum utilisation of the absorbent core structure. As most Superabsorbent Polymers (SAP) can take a few moments to fully absorb fluid, the
- ADL plays an important role in managing fluid during this critical stage.



The second layer is acquisition and distribution layer where fluid passes through the top sheet into this layer, where it is temporarily stored and distributed through capillary action. Why it is temporarily stored? Because in the next layer the storage of liquid should be there and it should be spread over larger area, the reason I have already explained, if the capillary action is not proper the spreading will not take place. In that case the proper utilization of next layer is not possible.

This facilitates maximum utilization of absorbent core structure as most superabsorbent polymers, SAP, can take few moments to fully absorb the fluid. So if it happens then that particular portion the SAP will get saturated keeping the SAP in other portion dry. So, that is not required that is not our target. So, the super absorbent polymer along the next zone that is the absorbent core area should get saturated evenly. So, in this layer, this layer plays an important role in maintaining the fluid during critical stage.

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3rd Layer- Absorbent Core

- This layer is appropriate blend of fiberized fluff pulp and superabsorbent polymer to absorb and retain urine.
- Total capacity can be engineered to a level appropriate for any individual product application.
- This is generally a pre-combined structure of multiple layers, containing both SAP and fluff pulp or other suitable capillary fibres.
- The absorbent core in modern absorbent hygiene products is made of cellulose-based absorbent material, of either rayon (viscose) or cotton, or a mixture of both.



The third layer which is absorbent core is a blend of fluff pulp, fiberized fluff pulp that is a fluff pulp, pulp is there fiberized fluff pulp is there and along with the mixture of the super absorbent polymer. So, this pulp and the superabsorbent polymer when they mix they help in retaining the urine, there is fluid, it absorbs and retain the fluid. So super absorbent polymer's a main characteristic is that it absorbs huge quantity and retain the fluid within that structure.

It does not allow the fluid to come out from the structure, it forms a gel like formation. The capacity can be engineered so we can change the capacity depending on the product requirement by changing the proportion. So, multiple layers of this SAP and pulp are used. The absorbent core in modern absorbent hygiene products is made of cellulose based absorbent material of either rayon viscose rayon or cotton.

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4th Layer- Back-sheet or outer cover

- The function of the back-sheet is to provide a fluid impervious barrier so that moisture is contained within the structure of the absorbent hygiene product.
- **Low gauge polyethylene** is commonly used.
- A breathable film or nonwoven layer is of benefit in maintaining good skin condition, particularly in baby diapers and pantliners.
- **Polyethylene can be made breathable at the film extrusion stage** by creating micro-pores in the substrate, and fibres in the nonwoven layer can be treated to be hydrophobic.
- These two processes allow air to pass through the film whilst maintaining an effective fluid barrier.

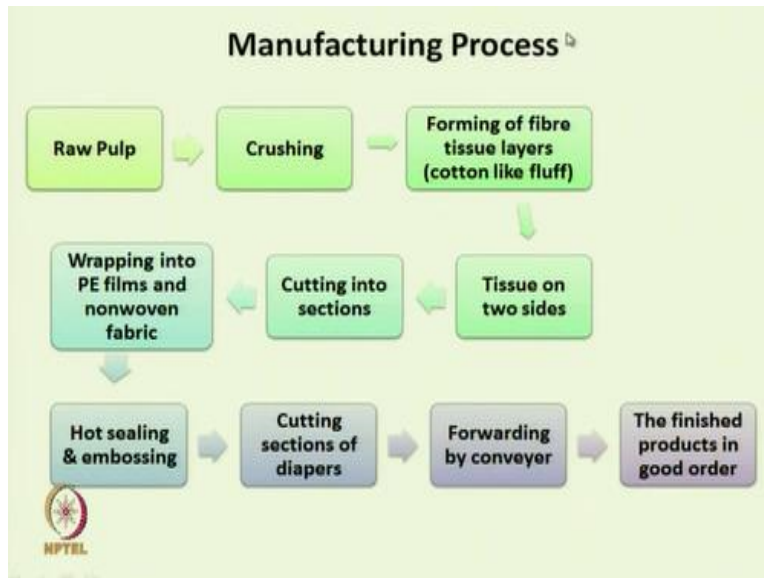


The final layer, fourth layer, which is known as back-sheet or outer cover the function of back sheet is to provide a fluid impervious barrier, so that moisture is contained within the structure of the absorbent hygiene core product so, it should not allow the moisture to come out. So, here the very low gauge polyethylene is commonly used, the low gauge requirement is due to the flexibility.

So we need flexible structure and here low gauge is enough because the liquid pressure is not that high as the super absorbent polymer absorbs the liquid and retain within the structure but it should be breathable film. So, breathable film or nonwoven layer is sometimes used to keep the skin dry. So it should not be impervious to the air, moisture or vapour. So polyethylene can be made breathable at the film extrusion stage.

So micropores are incorporated, so breathable polypropylene sheet can be used, so here air can pass through but at the same time it will act as fluid barrier.

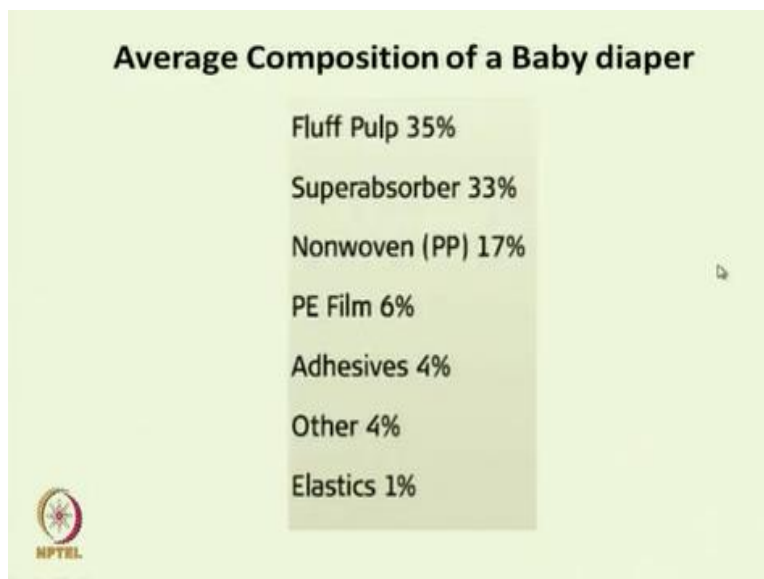
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If we see the manufacturing process here, it is a raw pulp; it is crushing, after crushing the forming of fiber tissue layer. So cotton like fluff is produced through the pulp. Then in two sides the tissues are there in the different layers are there, then cutting into section and then wrapped into the polyethylene film and nonwoven fabric and heat sealing and embossing is there, cutting in the form of diaper and then packing.

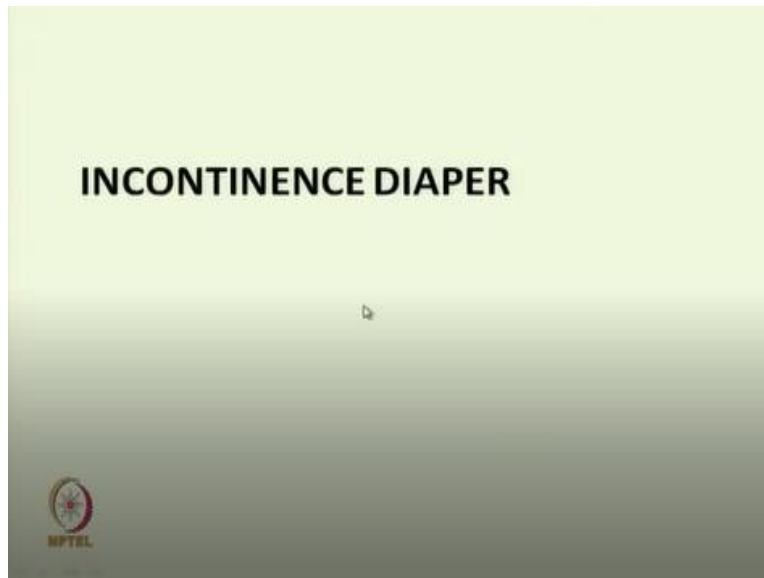
So the main process here is that we have to mix the super absorbent polymer with the pulp and then the layers of nonwoven fabric and the polyethylene films are added to that.

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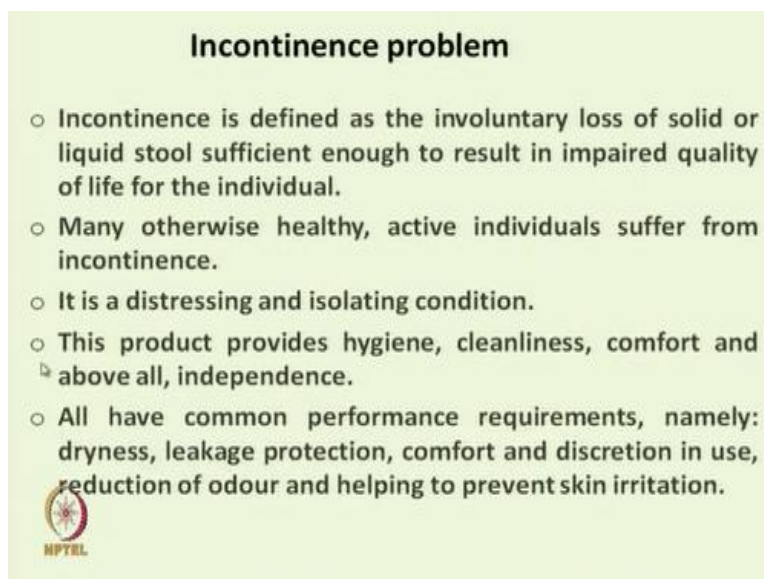
So, if you see the composition of baby diaper fluff pulps are 35%, super absorbers typically 33%, nonwoven polypropylene 17%. So this fluff pulp and superabsorber, these are actually for being the third layer the absorbing layer and nonwoven polypropylene it is 17%, polyethylene film it is outer layer, adhesives elastanes are used.

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Incontinence diapers, incontinence is defined as the involuntary loss of solid or liquid stool sufficient enough to result in impaired quality of life for an individual. So, that is the condition where textile material can help in improving the lifestyle.

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So it is a distressing and isolating condition, the hygiene products are available so, this all hygiene products have common performance requirement like the diapers, like the dryness, leakage protection, comfort and should prevent skin irritation.

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Incontinence Diaper

- The four principal functional layers of an absorbent hygiene product are important in all incontinence products.
- Other materials are necessary, depending on the type of product, to aid ease of use for the nurse and for the comfort of the user; examples
 - belts, waist elastic, leakage barriers, tape or hook
 - loop fastening and elastic pants.
- Adult incontinence products typically use the same materials as baby diapers but in different proportions.



So, the four principle functions the functional layers are used which are used in diaper. Here also these layers are used. In addition to these layers there are different material components used belts, waist elastic, leakage barriers, tape, or hooks these are used in addition to the different layers, which has been discussed, loop fastening and elastic pants. So, adult incontinence products typically used same material as baby diapers, but with different proportions. Depending on the requirement here;

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Average Composition of Incontinence Product	
Fluff Pulp 62%	For Baby diaper
Superabsorber 12%	Fluff Pulp 35%
PE Film 10%	Superabsorber 33%
Nonwoven (PP) 10%	Nonwoven (PP) 17%
Adhesives 3%	PE Film 6%
Other 3%	Adhesives 4%
Elastics 0.4%	Other 4%
	Elastics 1%

We can see the fluff pulp 62% and super absorber is used 12%. For baby diaper here, super absorbers are used at higher quantity and these are the different combinations.

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Feminine Care

- **Feminine care pads are designed to absorb and retain menstrual fluid and other fluids.**
- **In addition to the four principal functional layers of an absorbent hygiene product, pads and panty liners have-**
 - **a removable sheet made from siliconized paper which protects the glue underneath the bottom layer or a siliconized polyethylene, which works as a single-wrap protection.**

Next is the feminine hygiene product. These are feminine care pads are designed to absorb and retain menstrual fluid and other fluids. In addition to the four principles, which we have principal layers of any absorbent hygiene products, the pads and panty liners they have some additional requirements, which are removable sheet made of siliconized paper, so that the sheet will be removed which protect the glue underneath the bottom layer of the product.

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Average Composition of a Sanitary Pad

Pulp 48%

PE, PP, PET 36%

Adhesive 7%

Superabsorber 6%

Release Paper 3%



So average composition of sanitary pads are pulp 48%, polyethylene, polypropylene, polyester 36%, adhesive 7% these are the rough estimation of different compositions.

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Tampons

- Modern tampons are mainly composed of cellulose based absorbent material such as rayon or cotton or a mixture of both.
- In most instances, the absorbent core is covered by a thin, smooth layer of nonwoven or other suitable material, making the tampon easy to insert and remove.
- The withdrawal cord used to remove the tampon can be made of cotton or polypropylene.
- The tampon is individually wrapped with a paper wrapper or a thin film before being packed into cartons.

HPTEL

Ref: Sustainability report absorbent hygiene products (2007-2008)-EDANA


Tampons are also used so modern tampons are mainly composed of cellulose based absorbent material such as nylon, rayon or cotton and mixture of both they are used in tampons. In most instances, the absorbent core is covered by thin smooth layer of nonwoven fabric or other suitable material, making the tampon easy to insert and remove. Withdrawal cord is used.

Tampon is individually wrapped with a paper wrapper, so these are for packaging but here this is one of the applications of textile material in hygiene products.

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Wet Wipes

- Wipes can be a paper, tissue or nonwoven; they are subjected to light rubbing or friction, in order to remove dirt or liquid from the surface.
- Consumers want wipes to absorb, retain or release dust or liquid on demand.
- One of the main benefits that wipes provide is convenience – using a wipe is quicker and easier than the alternative of dispensing a liquid and using another cloth/paper towel to clean or remove the liquid.



<http://www.edana.org/discover-nonwovens/products-applications/personal-care-wipes>

The wipes is another area, so in wet wipes we use the paper, tissue or nonwovens. Nonwovens are nowadays widely used in wipes. So, they are subjected to light rubbing or friction in order to remove the dirt liquid from the skin surface or any other surface. So, the consumers want wipes to absorb retain and release dust or liquid.

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Classification of Wipes

- Based on application they can be classified into following three categories:
 - Personal Care wipes
 - Household & home cleaning wipes
 - Industrial cleaning wipes
- Technology used for manufacturing of wipes:
 - Airlaid
 - Spunlace
 - Wetlaid




<http://www.edana.org/discover-nonwovens/products-applications/personal-care-wipes>

So, wipes are classified into different categories. These wipes, in all these classes our requirements basic requirements are same, it should remove and clean the surface. So, the categories are; personal care wipes, household and home cleaning wipes and industrial cleaning wipes and they are manufactured by airlaid, spunlace and wetlaid system.

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Cleansing Wipes

- **Baby wipes:** These are wet wipes used to cleanse the sensitive skin of infants.
 - These are saturated with solutions anywhere from gentle cleansing ingredients to alcohol-based “cleaners.”
 - Baby wipes are typically sold in plastic tubs that keep the cloths moist and allow for easy dispensing.




Ref: http://www.nonwovens-industry.com/issues/2012-01/view_features/wipes-what-where-why-how/

In personal care wipes one is cleansing wipes. Baby wipes: these are wet wipes used to cleanse the sensitive skin of infants. They are actually saturated with some fluid. So, alcohol based, alcohol based fluid to clean the surface skin.

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Cleansing Pads

- Cleansing pads are fiber sponges that have been previously soaked with water, alcohol and other active ingredients for a specific intended use.
- There are different types of cleansing pads offered by the beauty industry.
- Cleansing pads for preventing infection are usually saturated with alcohol and bundled in sterile package.
- Hands and instruments may be disinfected with these pads while treating wounds.
- Disinfecting cleansing pads are often included in first aid kits for this purpose.



Ref: http://www.nonwovens-industry.com/issues/2012-01/view_features/wipes-what-where-why-how/

Cleansing pads is another example of wipe. These are fiber sponges that have been previously soaked with water, alcohol and other additives. So, pre soaked, the cleansing pads are available. There are different types of cleansing pads.

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Pain Relief

- These are pain relief pads sopping with alcohol and other medicines.
- These pads are good for treating minor scrapes, burns, and insect bites.
- They disinfect the injury and also ease pain and itching.



Ref: http://www.nonwovens-industry.com/issues/2012-01/view_features/wipes-what-where-why-how/

So, pain relief wipes are also there. These are pain relief pads sopped with alcohol and other medicines. So, these are available, this pads are good for treating minor scraps, burns and insect bites, we can immediately put the skin relief pads. They disinfect the injury and also ease the pain and itching.

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Personal hygiene

- These are usually pre-moistened.
- These kinds of wipes can be useful when someone is doing outdoor activities, especially during warmer weather.
- The wipes can remove dirt and sweat before they settle into skin pores.
- Some no-rinse wipes can even remove waterproof makeup.



Ref: http://www.nonwovens-industry.com/issues/2012-01/view_features/wipes-what-where-why-how/


In personal hygiene products, they are basically pre moisturized. These kinds of wipes can be useful when someone doing outdoor job when they are sweating. So, we can use the personal hygiene pre-moisturized pads. The wipes can remove dirt and sweat before the settle into the skin. Sometimes, no-rinse wipes are used to remove waterproof makeup. So we do not need any rinsing. So that special wipes are also used.

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Pet Care

- Today one can find even wet wipes for pet care, for example eye, ear, or dental cleansing pads (with boric acid, potassium chloride, zinc sulfate, sodium borate) for dogs, cats, horses, and birds


Ref: http://www.nonwovens-industry.com/issues/2012-01/view_features/wipes-what-where-why-how/

So pet care wipes are also available to clean the eyes, ear, and dental. So, dental cleaning pads are also there, they are soaked with different chemicals.

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Home care wipes

- Kitchen wipes
- Bathroom wipes
- Food service wipes
- Glass surface cleaning wipes
- Automotive care wipes



Household and home cleaning wipes are also there. So, kitchen wipes, bathroom wipes, food-service wipes, glass surface cleaning wipes, automotive care wipes. So, these are different types of wipes, but their structures should be different depending on the type of the fluid absorption capacity required and depending on the type of dust and dirt present.

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Industrial Wipes

- **Degreasing / Machinery cleaning wipes**
- **When it comes to industrial applications, choosing the right wipe for the job can make an enormous difference in terms of performance, efficiency and economy.**
- **Rags and laundered cloths were once the all-purpose solution for wiping dirt and oils from equipment and hands.**
- **Convenient disposable wipes are now widely recognized as the preferred alternative**



Ref: http://www.nonwovens-industry.com/Issues/2012-01/view_features/wipes-what-where-why-how/

So industrial wipe there are different types of industrial wipes, in earlier days, we used to use the old clothes. Their main functions are degreasing and machinery cleaning. So, when it comes to industrial application, choosing the right wipes for right job is important. So, the rags laundered cloths were once used for all purpose wipes for industrial application but nowadays it is specialty industrial wipes are available for cleaning, particular application.

So these are different types of wipes. So, we have discussed in short the hygiene products where the textiles can be used. Thank you.