what water means paper making

GOBINDA SENGUPTA*

Water plays the most vital role in stock preparation and sheet formation. Paper making process can be defined as addition of water in the stock and then extraction of the same through different devices of the paper and board machines.

Stock Preparation : In the stock preparation, water plays two vital roles. First, it holds the fibre in suspension and forms slurry of different consistencies to be pumped and passed through the refiners, stock makers, Jordons etc. etc., so it acts as the carrier of the fibre. The second, equally important function of water, is to facilitate preparation of fibre or beating to suit the quality of paper or board to be produced. Without the presence of water no stock preparation takes place. Pulp fibre is highly crystalline, and as such, is still and springy. If unbeaten fibre is passed on to the paper [1]machine wire "Brush-heap-type of mat" with a high sedimentation volume, a minimum number of contacts among fibres will take place, resulting in no sheet formation in the true sense. The aim of stock preparation is to effect an improved positioning of the fibres in the web, for better interlocking of fibres among themselves, to increase fractional resistance to fibre displacement and to reduce the elasticity of the fibre. In order to get this, a certain degree of plasticity must be afforded to the fibre. This is carried out through the introduction of water (plasticiser) in the fibre structure. As the beating proceeds (in water) swelling of fibre takes place which increase the plasticity of the beaten fibre. During the beating operation (apart from the mechanical shearing actions) the fibre undergoes certain amount of stresses produced by the water, in which it is suspended. Barkas [2] has shown, at the symposium on beating in 1951, that the water is rapidly accelerated when entering the gap (gap between the beater roll and the bed plate) and retarded when leaving ; this creates stresses in the aqueous medium and each fibre undergoes the stresses developed by the movement of the water ; and this helps develop fibrillation in the stock.

As we know, fibrillation is another important effect produced by beating ; this increases the external fibre surface and liberates internal hemicellulose which is an important agent for fibre bonding. [3] It has been seen that beating in non-swelling liquids involves very little or no fibrillation, but mainly cutting. Water is the cheapest source of swelling agent at the same time conveyor of the stock. Fibrillation is responsible for the availability of water of hydration in the fibre, which is a must in greater or lesser degree for sheet formation.

Paper Machine : Stock dilution is made final before the head box of paper machine. Head box consistency varies from 0.5% to 1% or sometimes, even a little more sometimes. As soon as the stock comes over the wire, sheet formation starts to take place. As we proceed further, we find different devices to take the water out from the web. On the wire part, water starts draining by gravity flow, by the capillary actions of the tube rolls, at the edges of the foils, through the suction boxes and through the suction couch. Generally, the paper web leaves the couch with 20% solid contents and the press section with 35 to 40% solid content. The rest of the water removal takes place by the costly way of evaporation in the dryers. Paper is reeled at 5 to 10% moisture content. There must be a minimum quantity of water in the final sheet, else the sheet will be brittle and unstable. If a sheet is dehydrated it may be crushed into powder, while water of hydration makes the sheet durable. Papers, like bond, record, bank, ledgers are made of highly hydrated stocks. The quality of the pulp, varieties of additives all will show their respective best functions for the durability and strength properties, provided this water of hydration is properly maintained in the sheet. Balancing of water of hydration and water of suspension (addition of water which lowers the head box consistency) is extremely important. It differs in different grades of paper.

It is always economical to have more water of suspension, which means free stock with more water on the wire to interlock the fibres.

Water of hydration (which means more fibrillation) involves more beating and refining costs.

REFERENCES :

1. Some aspects of the theory of beating process by W. Gallay, from Fundamentals of papermaking fibres, Edited by Francis Bolam, page 380/81 Technical Section of the B.P.A & B.M.A. (INC) Plough Place, Fetter Lane, London E.C. 4.
2. Symposium on Beating, Proc. Tech. Sect. B.P. and B.M.A., 1951, 32(2)—A (397), (b) 335, 360.
3. Kress, O. and Bialkowsky, H. Paper Trade Journal, 1931, 93 (20) 35.

*Titaghur Paper Mills, No. 3, Chawdar, (Orissa).