Application Note
pH in Wet End Stock Preparation

Pulp & Paper: Bleach Plant

pH control gets a lot of attention in bleaching processes however proper pH measurement in stock preparation is just as important to finished product quality.

The Process

After delignification and bleaching the pulp stock goes through final treatments leading up to the paper machine. The stock prep stages will vary by mill depending on the type of paper end product that is required; however nearly all mills will have some form of refining, chemical addition, and screening of the pulp. A typical first stage is to dilute the pulp and pass it through refiners. The refiners shred and flatten the pulp to improve its bonding characteristics. Chemical addition occurs downstream from the refiners. Common pulp stock additives include the following:

- Acids and Bases: Control of pH
- Sizing Agents: Water Repellent
- Dry strength Additives: Strength and Stiffness (starch)
- Wet Strength Additives: Linking of fibers (polymers)
- Fillers: Gloss, Brightness, and opacity (kaolin, TiO_2)
- Defoamers: Reduce foam and entrained air (surfactants)

Chemical additives are introduced at the mixing chest. As the name implies, the mixing chest allows proper blending of the chemical additives with the pulp. The next tank is referred to as the machine chest. The machine chest sets the stock consistency prior to the paper machine. The finished stock is pumped through the stuff box and final screening before it reaches the headbox. The stuff box maintains head pressure and allows air to escape prior to reaching the headbox. The headbox is the last point for final measurement before the pulp is spread out on the wire mesh of the paper machine for drying and rolling.

The Importance of pH

pH is measured throughout the stock preparation process. At the refiners pH control can have an effect on tensile strength (bonding) of the fiber. Higher pH levels (> 8pH) will improve the ability to shred the pulp and may save on energy costs to run the refiner.

pH measurement is done upstream of the mixing chest on incoming new pulp plus recycled “broke” pulp stock that may be blended in. These measurements allow feed forward control of acids/bases into the mixing chest. Maintaining pH levels close to neutral aids in the proper chemical reaction of additives and retention of fillers. Downstream measurement past the machine chest ensure that enough retention time has passed for the proper chemical reactions to occur.

The stuff box provides a final point for chemical addition thus pH is measured for setpoint control. The last measurement at the headbox ensures that the pH is correct prior to the paper machine. If the pH value is wrong at the headbox then off-spec paper will be manufactured at considerable expense to the mill.

Pulp Mill Stock Preparation

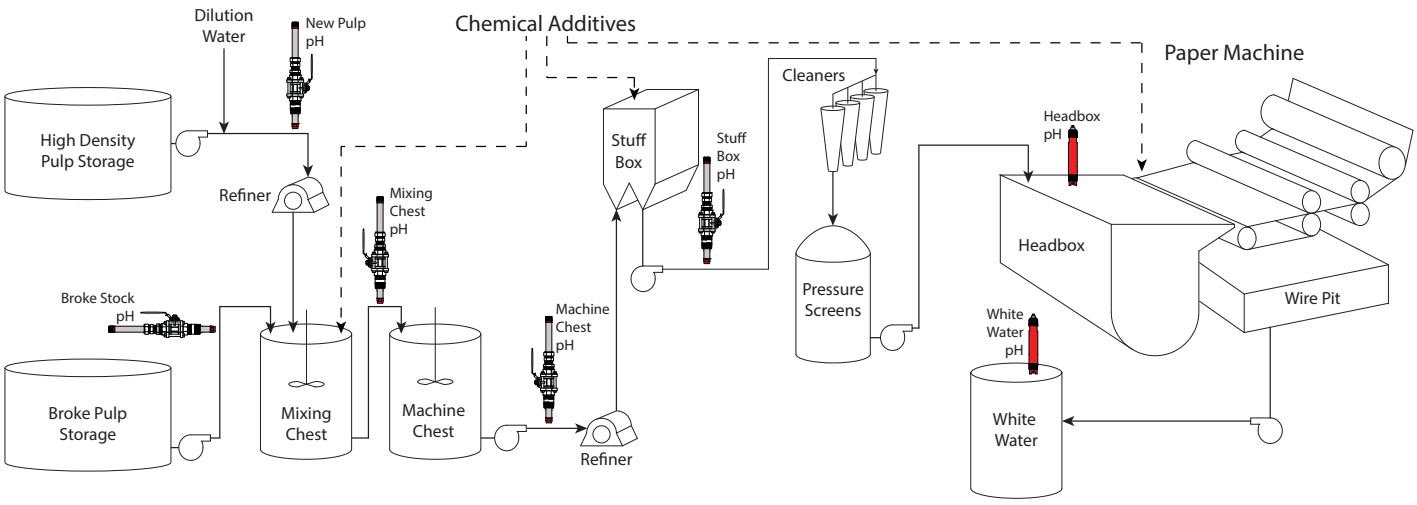

Figure 1

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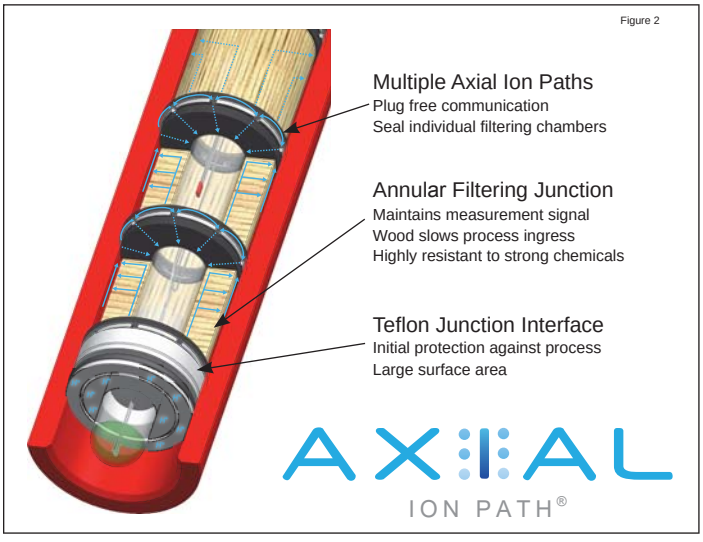
Solutions

pH measurement in stock preparation areas can prove challenging. The pulp stock can be abrasive to the glass electrode. For applications where the stock consistency exceeds 12% abrasion becomes problematic; thus Barben Analytical recommends our “CF” flat glass coat resistant electrodes. Our standard hemispherical “R” and “CR” glass electrodes are well suited for lower stock consistency applications below 12%.

Some additives such as colloidal silica (SiO_2) and defoamers can also cause measurement problems. SiO_2 aids in the dewatering of the pulp stock. It can also bond to the glass pH electrode thus hindering the measurement. The solution for silica coating is Barben’s “HR” and “FH” Silica resistant glass electrodes. These electrodes receive a special Nafion barrier that prevents silica coatings from occurring.

Defoaming chemicals can penetrate the reference of the pH sensor causing noisy readings and eventual loss of signal. The Barben Axial Ion Path® reference design provides highly effective against the clogging effects of defoamers. The reference consists of a large surface area Teflon interface followed by internal filtering chambers. The large surface area makes plugging much more difficult. The wood filtering chambers help to slow chemical penetration over time.

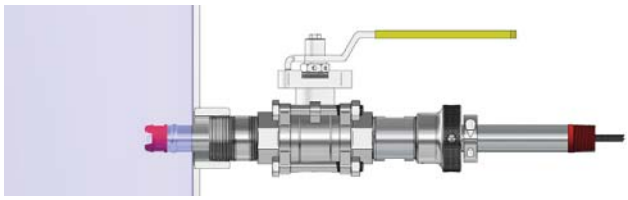


The illustration on the proceeding page shows two styles of Barben Performance Series pH sensors. For installation in pipelines the Barben 547 cartridge style pH sensor is highly recommended. The 547 sensor is a retractable “hot tap” design for installation directly into the process. The electrode tip should protrude at least 1/2” beyond the inside pipe wall to ensure that there is adequate flow past the sensor.

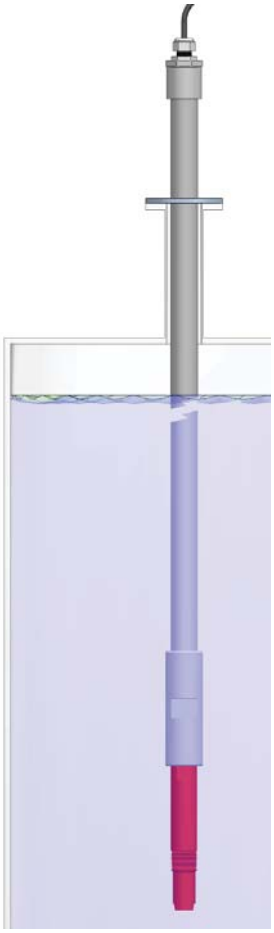
For measurements in the headbox, chests, and tanks the Barben 546 threaded sensor is a good choice. This sensor uses 3/4” male NPT threads on both the front and rear of the sensor body thus providing some versatility on how it will be mounted.

Barben pH sensors will easily connect to most analyzers in use today, Wiring diagrams for commonly available instruments can be found on www.BarbenAnalytical.com or via request from technical support.

Installation Examples



547 retractable pH Sensor mounted on side of vertical pipeline



546 pH Sensor mounted on dip tube into a vessel

Figure 3

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