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Retention definitions

Scope

Define the meanings of the retention terms commonly used in the papermaking process: overall, true, and first-pass retention.

Significance

The significance of the first-pass retention number is to provide a measure of the solids out of a process, compared to the solids going into the process at any given time and under the conditions of that time only. The higher the retention number, the higher is the proportion of solids held in the wet web of paper and the fewer the solids lost to the surrounding systems. It is a value the papermaker can use to determine process variability over extended measurement time intervals and to identify upset conditions within the processes being followed. High retention is not better than low, and low is not better than high, but each machine and process will find a level that is best for the maximum efficiency, best cleanliness, and lowest cost.

Safety precautions

There are no specific safety precautions associated with this TIP.

Definitions

In a stable papermaking system at steady state, equilibrium solids retention is the percentage of solids delivered from a process versus those that entered that same process. Lost solids in this calculation could include sewer losses, cleaner/screen losses, chest overflows, save all losses, spills, felt cleaning removal, dryer blade cleaning losses, and many more. However, different segments of the industry use different measurement and testing techniques, making it important to know terms and methods used for a better understanding of the numbers presented. The following definitions will help to clarify the techniques used to approximate the steady state or equilibrium solids retention of the paper machine, illustrate their relationship to one another, and highlight variables that should be considered in any comparison.

1. Overall (or “True”) Retention

Any paper machine system can have an overall retention, such as the paper machine itself, the short loop, the press section, the screens, the saveall, etc. This term refers to the portion of the tonnage per unit time exiting the defined process when compared to the total tonnage entering that same process. This term is more often than not used to mean the retention of the entire paper machine and/or a process system that will include more than one in-and-out flow. The equation below is given as a representation for this calculation of the solids retention for the entire paper machine system.

$$\text{Overall \% retention} = \frac{\text{Tons per minute at the reel}}{\text{Tons per minute into stock storage}} \times 100$$

True retention is a term no longer heard within the industry very often, and when it is used, it is used to define retention the same way as the overall retention definition. “True” does imply that there is a false retention, but “true” came to be used over many years of retention calculations. A second example is given below to further represent overall and true retention.

$$\text{Saveall \% retention} = \frac{\text{lbs/min of mat stock sent forward to the PM}}{\text{lbs/min sweetener stock} + \text{lbs/min of white water solids}} \times 100$$

2. First-pass retention

First pass retention is defined by

$$100\% \times (\text{HB} - \text{WW}) / \text{HB}$$

where HB is the filterable solids content at a given time in the headbox and WW is the filterable solids in the white water or “tray water” that flows through the forming fabric (WW is sometimes a combination of tray and press section filterable solids). This value is a measure of the proportion of solids being retained in the forming section at any instant in time. Since the WW solids sample can be collected at many locations down the forming fabric or from the off-machine silo, the retention value will depend on sample location. It is recommended to be consistent in sample location, and if possible, one should collect the white water sample from a combined water sample location such as the off-machine silo. If the silo is used, be consistent with respect to sampling location within the chest. Process status and chemical flows should be recorded when the retention samples are collected.

Keywords

Retention, Nomenclature

Additional information

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Reference

TAPPI T 269 “Comprehensive Retention Evaluation for Paper Machines” (currently withdrawn).

