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**15/ENG01/006**

**CHE 592**

**PULP & PAPER TECHNOLOGY**

**FIRST ASSIGNMENT**

From Bernoullis equation:



Since we have two variables for pressure and flowrrate,we then have:





Where;

P1 = 9.7 feet of water

P2 = ?

V1 = 8.2ft/s

V2 = 5.8ft/s









feet of water

**SECOND ASSIGNMENT**

1. **What is pulp refining?**

Refining or beating of chemical pulps is the mechanical treatment and modification of fibers so that they can be formed into paper or board of the desired properties. It is one of the most important unit operations when preparing paper making fibers for high-quality papers or Paper boards.

The term "beating" dates back to the early days of paper making when beating was effected by manually beating pulp with a stick, but has remained in use to this day to describe the mechanical treatment of wet fibers. The term was generally used earlier when the equipment commonly used in the process was Hollander beaters, but various refiners have now replaced beaters and the term "refining" is widely used. In fact, both terms are synonymously used, but here the term "refining" is used to describe the work accomplished with refiners on the fibers.

The main target of refining is to improve the bonding ability of fibers so that they form strong and smooth paper sheet with good printing properties. Sometimes the purpose is to shorten too long fibers for a good sheet formation or to develop other pulp properties such as absorbency, porosity, or optical properties specifically for a given paper grade.

1. **Briefly explain the theory of Pulp Refining using qualitative analysis.**

**QUALITATIVE ANALYSIS**

Pulp refining is a process in which fiber flocs collect on refiner bar edges and are subsequently deformed by compressive and shear forces such that the cell wall of at least some of the fibers is permanently modified.

The nature of the cell wall modification is dependent on the magnitude of the compressive stresses(or strains) that occur during the deformation of the fiber flocs. The extent of the cell wall modification depends on how frequently fiber flocs are collected and subsequently deformed for a given mass of fiber. In pulp refining, we are interested in both the magnitude and the frequency of these deformations.Within each fiber floc, the average cell wall deformation of individual fibers is directly related to the deformation of the floc itself: e.g. if the floc is only slightly deformed, then the average fiber cell wall deformation will also be slight. On the other hand, if the floc is greatly deformed, then the stresses and subsequent deformation of individual cell walls will be much greater. If the deformation of the fiber floc is so extreme as to cut it into two, a portion of the fibers within the floc are also likely to be cut.Recognizing that the deformation of the cell wall of an individual fiber during refining can only be accomplished by deforming the fiber floc in which it lies is a very important concept. First, it makes it quite obvious that the nature of deformations is highly varied.Even if it were possible to precisely control the degree of deformation of the floc, the randomly distributed fibers within the floc would be subjected to a wide range of deformations. Therefore, it is only possible to speak of average degrees of deformation and average subsequent effects on fibers. Second, it underscores the importance fiber flocs. How many and how large are the flocs that support the refining load at any instant? What effect does a change in the refiner filling design have on the size and number of fiber flocs?

The more refining that is done, the greater the increase in both fiber flexibility and surface fibrillation.Yet for a given amount of refining, there is no direct evidence linking the nature of the cell wall deformation with the resulting fiber characteristics. This would require a mechanism for precisely deforming a large number of individual fibers and then applying some sort of quantitative inspection criteria on those fibers after deformation. Nonetheless, there is some indirect evidence from measured pulp and paper properties which suggests that high magnitudes of cell wall deformation tend to cause surface fibrillation and internal swelling and, in the extreme, fiber cutting. Lower magnitudes of cell wall deformation tend to promote surface fibrillation without much cell wall swelling, along with a greatly reduced likelihood of fiber cutting. Recognizing the probabilistic nature of the refining process, it is quite certain that all of these effects take place to some degree under any given refining condition. However, it is possible to control the emphasis of one effect relative to the others by controlling the intensity of refining.Before discussing the effects of refining intensity, it is worthwhile looking at the general behavior of paper properties as the amount of refining is increased. Figures 7a-7c illustrate typical refining trends for mill refined softwood and hardwood kraft pulps



