Chemical technology
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Module - 3
Pulp and Paper
Lecture - 2
Pulping and Bleaching

The module 3 of the lecture 1 we discuss about the introduction to pulp and paper industry about raw material requirement and other development, technological development, which has taken place in case of the pulp and paper mills. Now, we will be discussing depend detail about the pulping process, pulping and bleaching and the actually the flow diagram of the, what are the various type of the digester we are using in case of the pulping.

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So, the coverage of the course will be introduction, pulping process, kraft, soda, sulphite process, mechanical pulping, bleaching commonly used terms in the pulping, kraft pulping process, development in pulping and bleaching, pulping of the rice straw, wheat straw, grasses, problems in utilization of the agriculture residues, these are the some of the and bagasse pulping.

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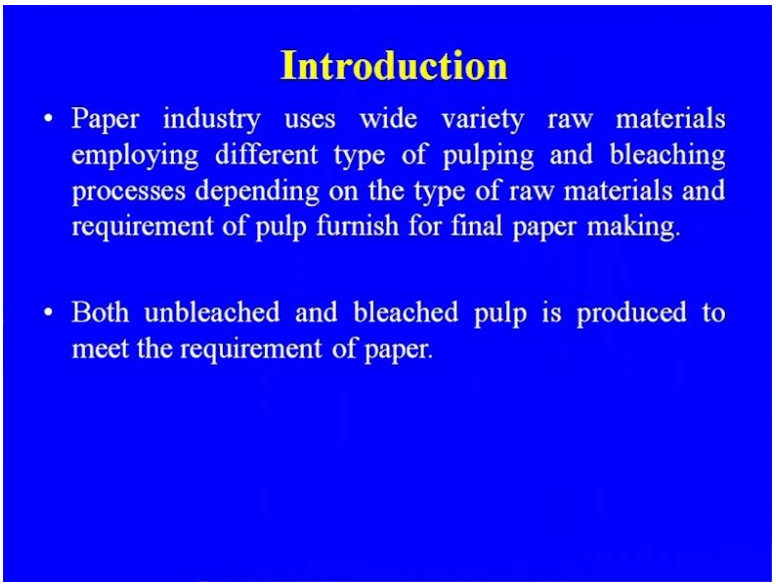

So, already we have discussed about the importance of the paper industry, but at the same time as know that is use of the huge amount of the raw material employing different type of the pulping and bleaching processes depending up on the type of the raw material and the requirement of the pulp furnish for final paper making at the same time ability of the raw material. Both unbleached and bleached pulp is produced to meet the requirement of the paper, because we are also making the unbleached paper which are using the fire boat and the other material, packaging material, the carry bags and also those things that we need the wallpaper, brown paper which is called the all are the unbleached paper that we are using.

So, requirement of bleaching chemicals are also varying depending on the quality of the paper and brightness requirements and environment considerations for cleaner and greener paper. Pulping and bleaching play important role in providing strength to the paper depending on fiber length, cellulose content because as I told you the in case of the hardwood short fiber length is there, in case of the softwood the fiber length is high, in case of the bamboo it is in between the hardwood and softwood.

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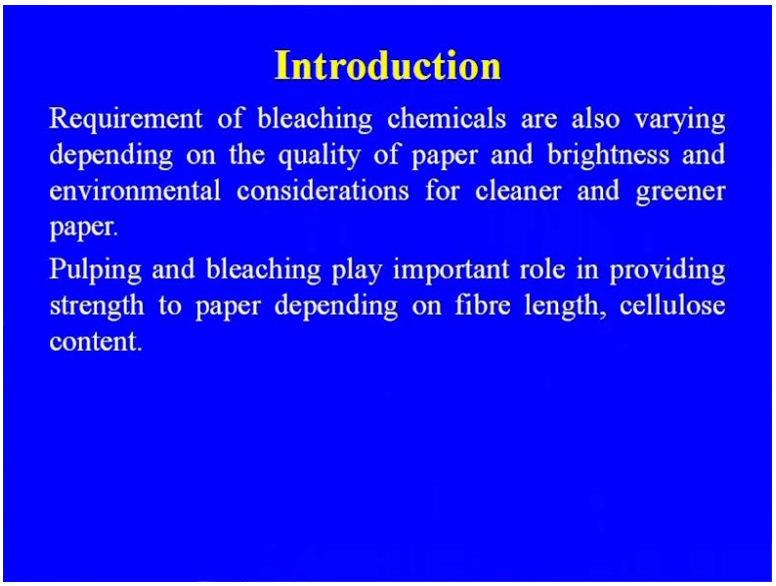

So, the quality of the raw material that play very important at the same time requirement of the pulping and bleaching chemicals that will also depend up on the type of the pulping process that has to be used, where the middle pulping that is required or the savior pulping that will be required. So, depending up on the quality of the paper requirement just like in case of the mechanical slide some addition of the chemical sodium hydroxide that may be there.

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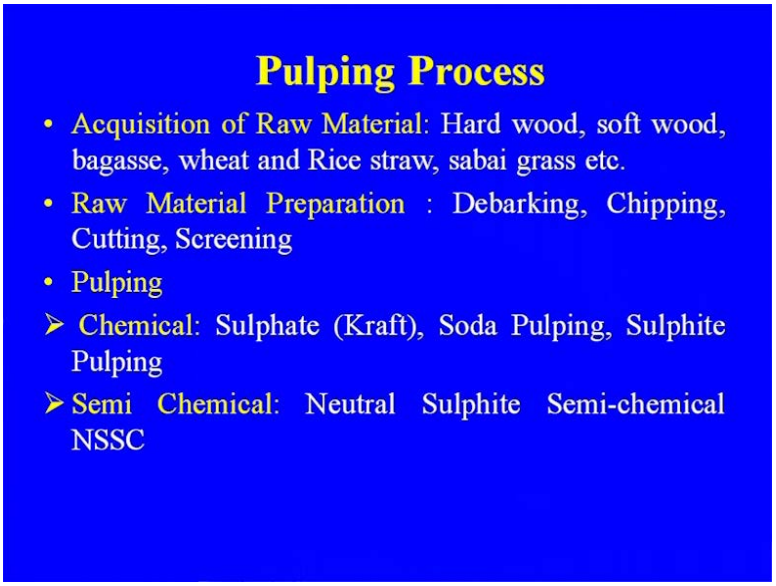

In case of agro based only we are using the sodium hydroxide, in case of sulfite pulping we are using the sulfite sodium sulfite and enriches is the cooking (( )). So, these are the pulping process already we discuss about the what are pulping process, what are the various stages involved. I will go very quickly about the acquisition of raw material, raw material reparation, pulping. These are the some of the process that we are using in case of the pulping and bleaching.

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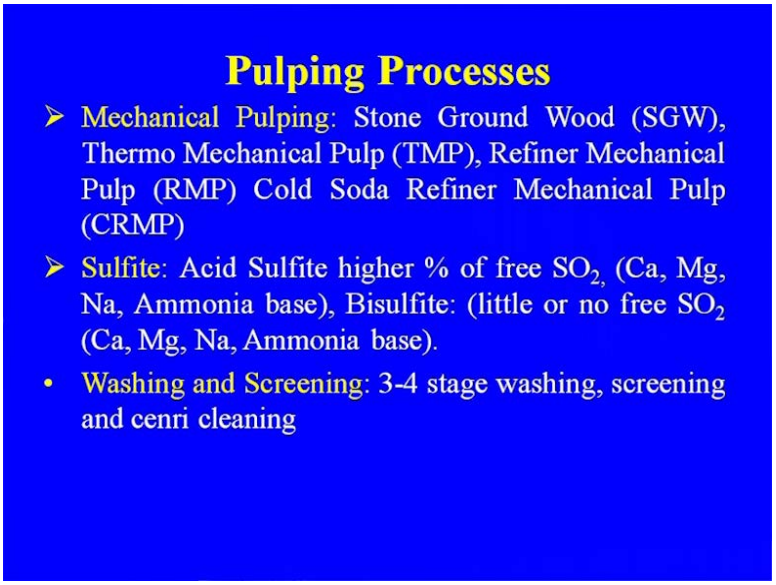

Now, come to the pulping process other than the, what we are having the mech, because some of the mechanical pulping especially in case of the different type of the mechanical pulping that we are using; sulfite pulping, washing and screening. These are the stage already I has discussed, so I will not go in detail in bleaching, advance bleaching, sequences it has been corporating in bleaching sequences just to have the higher resistant of the paper and to reduce the congestion of the chlorine or just to have the chlorine free paper.

Oxygen delignification already we have discussed because now we are oxygen the oxygen delignification along with the pulping. So, oxygen delignification offers many advantages over the conventional delignification processes and there is a steady growth in the worldwide in the production of oxygen delignified pulp. So, there kappa number other thing that is the improvement is there and so the process are now capable of

producing pulp with kappa number 30 to 50 percent lower than the conventional kraft cooking method. So, these is the advantage in case of the oxygen delignification.

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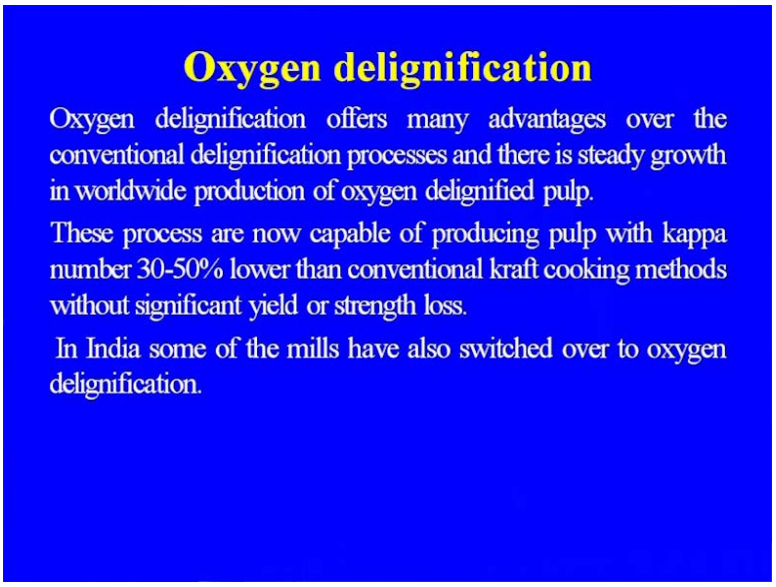

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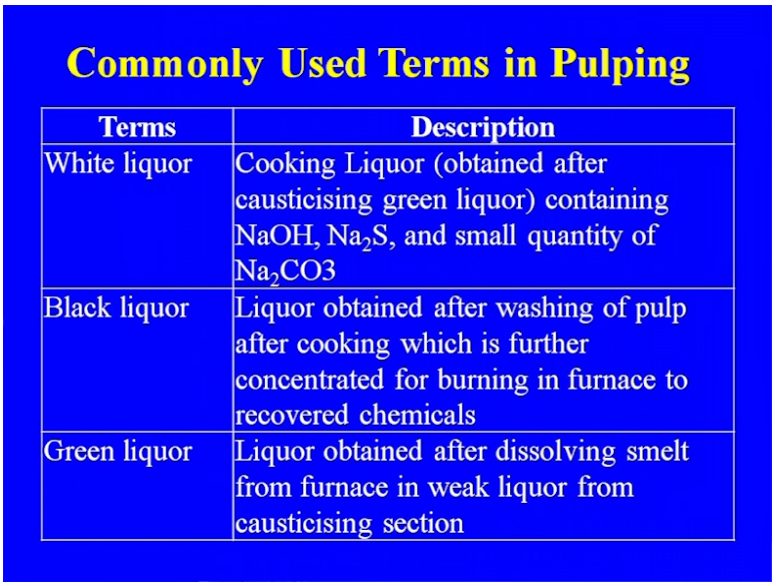

These are the some of the terms that we are using in case of the pulping, white liquor, cooking liquor, which is used for the cooking of the other raw material. The cooking liquor, white liquor why you called because green liquor we reproducing from the recovery furnace that is causticised and the liquor which we are getting after the causticising green liquor that we called it the white liquor.

So, white liquor is nothing but it is NaOH, Na 2 S, Na 2 CO 3 which is the actually the cooking liquor, which you are using in case of the digester. So, black liquor black liquor obtain after washing of the pulp, green liquor obtain after dissolving this smelt form the furnace, in weak liquor from causticising sections. These are the some of the other terms that we are using for the because of how to judge the whether the (( )) properly cooked cooked or not or what type of the pulp we are making.

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Commonly Used Terms in Pulping

Terms	Description
K.No.(Permangnate numer)	No. of 0.1 N $KMnO_4$ consumed by 1 gm of moisture free pulp.
Dilution factor (D.F.)	DF = W –E W= Water added per ton of mass E=Water going in pulp per ton of pulp
Bath Ratio	Wood to liquor ratio

So, Kappa number or the permanganate number these are the two numbers we are using in case of the permanganate number, number of the 0.1 N KMnO4 consumed by 1 gram of the moisture free pulp. And even by seeing the appearance of the pulp 1 if the people like feel they can judge what is actually the Kappa number or the K number of the pulp. Dilution factor that term using in case of the washing of the pulp, because that is very important.

We need the higher concentration of the black liquor and so for that the less water requirement that should be there part term of the paper. Bath ratio, wood to liquor ratio or the bamboo to liquor ratio already stock that term we are using in case of the digester. Consistency means that is very common term we are using in case of the paper industry the that b pulp or the total pulp weight, weight of the pulp in 100 gram of the water.

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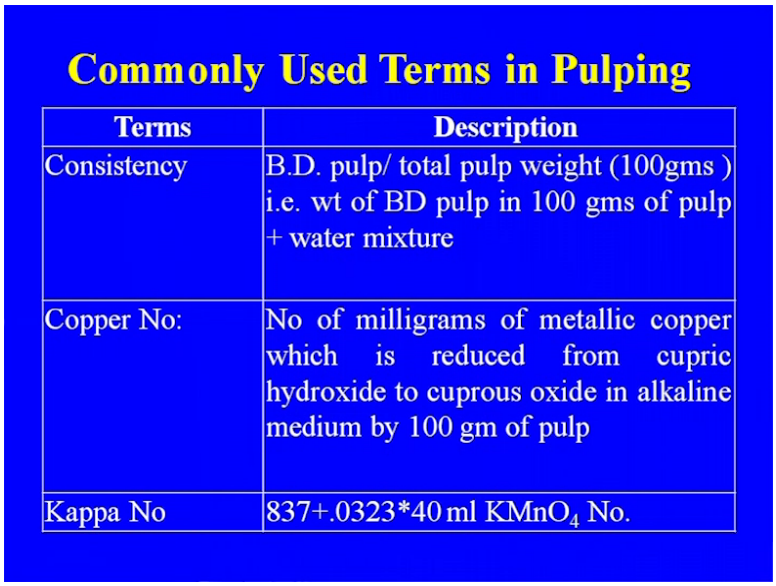

So, normally as I told you earlier we are using pulp of the various consistency 1 to 10 percent depending upon the type of the process, but in many cases in the pulp and paper we are having the very lower consistency around 1 percent in the centric cleaning and the paper making. So, that is very important and the Kappa number another that is the actually the measurement for the degradation which is taking place especially in case of the hypo chloride. Kappa number is just like your permanganate number.

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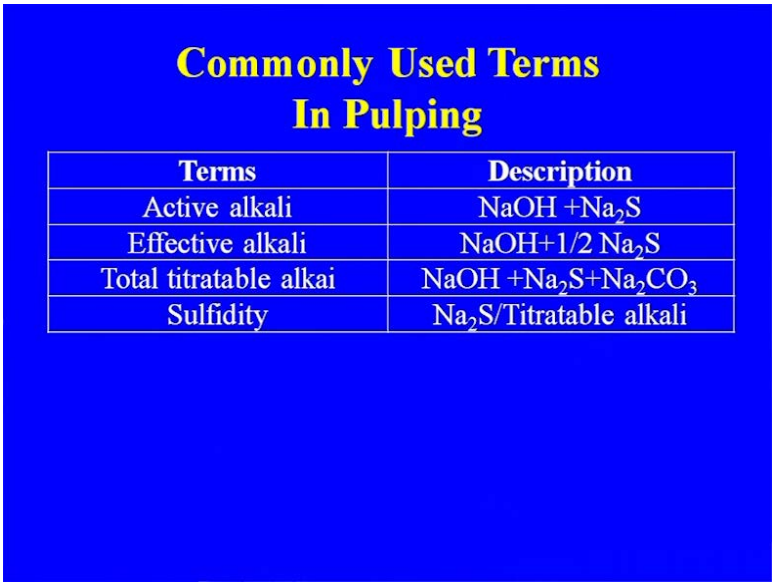

These are the some of the another term that we are using in case of the pulping liquor that is active alkali, effective alkali, total titratable alkali and the sulfidity because normally we had the in case of the kraft pulping this term is very common and sulfidity around 15 to 16 percent. If you are going for the higher sulfidity more emission of the sulphur compounds will be there, but at the same time quality of the paper.

Now, we will have to optimize whether we should go for the higher sulfidity or because now the people are talking about the sulphur free paper also. It was the chlorine next time it may this sulphur free so that the emission of the because during the recovery or, the even during the purpose lot of the marchapten other the odours, sulphur compounds are generated.

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Commonly Used Terms in Pulping

Terms	Description
Causticity	$NaOH/ NaOH + Na_2S$
Causticising Efficiency	$NaOH/ NaOH + Na_2S)] \times 100$
Reduction	$Na_2S/(Na_2SO_4 + Na_2S)$
Over all recovery	Recovery ± black liquor stock/ froth liquor consumed

These are the term that is being used in the recovery so we will be discussing while discussing about the recovery of the chemicals. Kraft pulping involves first stage is the chipping, second is the puling, washing, screening, and then the finally bleaching of the pulp.

Pulping involves the separation of a fiber for the chemical or the mechanical pulping. So that may be the fiber in case of the, because we are doing in case of the mechanical pulping there we do not use the in earlier because now we are using the steam or the pre-steaming of the chip sometimes we are also adding some alkali, but the what is the actually separation of the fiber from the chip that is taking place.

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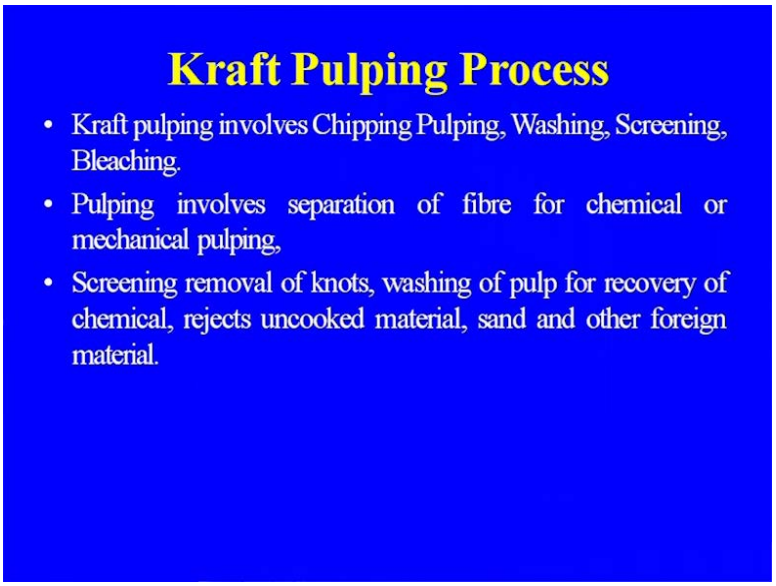

Screening part of the removal of knots, washing of the pulp for recover of the chemicals reject uncooked material and other foreign materials sometimes if it is there so that will be actually come in the paper especially in case of the bleach paper. For the inferior quality of the paper that may not get so problem, but in case of the bleach paper at least if fines are there that is visible even by seeing the paper you can judge the quality is not good.

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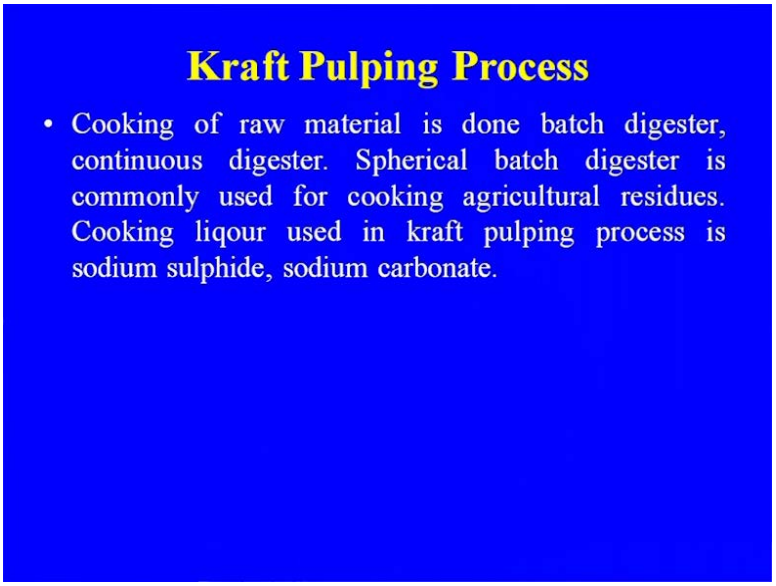

The cooking of the raw material is done in the batch digester, continuous digester, spherical batch digester that is for the agro based raw material. Cooking liquor used in the kraft pulping as I told you sodium sulphide, sodium hydroxide, sodium carbonate that is the mixture that we are using for the cooking purpose, but sodium carbonate that is antri present in the green liquor and the cuasticise liquor and so, but it is not participating so it is not part of the active alkali. Chipping that is very important because if you are having the proper size of the chip then the pulping will be better and the quality of the pulp produce that will be better. So, this chipping is very important role in case of the quality overall quality of the, deficiency of the debarking process that also very important case of the getting the good chips, bars if the present in the in the chips.

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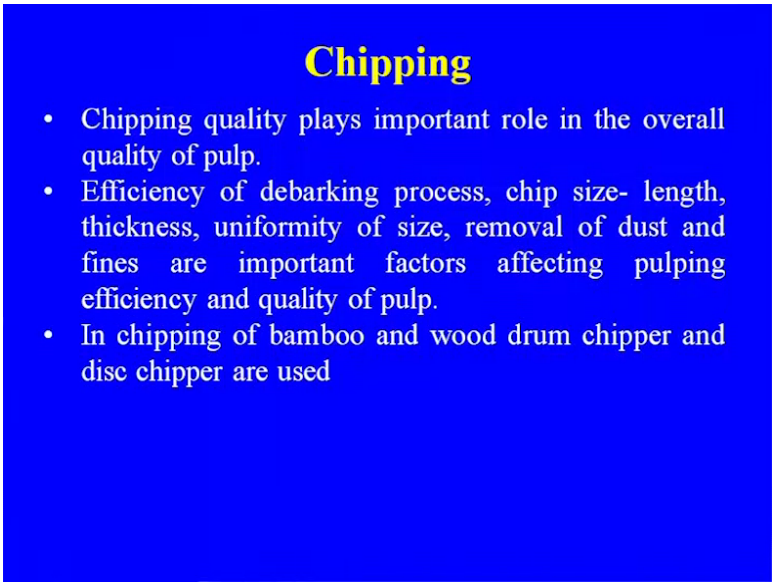

So, that will have the problem in case of these especially the bleach problem. So, the chip size, thickness, uniformity of the size, removal of the dust, fines that is the reason why the sometimes the in case of the wood and bamboo we are doing the also washing of the raw material. It is important for because these are all will go along with the pulp and the will have to go for this screening, cleaning. So, that will play very in chipping of bamboo and wood drum chipper now the new generation of the wood drum high capacity drum chipper and the disk chipper that we are using.

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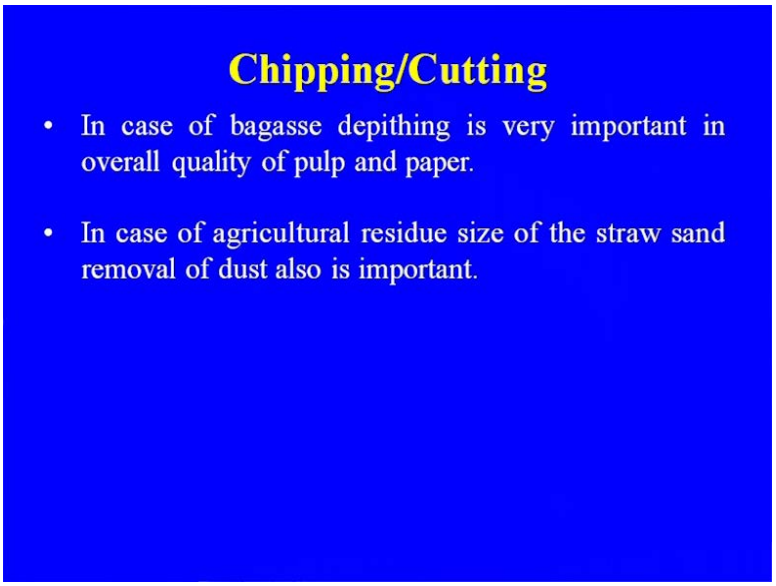

In case of the bagasse depithing, because removal of depith that is not actually adding to the any property or that is not suitable for paper making and so the we are removing why the dye or the depithing. In agriculture residues size of the straw, sand removal of the dust also very important especially the dust particles because during the cutting of the straws lot of the dust is generated. So, that has to be so we are using the having the cyclones where the dust particles they are separated after the final cleaning that is going to the chip is going to the digester.

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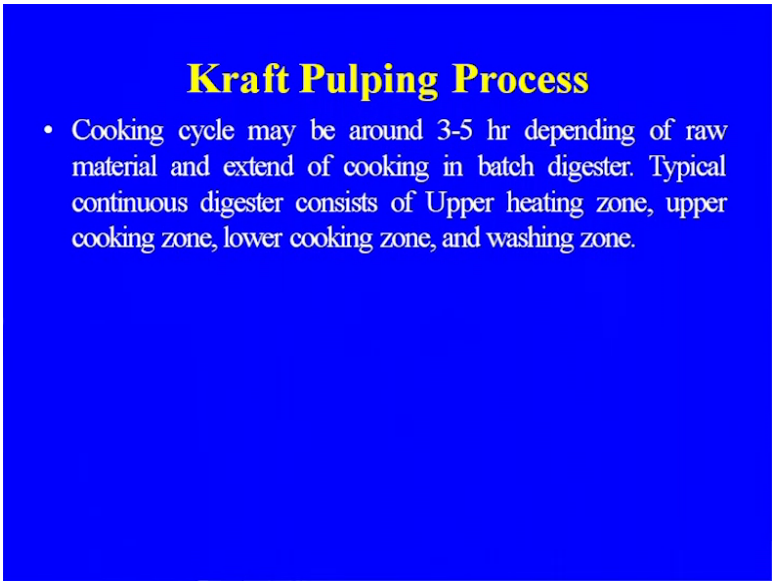

The again the cooking cycle that let us discuss slightly more in detail about the kraft pulping process, cooking cycle may be around 3 to 5 hour depending upon the raw material and extend of cooking in the batch digester because some times in case of especially if the hard wood. As I told you earlier also the requirement of the chemical, type of the fiber, type of fiber length and the quality of the because the way all the constituent that is changing in the case of the bamboo, hard wood and the soft wood and so when you are cooking at the mixed spaces so the requirement that time.

So, that is why in case of the especially the hard wood sometimes we are preparing two stage cooking means rise the pressure, keep for some time and then again rise the pressure. Typical continuous also we are having the in continuous digester. For pulping it may be as I told you the, I will show the diagram of the batch and continuous digester. It may be in case of the because all this step of the cooking that is taking place in case of the up to the washing that is taking place in digester, so operating zone, upper cooking zone, lower cooking zone and the washing zone.

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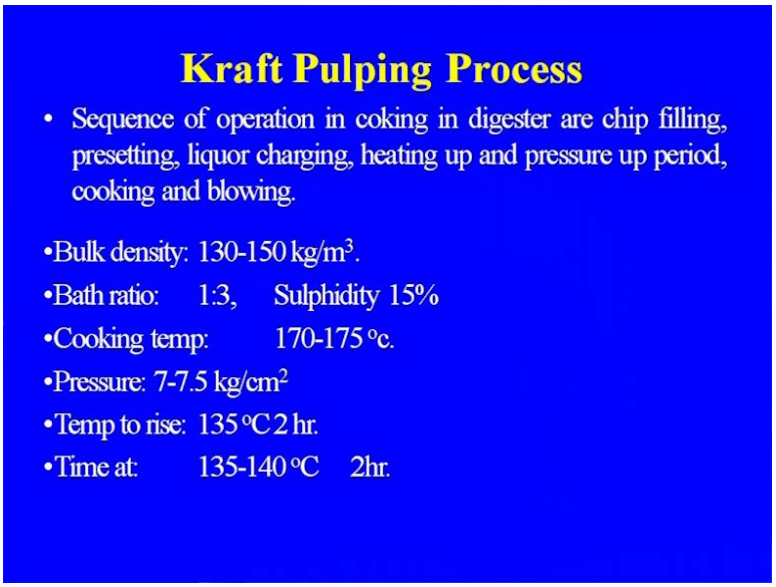

Sequence of the operation in the digesters are chip filling the then the liquor charging, heating up and the pressure up period, cooking and blowing. Finally, the after the cooking the pulp is blown to the blow blow tank and from where it is being process it is going to the (( )) it is going to the washer like that. So, these are the some of the actually the operating condition, we are using in case of the some of the for a strong material bath

ratio because you see the bath ratio here it is less in case of the agriculture residue that is high, cooking temperature high in case of the your normally the wood 170 and even the cooking pressure that is to 7 to 7.5, but in case of the agro based raw material that is less than. The temperature because as I told you in some of the cases, they are having the two stage temperature to rise 135 temperature at 135 to 140.

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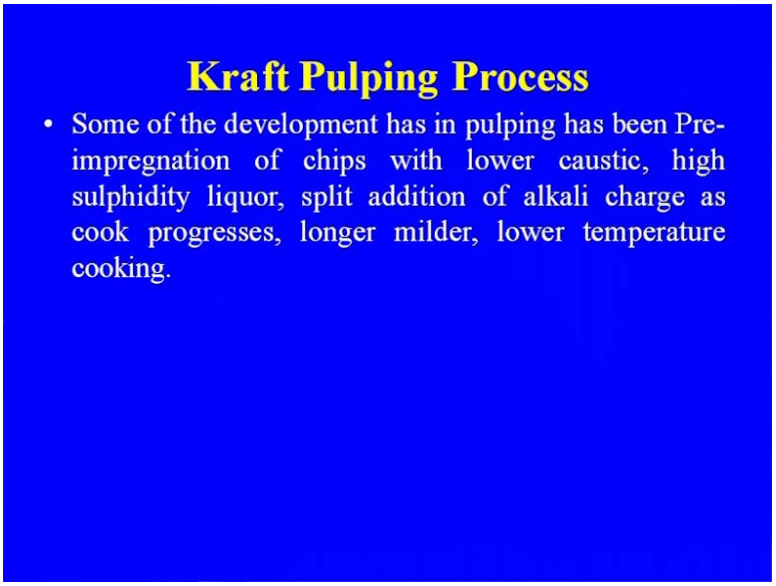

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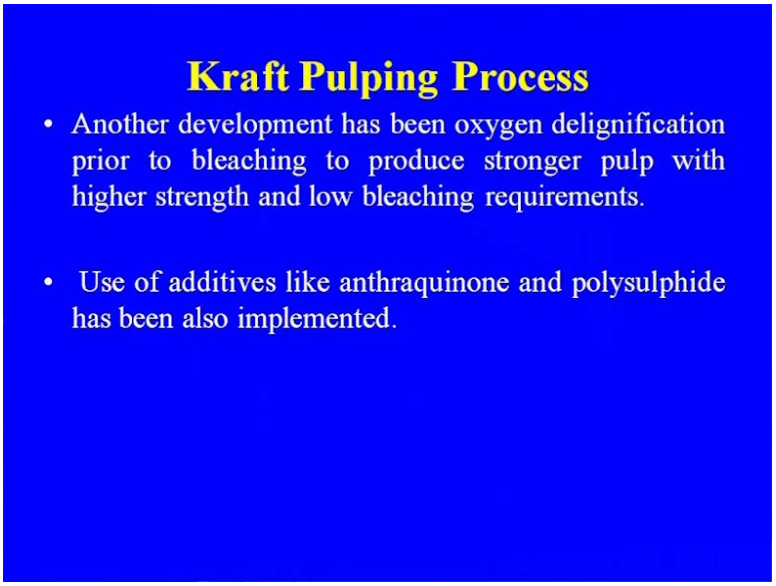

Some of the development which has taking place in case of the kraft pulping has been preimpregnation of the chips with the lower caustic means lower caustic or high

sulphidity liquor, split addition of alkali charge as cook progresses, long milder, lower temperature during the cooking. Another development that has been the delignification using the oxygen and so already I have discussed this. And use of the additives like anthraquinone and polysulphide has been also implemented and the improvement in the pulping that has been observed.

These are the some of the problems we are facing in case of the utilization of the hard wood that is the debarking, chipping problem, higher rejects problem in washing due to more fines and foam, because as I told you the fiber length is less in case of the hard wood in comparison to bamboo and the soft wood. And so more fines are generated and these fines resulting the lower resistance of the paper also and at the same time they are present in the during the cleaning, the waste water which we are getting. Bleaching of the mixed hardwood again the varying bleach requirement, shade variation some of the thing problem in evaporator, higher percentage of hardwood affects runnability of the machine also.

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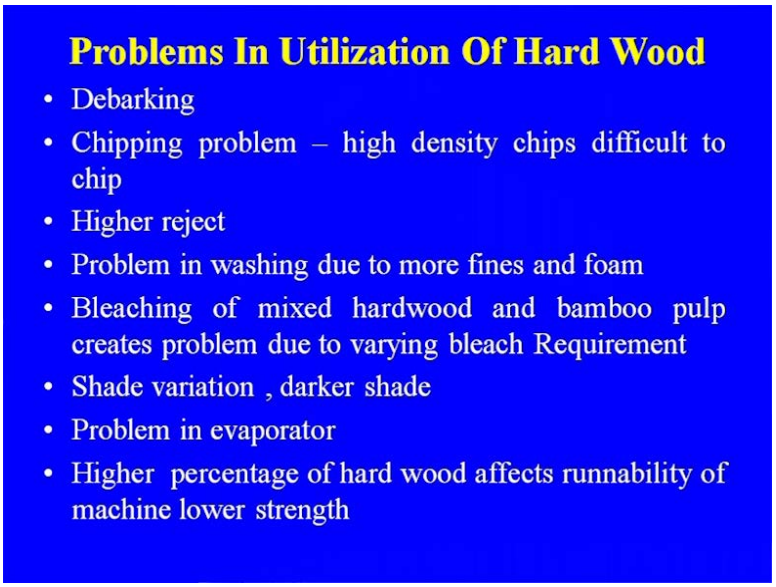

So, 100 percent hardwood we are not operating except eucalyptus because eucalyptus is having the better quality and other hard wood especially. These are the some of the development in the pulping already we have been discussed about the bleaching of the pulp that is normally the conventional method of bleaching that was CEHH, CEH, CEHD. Now, we are taking about the oxygen also in between the pre bleaching, pre

delignification oxygen that is also added or od not the c, because the c is chlorine, oxygen chlorine dioxide and the now all those thing extraction all those thing because extraction that is integral part with the caustic the all the lignin compounds, they are removed during the extraction stage.

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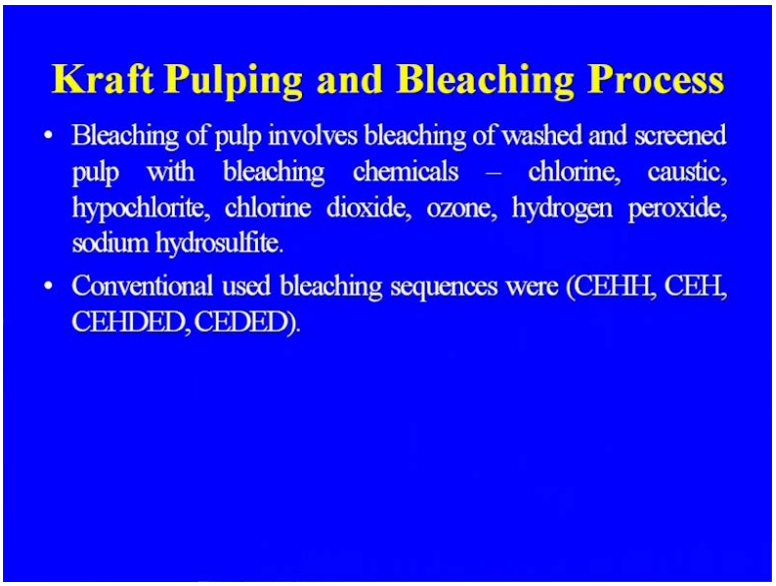

And so that is why the extraction stage is highly colored. Now, the bleaching these are the some of the development already we have discussed about the major development in the bleaching because now we are talking about the chlorine free bleaching or the totally chlorine free bleaching. Driving driving force in the pulping and the bleaching technology has been to produce pulp and paper with the lower possible lignin content while preserving in the yield and strength at the same time because during the chemical pulping especially and the bleaching lot of the detoriation in the strength of the pulp is also there. How to retain, how to preserve the yield, because high yield is always desireable, you cannot because whatever you are losing that we are losing in the raw materials.

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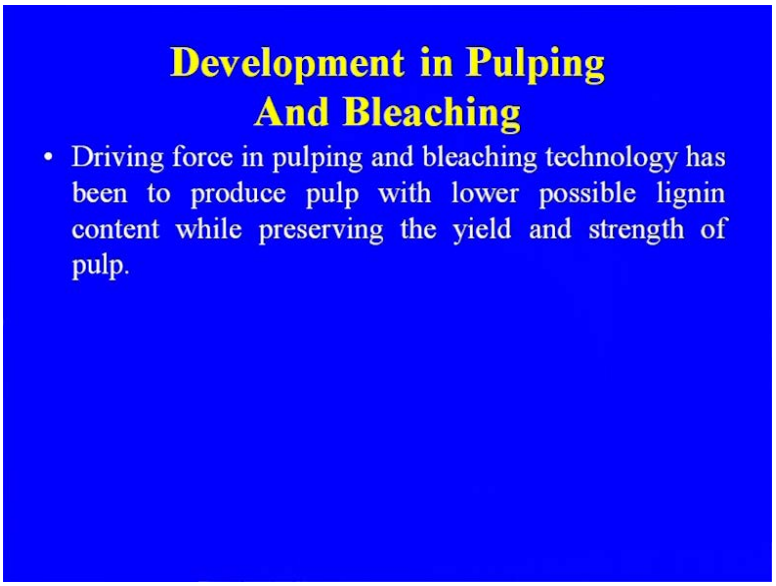

So, yield it is around for 50 percent is okay, but if you going getting became some of the mills because of the poor pulping and bleaching condition are even in case of the chlorine loss of the pulp yield is higher.

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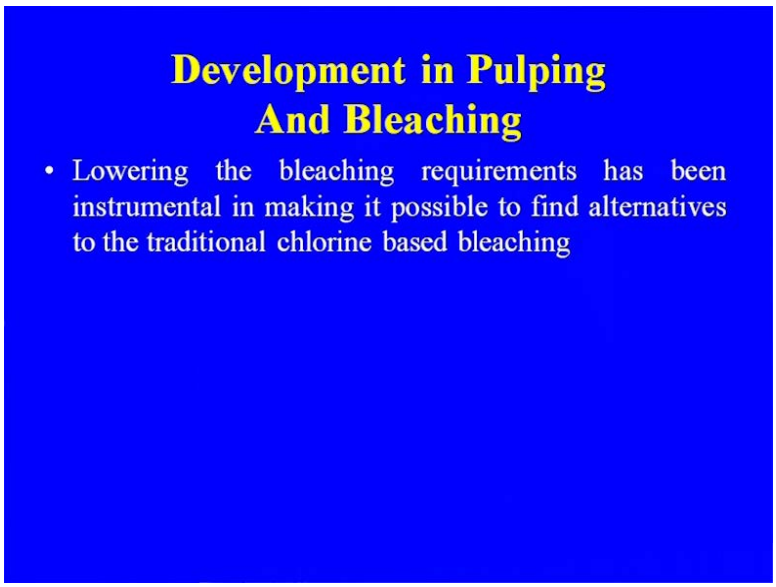

Lowering the bleaching requirements has been instrumental in making it possible to find alternatives to the traditional chlorine based bleaching and that is why the all the chlorine free or the chlorine dioxide oxygen come to the existence. This is the process, the kraft pulping process, bamboo, wood other raw material that is going to barker, baker to the

chipper house. Before that one stage some of the mills they are having the washing of the raw material before it is going to the chipper.

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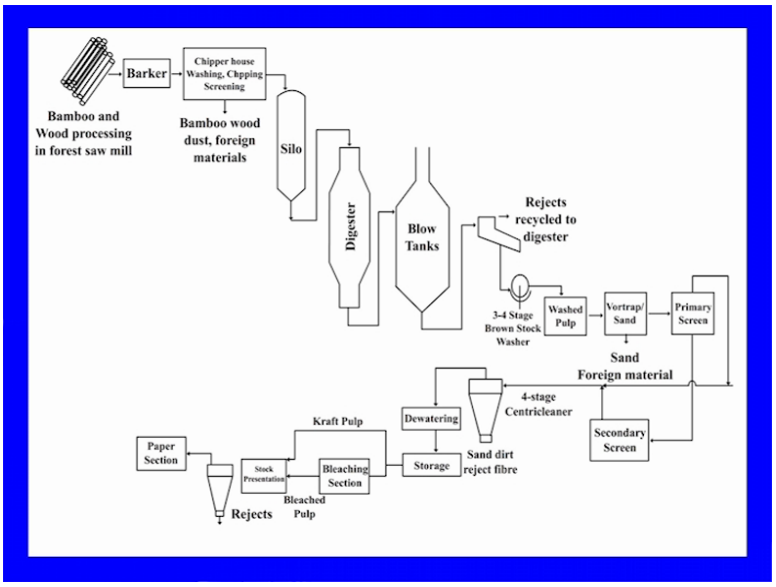

After the chipping it is going to the silo, from the silo is it is going to digester where the cooking of the chip that is taking place maintaining proper bath ratio and the temperature. Continuous degassing is also done here after the depending upon raw material because soft wood or the bamboo they required less cooking time, in case of the hard wood that required longer cooking time. So, depending up on that, we are maintaining the temperature 170 to 175 degree centigrade faces 7 to 8 k g around 7.8 k g. And after that your cooking is completed is blown in the digester and after the blowing it going for the removal of the your rejects, fine knots and then it going to the 3-4 stage washing.

And after the wash pulp that we are getting after the wash pulp going to this screening section both have or the centric cleaner all those thing we are using there for removal of the fine dirts; that is that may be there even after, because here after chipping it is going to cyclone also. But some of the silica that may be still there and so that has to removed before it is going to the paper making.

So, after the 4 stage centric cleaner, so you see that the washing or a dilution is there during the bleaching dilution is there. So, four stage centric cleaning that we are having centric cleaning is nothing, but the smaller diameter cyclone where we are removing the

sand at the in the bottom and the accepted pulp with the silica free that is going to the for further processing it may be kraft pulp for the bleaching. So, dewatering, storage then the bleaching after bleaching it is going to stock preparation. And after stock preparation again there also, we are having the centric cleaner just to remove the silica and another martial that may be there and then finally it is going to paper section.

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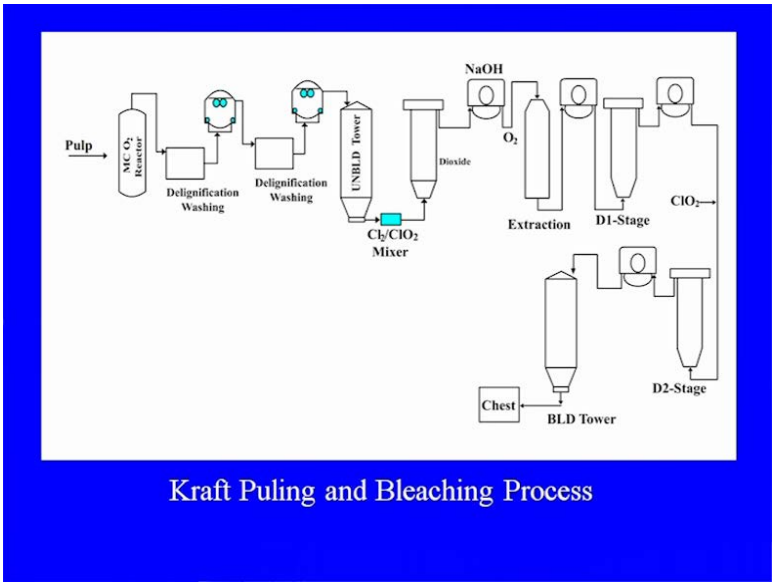

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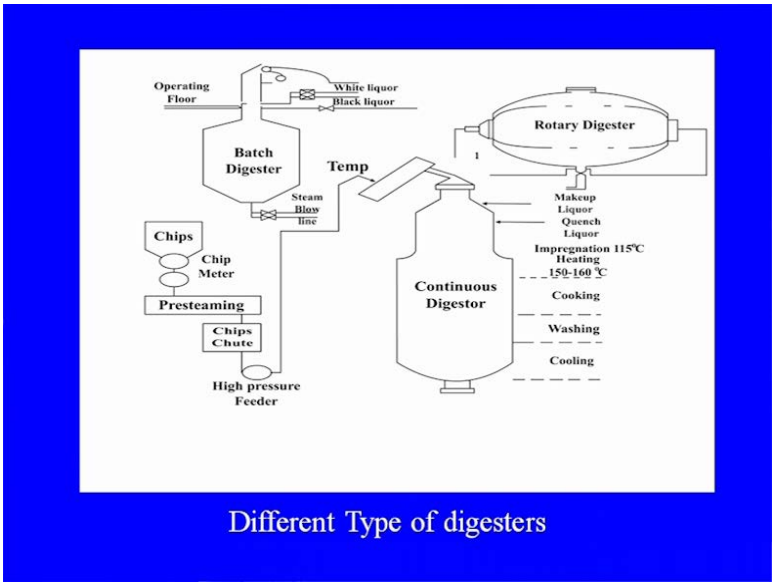

This is the actually the bleaching sequence in the kraft pulping that is, this the pulping. So, kraft pulping and bleaching that is been added the chlorine dioxide bleaching that is

there, here actually the consistency in the bleaching towers also that is in case of the chlorine earlier use to be 3 percent consistency. In cast in the hypo chloride stage that is around 8 to 10 percent. So, consistency is also because initial stage pulp, which you are getting after bleaching that is going for the washing. So, we have here we are having the washers also, so the initial stage of the now bleaching we are having the washers.

These are this some of the different type of the digesters that we are using in the so as I told you we are having the batch digester, we are having the continuous digester where the continuous cooking, washing and the final digester of the pulp is there. Rotary digester this is the spherical shape that we are using a even some of the continuous pulping for the agriculture is due to the pandya digester, continuous digester. In some of the mills they are also using in the bagasse as a raw material. So, they are using the so some of the mills which are using bagasse, they have also come for the continuous, but this the batch digester.

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This is about the pulping of this straw requires mild cooking because these are the in case of the agro more silica is there and more soft is there. So, if you compare the cooking time that is less in case of the agro base raw material.

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This is the various stages; we are cutting, cooking and the blowing, washing, bleaching, recovery of the chemical. Earlier it was not there, but in case of the bagasse base, they having the recovery, but agro based now that has mandatory and people have gone for the now the recovery of the chemicals in the agro base or some of the mills, what they have done they have shifted from the agro base to the waste paper base mill.

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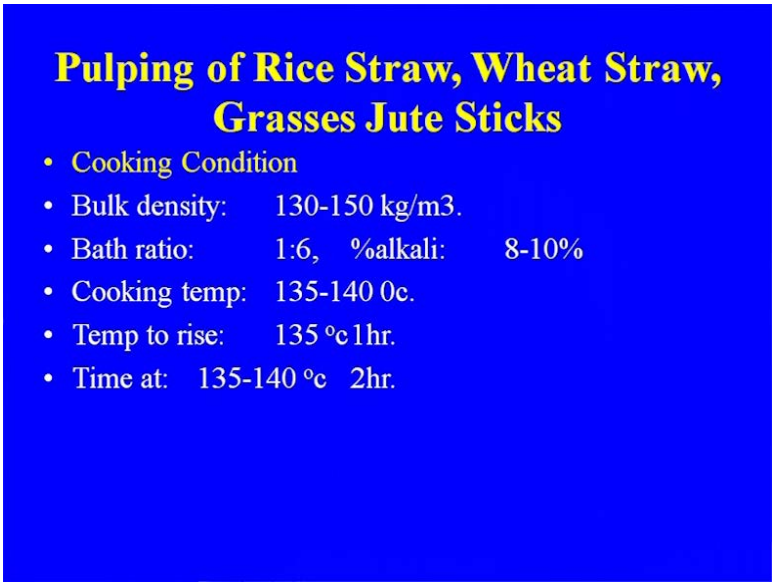

This is the cooking condition here if you see the cooking condition; alkali has NaOH here, no sodium sulphate is use in case of the pulping of the wheat straw or the grass.

Normally, it is the alkali NaOH that we already 8 to 10 percent, temperature is less, cooking time is less if you compare with the hard wood or the bamboos. So, these are the some of the problems in utilization of although we are as I told you earlier also while discussing the raw material in the module 1. Huge amount of the bio ass is available, but how to utilize this?

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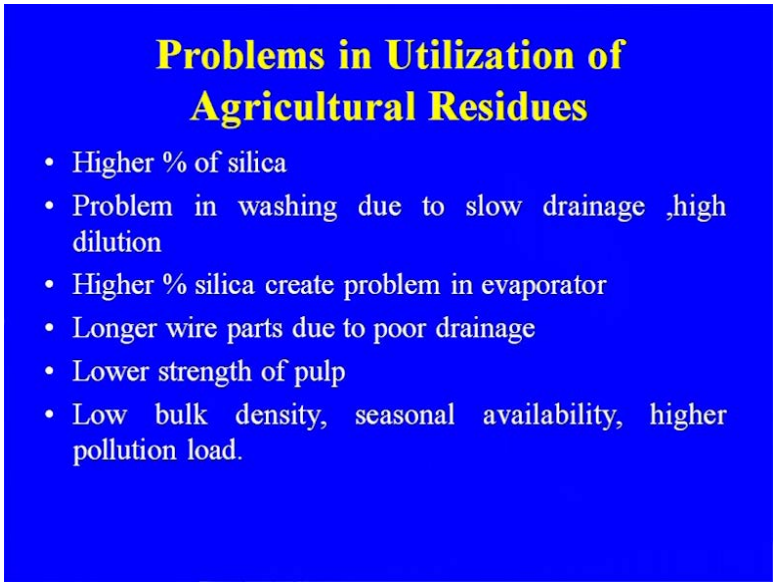

These are the some of the problem with reference to paper industry, we are facing in the utilization of the agriculture residue and that problem that may be in other cases also. Higher percentage of silica, problem in washing due to slow drainage because this is drainage of the water while washing that is poor in case of the agro based raw material. So, more dilution that will be require for washing of the, that is one of the disadvantage in case of the agro base. So, the washing is not proper (( )). Higher percentage of silica we cannot go after the 30, 35 percent in the conditional evaporator.

So, the our requirement or the efficiency of the recovery furnace that will go down and even cannot achieved at target of the 60, 70 percent, which you are getting in case of the hard wood or the bamboo or the soft wood. Longer wire part due to the poor drainage because the drainage what we are doing as I told you earlier also that we are adding water are at 10 different places in the paper making. So, the finally the pa pulp after bleaching is stop from the stop profession that is going at 1 percent around 1 percent to

the air box of the pulp. So, 99 percent of the water that has to be remove, first portion is the wire part.

So, the wire part the drainage so longer wire part that will be require for the because before shifting to the place the water has to be removed so that the air your the paper is made and that paper that can be transferred. So, lower resistant of the pulp that is there in case of agriculture residue, low bulk density another problem is the seasonal availability. You, cannot depend up on the bagasse totally or the wheat straw because seasonally they are available. So, this is the another problem that is been in the higher pollution low.

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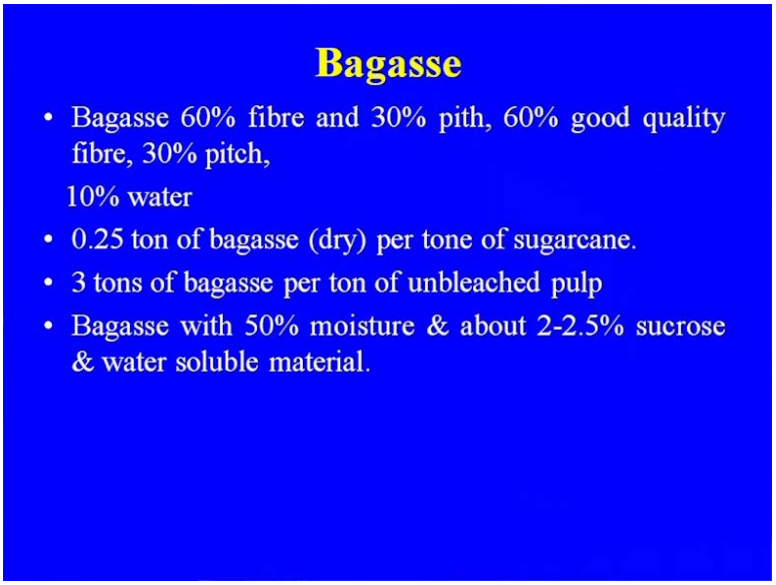

This is the one on area where the scope is there because 10 percent of the bagasse is still surplus that can be used for the. Now, let us discuss about the bagasse pulping because the bagasse 60 percent fiber, 30 percent pith, 60 percent of the good quality fiber. So, that 30 percent pith it is not desirable and 10 percent of the water. 0.25 ton of the bagasse per ton of the sugar cane that is produced and the 3 tons of the bagasse per ton of unbleached pulp that will be requirement. Bagasse with 50 percent moisture and about 2 to 2.5 percent sucrose and water soluble material this is about the some of the characteristic of the bagasse, but bagasse in comparison to rice straw and wheat straw is consider much better and so the scope is there for integration of the sugar mill with paper.

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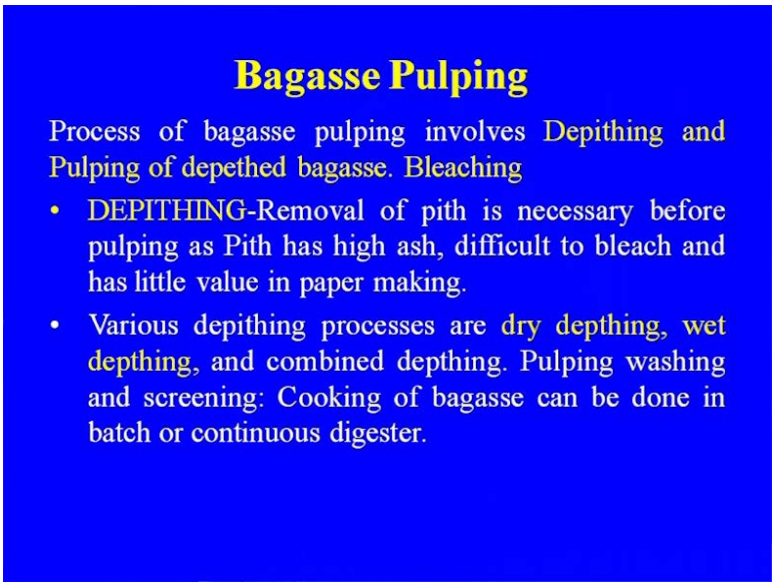

Already, we have some of the mills smaller paper mills where they are using the bagasse producing the sugar mill. In the bagasse as I told you the removal of the pith that is important. So, that is the depithing and then the various here we using the dry depithing and wet depithing and the combining depithing that may there depending upon the process condition. Pulping, washing, screening, cooking of the bagasse can be done as I told it can be in the batch or the continuous.

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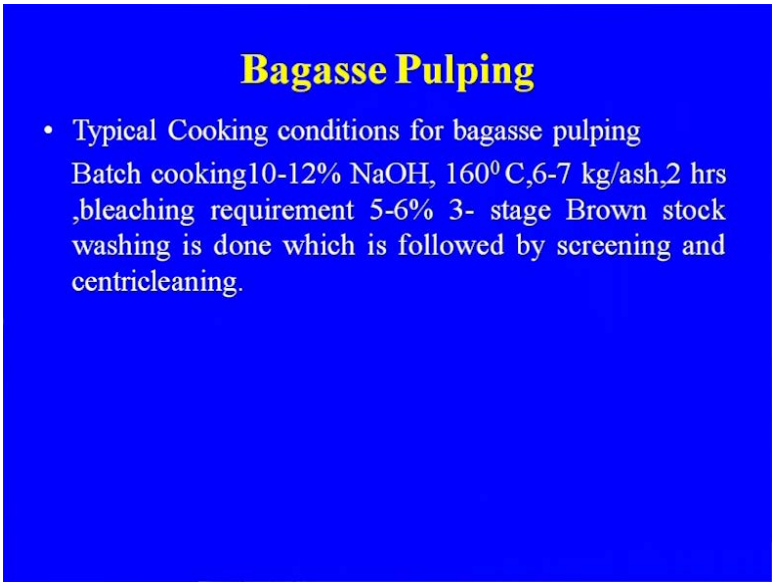

This, is the typical here also normally it is the NaOH that we are using 10 to 20 percent slightly high temperature and the belching requirement 3 stage brown stock washing is done, which is followed by screening and centric cleaning. But in case of the bagasse slightly better property of the pulp is there in comparison to wheat straw.

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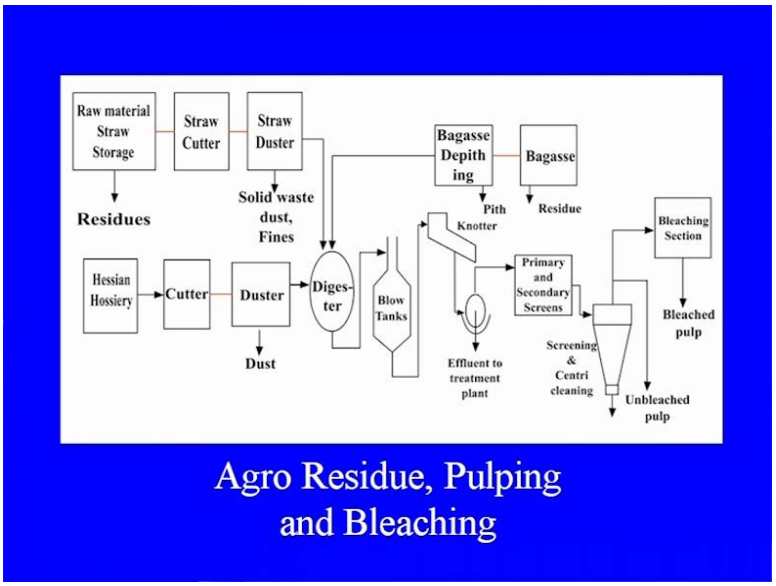

This is the typical flow diagram for pulping of the agro based raw material that is the raw material straw there straw cutter, straw duster. After the straw duster it doing to the digester sometime I told you that the entering discussing with the raw material. We are also using the Hessian or Hosiery cuttings in the or cooking after cooking it is been added along with the pulp for making the specially the board paper. So, bagasse after depithing that will go to the that digester is the spherical digester, blow tank then the knitters, then it is retained different, but now it is the mandatory to go for the recovery.

So, 3 to 4 stage washers are there, centric cleaner and the bleaching section finally it will go depending up on the requirement of the bleach by the kraft pulp. Mechanical pulping you see the mechanical pulping has significant importance in the paper making, because of the high yield and its requirement in news print, because as I told you the major lines here about 70 percent is the mechanical. What, why it is needed, because this is the there are two advantage; one advantage is the cost of the paper new print, because that has also control and so cannot increase the cast of the paper like oil other things.

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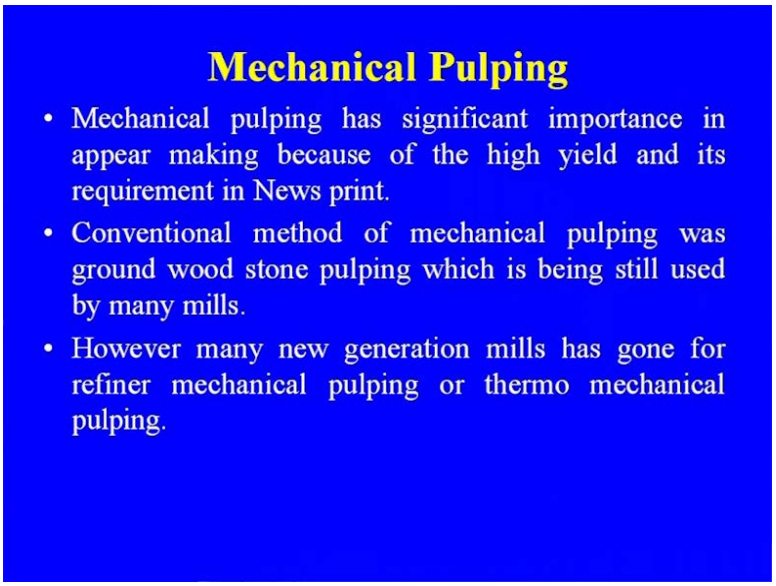

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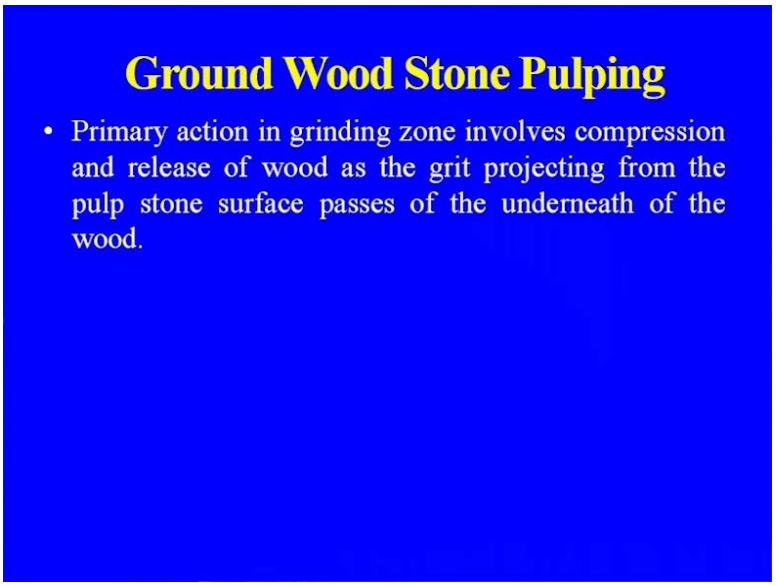

So, you will have to be very particular about the case of the paper and so the requirement. Another requirement because while discussing the news print we will be discussing why the mechanical pulp is prefer, because that will helping in the because the requirement in case of the news print and requirement in case of the writing paper that is different. This is the ground wood stone pulping that was earlier many of the just like the paper mill there still using the long stone one section is there. So, for making of the, but in case of the stone pulping there are having the thermal mechanical pulping. So, primary action in grinding zone involves the compression and release of the wood as the

grit projecting from the pulp stone here we are using pulp stone surface passes of the underneath of the wood.

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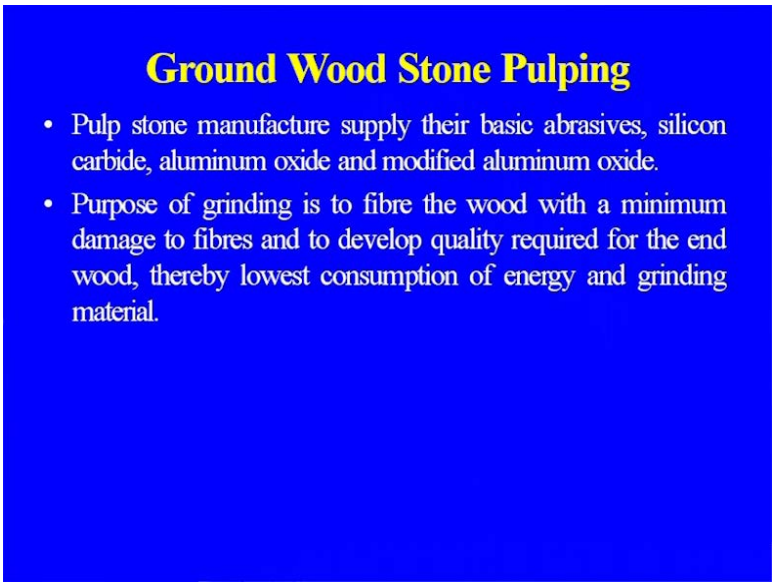

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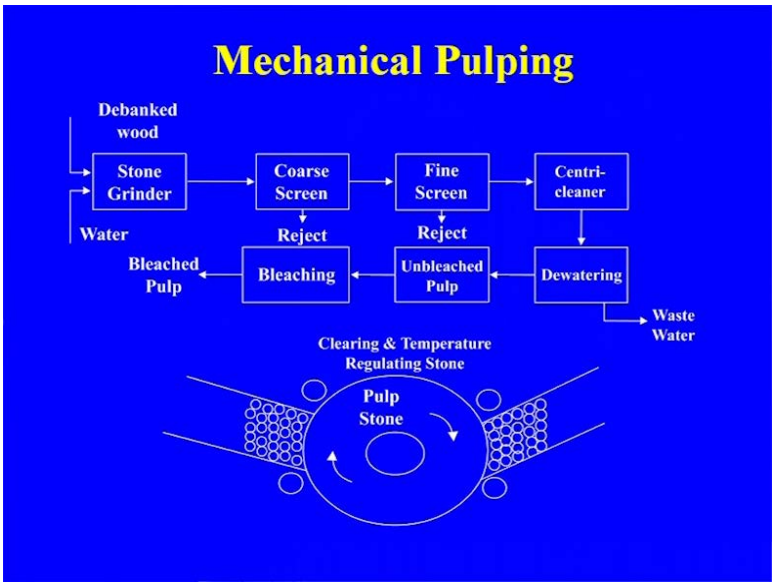

And so the pulp stone manufacture supply their basic abrasives, silicon carbide these are the some of the because special type of the pulp stone that we are using. Purpose of the grinding is to (( )) fiber to separate the fiber from the wood with a minimum change to the fibers, length and at same time retaining the yield of the pulp. This is the mechanical

pulping process in case of the stone round grinder de banked wood that we are using course screen to reject and the fine screen centric cleaning.

All these screening part and centric cleaning, dewatering, unbleached pulp and then final bleaching and that is bleaching here we are using not the conventional bleaching sequence, but the hydrogen peroxide bleaching or the sodium sulphide bleaching that we are using. So, the requirement of bleach that is also less in case of the bagasse pulp or the stock pulp and this is or the mechanical pulp also because the here our majors here is the mechanical if the 30 percent we are so whatever the brightness that is given. But not now the you see the changes the quality of the paper that is also news printer also there, so requirement that will be difference that more bleaching that is required in case of the new print where earlier the brightness requirement that was less.

So, this is the process how the bleaching, the cleaning and the temperature regulating, pulp stone that we are using and the these are the smaller wood clocks are that is going to the your stone ground pulping. Refiner mechanical pulp this is another development that has taken place involves the mechanical detection of the chip in the precious double rotating disk definer what you called it the with use of two refiners (( )) stronger pulp than the stone ground pulping that is there quality of the paper is also better in the if you having the disk refiner. This involves about the disk reformers slightly let us going in detail.

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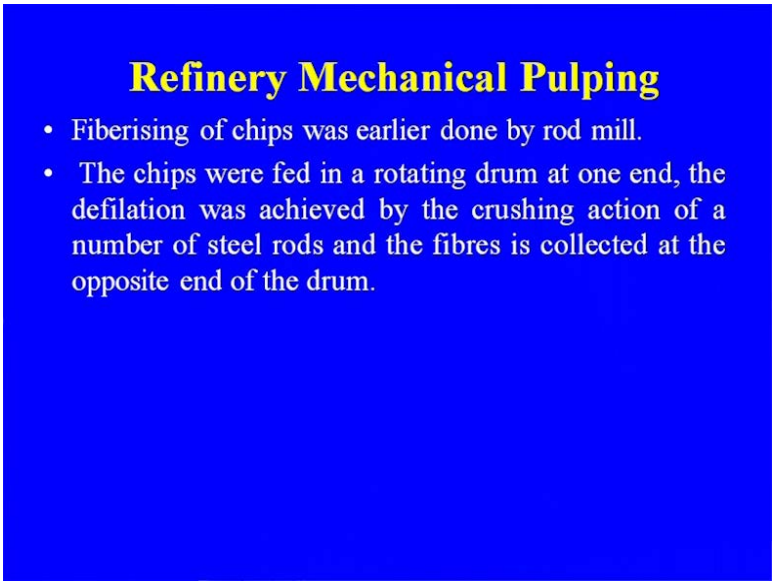

This involve the mechanical reduction of the chip in the double rotating disk with the use of the two (( )) and it gave the pulp with the much stronger although soft wood does not need any treatment. But hard wood if you are using the hard wood so chemical treatments slightly pre treatment with the soaking with caustic that we are doing just to improve the separation of the fiber from the chips. So that is helping; and so the damage during the further refining or the separation; that is less because of the (( )).

Fiberising of the chips was earlier done by the rod mill, the chips were fed in a rotating drum at one end, the defilation. This the another type of refiner that was being used. The variables in the refining are speed of the rotation, disk inter distance, load, temperature and consistency.

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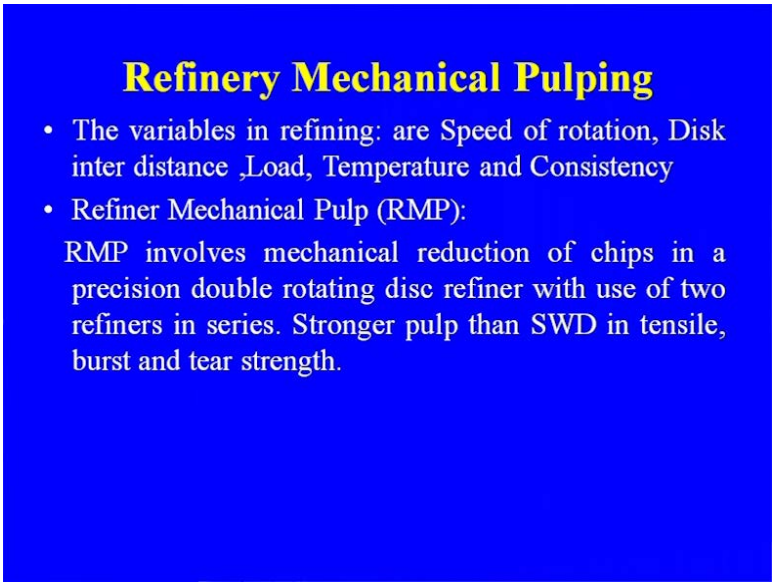

This is the refiner mechanical pulping instead of disk refiner we are also mechanical refiner because that also used in case of (( )) during the stock prepration, but here normally we are having the disk refiner in case of the so that is the refiner mechanical pulp. Again the thermo mechanical pulp here the start streaming period why the thermos may not mechanical with thermo, because the start steaming that we are doing before it is going to the final refining in the first stage we are doing the steaming and then because by steaming this chips are getting soften. And then the total energy consumption in case of the disk refiner that is less and the requirement of the and the quality of the pulp is also good.

This is about the another condition that is the temperature why the pre steaming that we are doing. These are the some of the again some times as I told you the we are also adding the alkali. So, if you are having the alkali that is helping in the straining of chips and so have waiter separation that is taking place, higher strength that we are getting so these are the some of the advantages we are going for the pretreatment or the pre steaming of the chip that we are doing.

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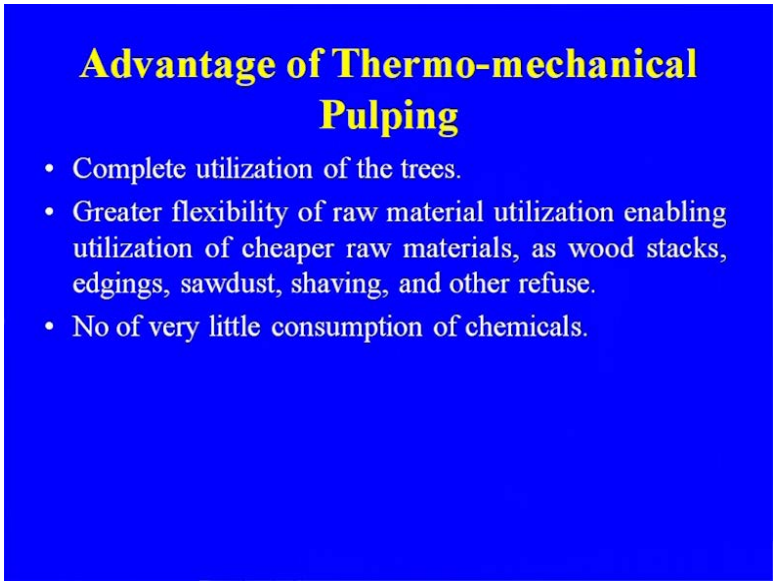

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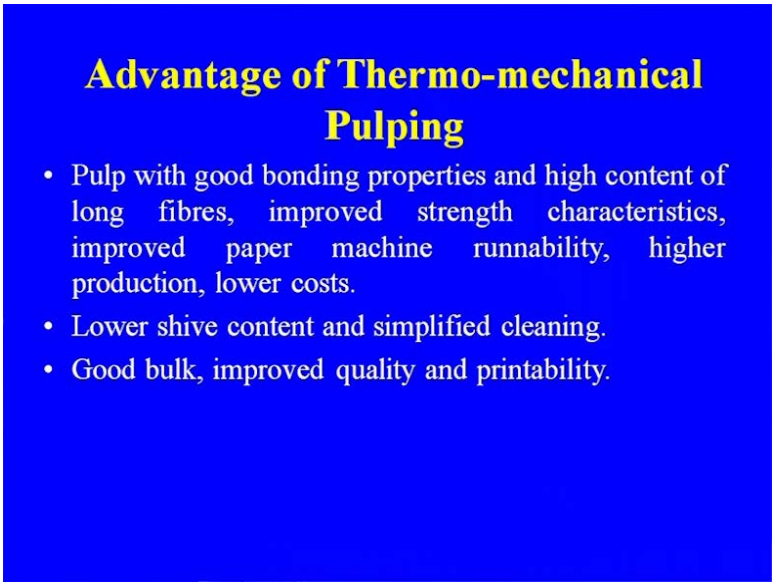

This is the actually why we are going for thermo mechanical pulping because as I told you the in case of the news print requirement is also very high and just to have the better yield, better utilization should be there of the raw material. So, the complete utilization of the tree, greater flexibility of raw material, number of the very little consumption of chemicals is there in compare to the kraft pulping at the same time we are having the higher yield.

Advantages of the again mechanical pulp with the good bonding property and high content of the long fiber improved strength characteristics, improve paper machine runnability, higher production, the lower cost. Lower shive content and simplified cleaning, good bulk improve quality and printability that is the some of the advantage of the thermo mechanical pulp. Another advantage minimum labour cost, high yield because the stone ground pulp that was using high energy. So, minimum labour, high yield and high strength resulting in either reduce or eliminated costly chemical pulp, improved quality and lower cost, more and better utilization of the available raw material, numb no air atmospheric pollution, little water pollution because in case of the stone ground we are also adding during the pulping water.

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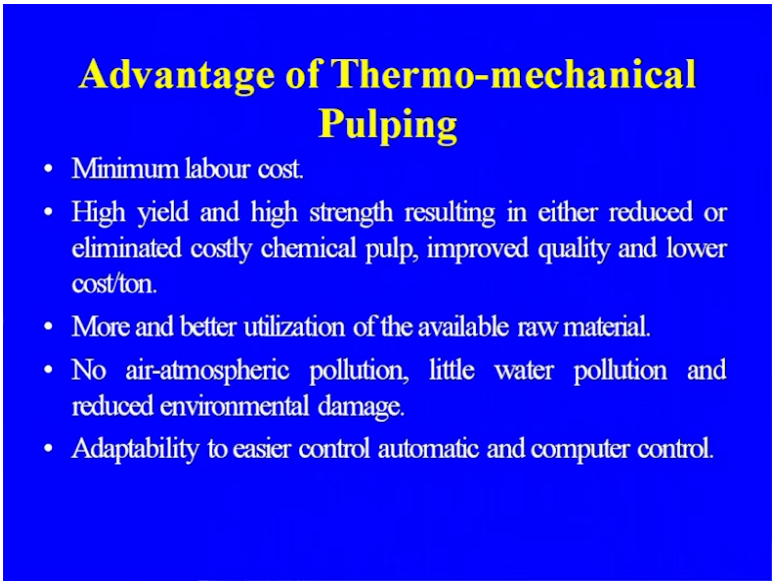

So, the water has to be removed and to reduce the environment damage, adaptability to easier control automatic and this computer control now the new breed of the disk refiners which you are having. Chemi-thermo mechanical already we have added the some slight

mild treatment with the sodium hydroxide or sodium sulphide that we (( )) so that is helping in the separation.

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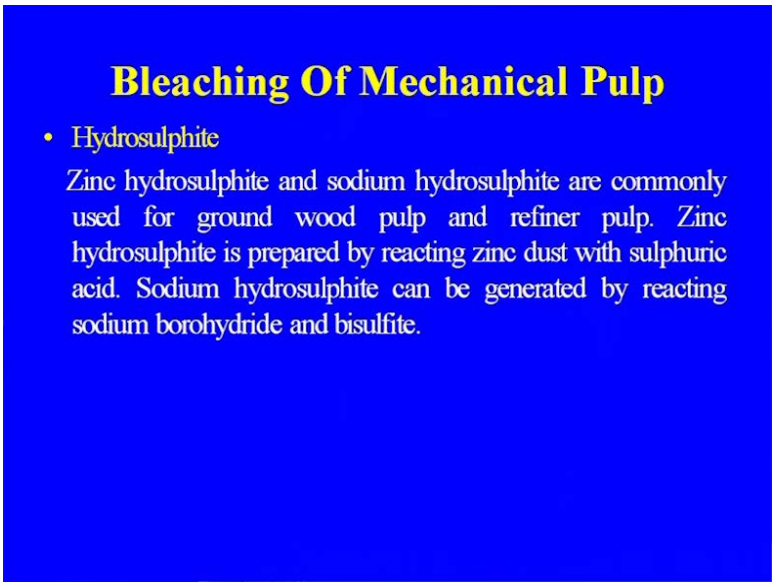

This is the bleaching as I told you the we are for bleaching of the mechanical pulp we are using the hydro sulphide and the hydrogen paraoxide. This, is the paraoxide and these are the very commonly use in case of the mechanical although this is paraoxide hydrogen paraoxide that is also being used for the in the kraft bleaching process also.

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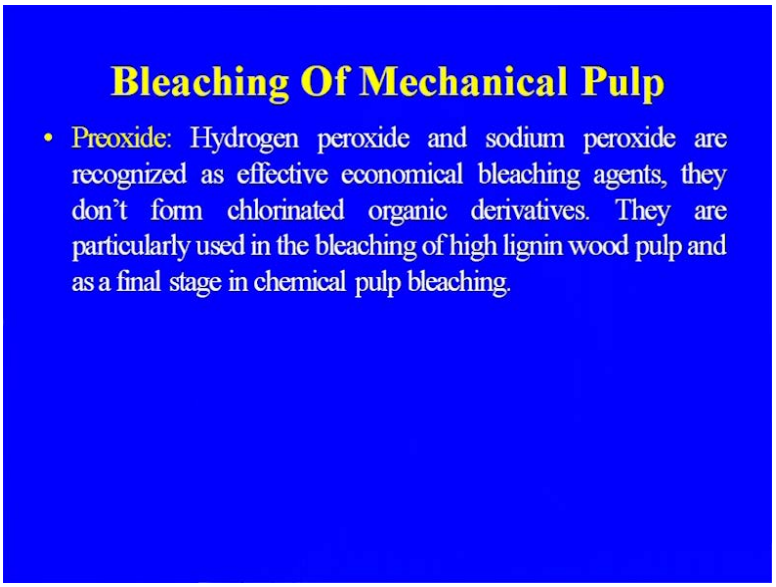

News print let us discuss the because in brief about the news print manufacture, in the news print manufacture the major that is playing an important role in the information culture and economic growth and in the morning if you are not getting paper news paper you are not comfortable.

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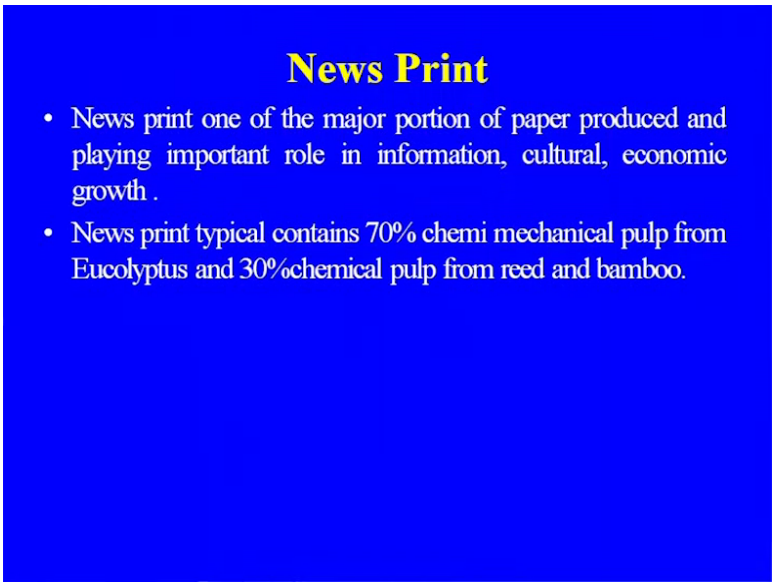

So, lot of the information for the cultural, social development give news the and the that is the reason why the importance. One very interesting figure I will give, the one New york times they are consuming raw material equivalent to 1 ohio state total forest. So, number of pages you see the if you go to the any metro politan city that is very high and so this is the reason why the news print industry that is also one of the very important sector of the paper industry.

And here we are using the 70 percent of the mechanical from the eucalyptus and the 30 percent chemical from this is hardwood these are the raw materials bagasse is also some of the they are using the bagasse also for making the news prints. These are process we are using eucalyptus wood is also being used impregnated chips that is going to be thermo mechanical pulping. These are the some of the why we need the mechanical pulp incase of the you see the paper. If you see the lot of the painting that is involved and so the two side should not be there because if you are printing on this side there print should not come on this side other side. So, that is very important in case of the manufacture of

the so that is the helping the ground wood pulp or if you are using the mechanical pulp because this is more fine.

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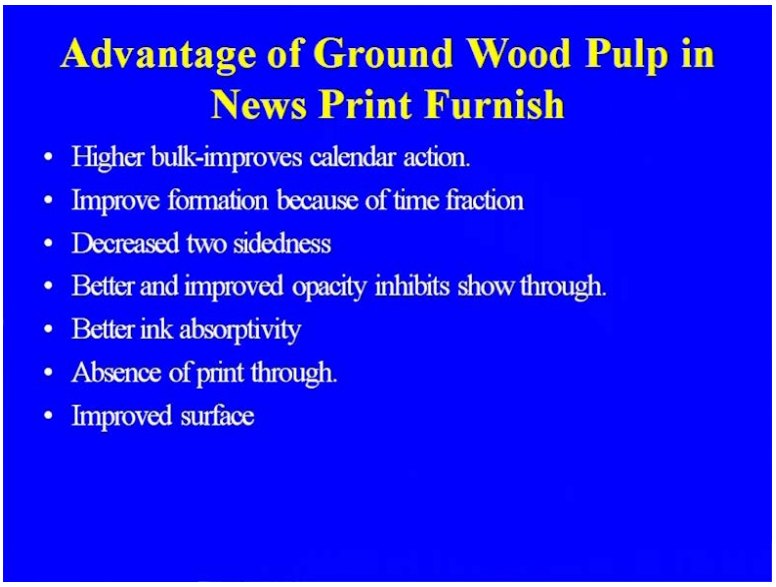

So, it is helping in the so these are the some of the advantages higher bulk improves the calending action, improve the formation, decrease four sidedness, better and improve opacity, better ink absorptivity, absence of print through that is very important in case of the news improved surface.

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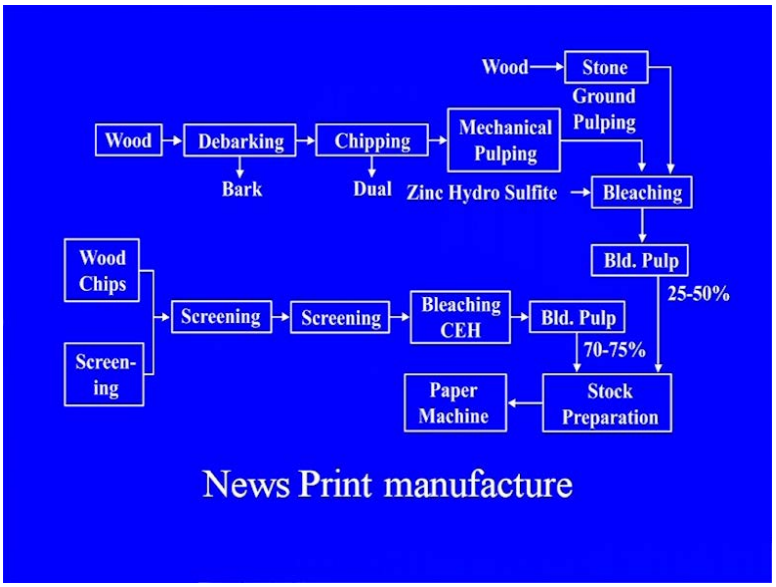

This, is the news print manufacture where we are using wood that is going to the both the mechanical and the chemical it may be sequence now it is the not the CE, but CEHH or it may be the DEH, which the chlorine dioxide or it may be oxygen delignification also.

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After the because rest of the processes pulping bleaching centri cleaning washing all similar; so finally going to the stock preparation and then the paper making quality. These are the some of the requirement in case of the runnability, good printability,

minimum two sidedness, pulp formation should need following requirement; low freeness because that is also very important means the freeness measure the drainage of the water especially good screening should be there.

Good pulp strength, uniform pulp quality, controlled bleach system, mechanical pulp has to be good wet end wet end strength and good bonding during the paper making. So, these are the some of the requirement.

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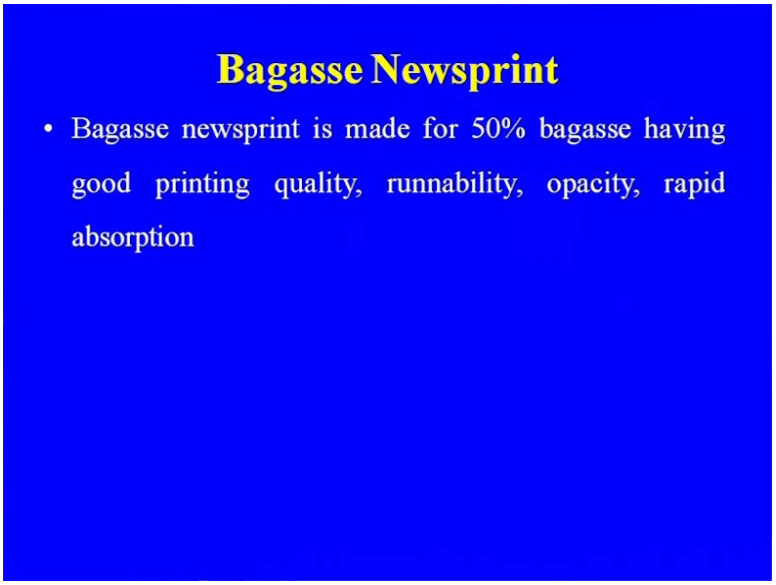

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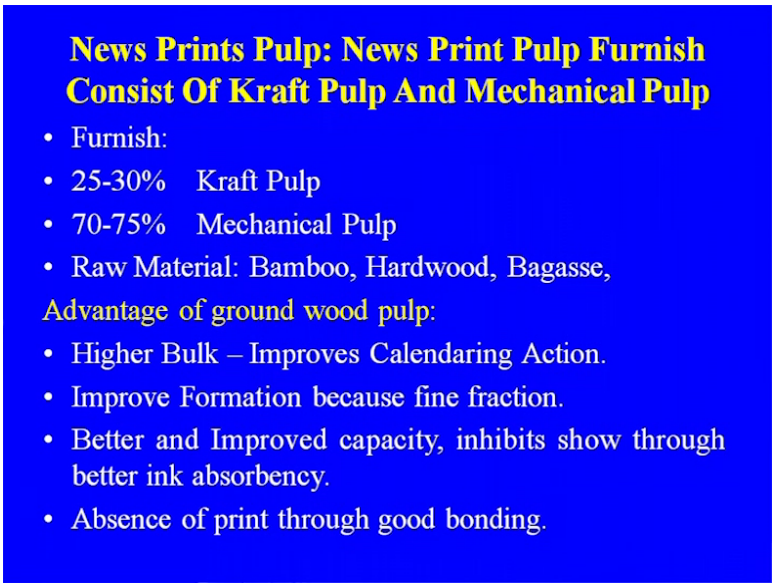

Bagasse is made for the 50 percent bagasse having good printing quality. So, already we have discussed about the bagasse all those things because in some of the mills, they are using the bagasse for making of the news print the other condition pulping or the processing of the already we have discussed about the bagasse pulping. This is the news print furnace that we are using about the 25 to 30 percent the kraft pulp, 70 to 75 percent the mechanical pulp and these are the raw material advantages already we have discussed.

Sulphide pulping just to go and brief about the sulphide pulping because although it is not being used now in any mill in india, but earlier if you see the historical development that was the sulphide pulping came first. After that looking to the problem whatever inherent in case of sulphide pulping we went for the, because the quality of the paper that was better in case of the kraft pulping. So, the plus pollution from point of view, so this was the problem in case of the sulphide pulping and so the we are not using anywhere the sulphide pulping, but let us discuss in brief about the bisulphate that we are using.

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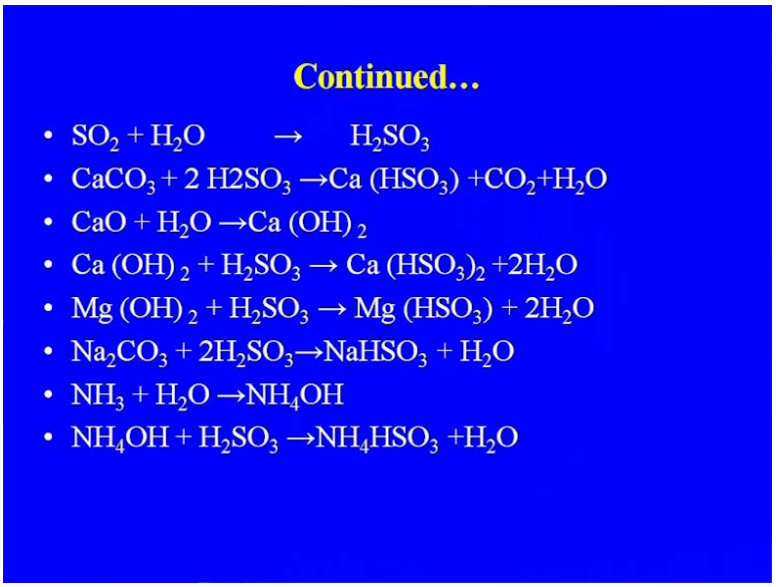

These are the some of the reaction because requirement of the So2 is there in case of the sulphide pulping and so the generation of So2, so lot of the environmental problems are involved in case of the So2 generation. So, this was the reason here actually the basis that may be magnesium sodium or the ammonium based whatever the base that may be

magnum sulphide, sodium sulphide or the ammonium sulphide any type of the pulping liquor that can be used.

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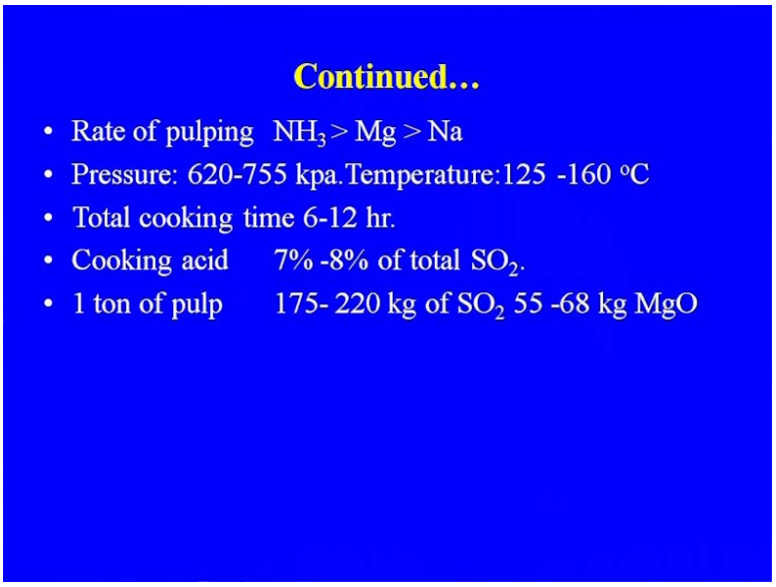

This is the rate of pulping if you are having the ammonia, magnesium or sodium these are cooking condition and then these are the some of the term that very commonly used in case of the sulphide pulping; total sulphurdioxide, free sulphurdioxide and combined So2.

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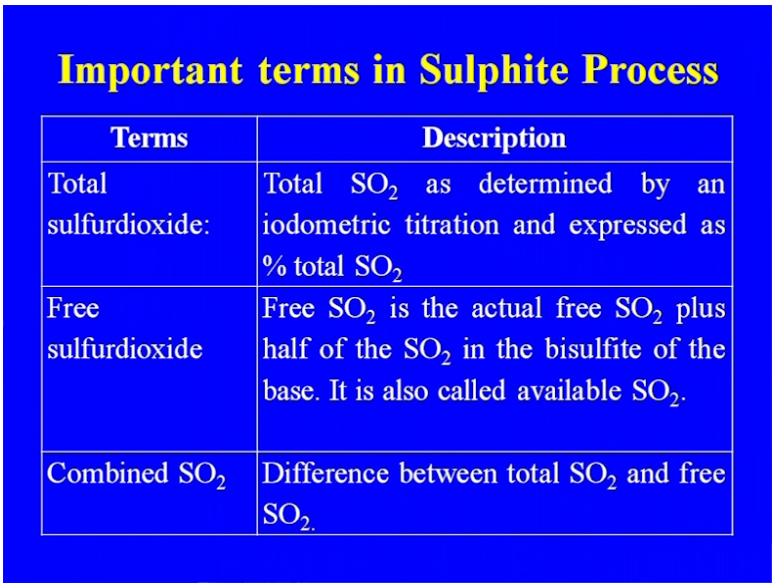

So, these are the terms as incase of the kraft pulping your some terms we are using here the total sulfur dioxide that is important; and so the that that can be determined by the or the free So 2 is the actual free So 2 plus half of the So 2 is the bi sulphate of it is also called the available So 2 because whatever the So 2 that we adjust like there we are using two term; active alkali and total alkali. So, this is the about the in brief about the sulphate sulphide pulping. So, this was the actually about the pulping and the bleaching what are the various development that has taken place in pulping, how what are the problem faced in case of the pulping of the agriculture residue and the hardwood and the now actually the because as you see the you are using chemicals for cooking.

So, recovery of the chemicals from the black liquor, which is separated during pulping process that is very important and so the if whole efficiency economy of the plant that will depend upon the total recovery of the chemicals. And the now the people are work have gone for the 95 plus recovery of the chemicals, which we are using that has to be recycled otherwise you cannot survive.

And so the next lecture of this module module 3 lecture 3 that will be on the recovery of the chemicals, because the if you are having the hardwood bamboo the problems are different, in case of the softwood agro base raw material the problems are different. So, we will be discussing about the what are the various stages involved in the recovery of the chemicals from the whether the kraft pulping or the soda pulping.