

# INFLUENCE OF ANTHRAQUINONE ON ALKALINE PULPING



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## SUMMARY

The search for increased production and improvement of the cooking process is continuous and has shown tremendous progress in the recent past. It is a common practice throughout the world to use some cooking additives during the pulping process. The main purpose of using cooking additives generally consists of the following : use of Cooking Additives results in reducing the cooking cycle, it results in reducing the chemical consumption and it can result in improving the pulping yield. All the pulp and paper technical persons are well aware of the mechanism of pulping and the various steps involved during the cooking process.

However for a quick review it can be said that the penetration of the cooking chemicals, the dosage of the chemical employed for cooking and the cooking cycle are the most important parameters during the cooking process and they govern the cooking process to a major extent in all cooking processes whether acidic cooking or alkaline cooking i.e. Soda/Sulfate cooking of the raw material. These parameters play the most significant role irrespective of the nature of raw material and pulping process

Various kinds of chemicals have been advocated for achieving the above mentioned parameters at a faster rate. In the recent years the raw material costs have increased significantly specially in countries like India where there is a shortage of the fibrous materials and the paper makers have started using alternate sources of fibre apart from wood such as bagasse, wheat straw, rice straw etc. Under these circumstances the overall pulp yield from a particular raw material has started playing a major role in the selection of digester cooking additives. The additive which result in increasing the pulp yield in addition to improving the pulping parameters as detailed above have started playing a major role.

## INTRODUCTION

It is a very important subject for pulp mills to increase pulp yield from a viewpoint of not only the improvement of profitability but also the effective use of fossil fuel and forest resources. In order to improve pulp yield, cooking additives find their application. In any chemical pulping process, it is essential to achieve adequate penetration of liquids into the wood. It means each fibre in a wood chip that is being pulped should receive the same chemical treatment which involves immersion in pulping liquor of the same concentration, at the same temperature, and for the same time. Usually pulping is carried out at temperatures in the range between 140 and 175 °C.

To meet the above requirements we have developed an additive based upon a combination of judiciously selected chemicals which contribute as a whole in all the pulping process parameters in the desired manner without causing any adverse effect in any section of the pulp & paper mill. These cooking additives are based upon a combination of penetrant, emulsifier, descalant & catalyst. When this cooking additive is used in the soda & sulfate pulping process along with the cooking chemicals it significantly improves all the parameters such as yield, kappa Number, and retention time.

## MECHANISM

Cooking aids are mainly based upon two mechanisms namely:

surfactant based and

Anthraquinone based

Surfactant based digester cooking additives is a combination of different ingredients such as surface active agents, penetrants, dispersing agents and stabilizers. The formulation can be modified depending upon the requirements of the end users and plant conditions. Anmopulp is based upon this chemistry and acts as per this mechanism. It enhances the delignification rate due to change in interfacial tension, surface tension and contact angle. In this process the fragmented lignin in wood chips is chemically attacked by the hydroxyl and hydrosulphide ions present in cooking liquor and lignin fragments are washed away during pulp washing stage.

The mechanism of cooking aids based upon surfactant and anthraquinone is that the benefits of penetration, emulsification & dispersion are achieved in the same manner as in case of surfactant based cooking aid as discussed above. In addition the AQ content component of the formulation results in introducing a catalyst which fastens the delignification reaction to a considerable extent depending upon the dosage. It also stabilizes the carbohydrates chain and thus results in increased yield of the pulp. To achieve the advantages these days we are more emphasizing on the use of our new cooking aid. The cooking aid is suitable for both the batch and the continuous digestors.

CAPACITY (TPD)	200	250	200
Alkali charge %	2	2	2.11%
Cooking aid (g/ton)	0	500	500
Cooking time (min)	75	75	75
kappa No.	22	20.7	23.2

## RESULTS AND DISCUSSION

The studies carried out in the laboratory and plant indicates that with the composite aid i.e. Anmopulp AQ which is a combination of surfactant, de-scalant and AQ results in a reduction of DCM extracts by about 25%. Its use results in a reduction in cooking chemicals by 10-15% at the same kappa number or a reduction in kappa number of 10-15% at the same alkali level.

Due to the reduction in DCM extracts the problem of pitch has been eliminated to a considerable extent. The mills have reported an increase in pulp yield of 0.2 – 0.5 % which again results in substantial saving of mills.

For mill no. 1, the results indicated an increase in yield from 41% to 41.3% along with the reduction in rejects.

For mill no. 2, the long term results regarding yield indicate that there is a definite increase in yield by 0.3%. This covers all kind of raw materials used by mills on a long term basis and these results are in accordance with the laboratory findings.

For mill no. 3, it is observed that the mill could gain a reduction in kappa number directly, along with reduction in cooking chemicals with DCA dosage starting at 500 gms/ton of pulp with yield % remaining same.

## EXPERIMENTAL

To-date a large number of mills are using our composite cooking aid i.e. Anmopulp AQ and are deriving multiple benefits with its use.

## CASE STUDY – 1

A mill with a capacity of about 200 TPD is using this product for the last 4 years, this mill is based upon batch digestors and cooking aid is added along with the chemicals batch wise. The cooking dosages are from 500-600 gms/Ton of pulp. The following observations have been observed:

- A reduction in cooking chemicals by about 10%
- Or, The cooking cycle was reduced by about 15-20 minutes
- Or, An increase in bleached pulp yield by about 0.2 - 0.5%



## CASE STUDY – 2

This mill is using Anmopulp AQ for the last 1.5 years with excellent results. The afore said mill is having a bleached pulp capacity of around 600-650 MT of pulp per day and is based upon continuous digestors. The cooking aid is added continuously along with the cooking chemicals. The furnish of mills is mainly mixed hardwood consisting of casurina, subabul, eucalyptus, poplar, akasia along with bamboo. The cooking dosages range from 450 – 540 gms/ton of paper

- Reduction in cooking chemicals by 5 - 7 % i.e white liquor a reduction in bleaching chemicals by 5 %
- Pitch problem has been eliminated
- An increase in yield by 0.3 %

CAPACITY (TPD)	600-650	600-650
Digestor	Continuous	Continuous
DCA dosage (gms/ton)	0	500-550 gms
Kappa number	18	18-19
Yield %	10 %	10.3%

Note: The above data has been collected at the same alkali charge

## CASE STUDY – 3

Anmopulp AQ is being used in number of mills based upon agricultural based residues such as bagasse, wheat straw etc. The results have been found equally encouraging. In a mill which has used anmopulp AQ for a long time in their continuous digester (Tube digester) it was observed that there is a 10-15% reduction in cooking chemicals with a reduction in kappa number of 5-10%

There was also a reduction in rejects. However impact on the yield could not be evaluated on plant scale.

CAPACITY (TPD)	200	200	200
DCA Dosage (gms/Ton)	0 gms	500 gms	540
Cooking chemicals	X	X	X-10%
Kappa No.	19	17.5	18.2

## CONCLUSION

The product has been approved suitable for hardwood, softwood and various agricultural raw materials. Various studies by different paper mills have shown that by using Anmopulp AQ it gives better results than surfactant based cooking additives or AQ alone.

The presence of anthraquinone in the cooking liquor had a positive impact upon the rate of delignification. Anthraquinone addition led to a decrease in the amount of rejects and kappa number of pulp cooked. The bleached yield of pulp also increased in all the mills.

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