Stock Preparation—Operational Objectives and Practices

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In these days of general adoption of more or less fully automatic stock preparation systems to cope with higher paper machine speeds, an attempt towards a clear exposition of some basic aspects of the methodology—well-established as it is-will not be, it is hoped, without some practical utility. This is more so, as discussions on stock preparation normally centre around hydration, fiber length, additives etc., and not on operational practices.

Storage

The quality of the stock at any instant is not so important as the uniformity of furnish to the machine. There should be minimum variation in stock hardness, strength resilience characteristics, affinity for water, drainage properties, etc.

Large capacity storage chests will even out swings. At high consistency, fiber degradation is less (once pulp is washed free of cooking liquor and bleach liquor). In fixing the size of the final chest, blending needs (that is, high flow velocity at small volume) should weigh over storage considerations. Normally design should envisage a total storage holding of one day's stock and that of machine chest equivalent to a couple of hours machine run. 3 to 4% is normal consistency for blending chests and is in the easily pumpable range.

All chest levels should be run as uniformly as possible and all bumps in level taken in storage tanks. Changes in chest level affect agitation, pumping head, consistency leaving chest and may cause removal of dry stock and dirt adhering to the walls of the chest. At machine chest stage, additional mixing is achieved by partial recirculation of stock pumped, the excess over the draw-out returning to a high point in the chest. Too much of blending and recirculation is not advisable in the case of short fibred and slow stocks, for obvious reasons. Two machine chests are common in mills designed for frequent change-overs from one grade to another CONSISTENCY CONTROL.

Consistency control is accomplished by either 'in-line' regulation or in a chest by means of a sampling system. For efficient control, uniform dilution water pressure is essential. Stock freeness, stock temperature and line pressure at sensing device are other factors which affect proper regulation. Dilution valves can also be time-set. For finer consistency control, regulation at two points is sometimes resorted to. Stuff meters which control flow of stock rather than consistency are also in vogue, at the machine stage.

Broke system

A separate broke system of deckers, chests and proportioners is necessary to reduce sharp stock variation. This is particularly so when a variety of papers are being made. Broke storage capacity should be large enough to allow a relatively constant amount of broke to be used in the machine furnish continuously.

Couch pits of bigger machines have two pumps, one for pumping low consistency stock to deckers and the other to pump directly to broke chest (at high consistency) when there is a big wet end break.

Stock Refining

Refining of stock for strength development (as apart from defibering partially cooked stock and refining rejects for rescreening and recovery) always involves some amount of recirculation. This is because refiners working on the single pass principle must over-refine some acceptable pulp to ensure reduction of shieves as well as fiber bundles. The normal method is to have part of the pulp in circulation through a pump and the rest drawn out contiunously. Recycling of the same stock from a chest through a refiner for a definite number of times or for a specific timed interval may also be adopted.

A contact feed at constant consistency is necessary to run at constant load, the disc clearance being adjusted for changes in pulp pressure. A

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battery of refiners normally has provision for series and parallel feeding facilities.

Just as refiners are replacing beaters (but for special uses) pulpers are replacing breaker beaters for disintegrating waste paper, pulp sheets, broke, etc.

Proportioners

The normal method of making up a multistock furnish has been by the use of a multicompartment stock regulating box provided with suitable inlet, outlet and overflow ports with adjustable dams. The present trend, however, is to have flow control device (with the advent of magnetic flowmeters) installed in stock lines with automatic adjustment of control valves for proportioning by a ratio controller.

When preparing the furnish from different types of stock, a low consistency of around 2.5% is desirable for good mixing.

Chemical 'Trim'

For proper mixing of added chemicals uniformly throughout the stock, grouping is normally as follows :

Machine Chest (or earlier) group : Size, alum, filler & dyes.

Fan pump group : Sodium Aluminate, absorption agent, wet strength additive, chlorine, etc.

Wirepit group : Sodium Carbonate, Sulphuric acid for pH control.

Mill water supply, residual chemicals after washing, addition of alum, pitchy materials in stock, etc., have deleterious effects on sheet formation, slime growth, foaming, etc. So, careful control of the concentration of chemicals in the entire pulping system will be definitely worth the trouble. It is not considered good practice to mix pulps of different pH values when making up the furnish.

White Water-re-use

Reusing white water is intended for recovering chemicals, fiber, water and for saving heat and reducing stream pollution. The accompanying disadvantages are that there is a slowing of stock with resultant sheet formation troubles, decreased felt life, difficulties in clarification of white water and an accumulative effect on dirt, slime and foam. So, it is customary as in the case of screning systems to have a bleed-off at some suitable point. The higher the consistency in the headbox the more closely the wet end approaches a closed system.

In paper mills located in colder areas particularly, white water temperature is kept up with steam in the wirepit in winter and sewering of white water in summer as variation in temperature affects stock drainage.

It is not unusual to separate white water systems into rich and lean fractions, the former for purposes of fiber recovery and the latter for water conservation.

White water storage design normally envisages a capacity that is equivalent to the difference between the consumption at weekend start-up and normal consumption. This can best be fixed through the help of Sankey Diagrams (which enable quantitative study of flow systems) of various seasons.

Slime Prevention

Streamlined chests and piping are vital for reducing slime formation. Stainless steel surfacing for the headbox and savealls and tilelining for the wirepits are common. Wet end system design should be such as to be easily accessible for cleaning. The use of slimicides, maintenance of proper pH and uniform stock temperature are basic for slime control. A constant amount of chlorine is continuously dosed in the fan pump and sometimes in the wire and seal pits also to keep slime off the wet end. Chests should be cleaned in rotation on a planned schedule to remove slime pockets.

Slime formation can be measured by the amount of deposit on a wooden or concrete panel placed in continuously circulating white water or stock. This panel which may be inspected by removal or through a transparent flowbox is known as the McKeown Unit.

Pitch Control

Pitch or resin accumulates in mill systems producing unbleached and groundwood type pulps particularly. Pitchy build-up is prominent in pickup, press felts, in couch and press shells, necessitating frequent cleaning—which is sometimes done with special high pressure pumps.

Pitch control is based on the assumption that Aluminium ions or complexes neutralise negatively charged pitch particles before they have a chance to agglomerate and thereby cause trouble. So, alum is added at several key points to be later neutralised with soda ash or lime to combat corrosion.

Draining of superfine (normally containing unusable fiber or crill as it is called) white water is useful in removing pitch. Fractionators (filters with nylon cloth) are being tried nowadays for trapping resin. Many felt washing compounds are in vogue for removing pitch. Control of pH and temperature of lumpbreaker roll shower is helpful in reducing pickup.

Prevention of Air Entrainment

Finely divided solids in white water and resinous materials in pulp are major causes for foam formation. Low consistency pulps cascading in the open at high velocity, oversize piping, leaky pumps, air suction in refiners, and turbulent 'falls' from screens, also are responsible for the taking in of air by stock.

Defoamants and gentle foam showers at appropriate places are useful in counteracting foam accumulation. Proper softening of water, thorough washing of pulps after bleaching, lengthening of stock inlets to chests, etc., are helpful also. Pressurised screening at headbox stage (with a two pump system) is standard practice nowadays to prevent aeration of stock. Vorvac and deculator systems for removing gas from stock are being used in some mills. The approach system of the stock at the slice, etc., also needs careful study.

Modern wirepit design has been directed towards the releasing of the air contained in the white water. The return from the savealls to the wirepit is submerged so that the white water enters below the water level. Then the white water flows along shallow longitudinal channels at the front and back sides of the pit at a velocity as low as one foot per second towards the couch pit to return up a middle channel to the fan pump suction 'silo' in which it descends at the rate of half a foot per second, leaving the foam at the top. The scum formed at the couch pit end is removed by a skimmer, a shallow tray which extends the entire width and is equipped with an adjustable flow dam.

References :

1. Boadway, J.D., p.p. Mag. Can., p. 184 Conv. 1954.
2. Bourke, A., Tech. Sec. Pro., C.P.P.R., p 157, 1957.
3. Brust Back, Svensk Pappersti-dning, Vol. 59, No. 9, May 15, 1956.
4. Dykes, J.T., T-63, P.P. Mag. Can, 2, 1963.
5. Greey, D.N., P.P. Mag. Can, Conv, 1961. T-117.
6. Papermaking Practice, Hardman & Cole, Manchester University Press, 1960.
7. Modern Methods of Mechanical Pulp Manufacture, K.H. Klemm, Lockwood Trade Press, 1959.
8. Lardieri, N.J., T-186, P.P. Mag. Can., No.3, 1960.
9. Pulp & Paper Science and Technology, Vol. 2, Ed., Libby, C.E., McGraw Hill, 1962.
10. Walker & Cholette, P.P. Mag Can., No. 3, 1958.

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