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IDM instruments

Understanding and Using the ERIC Measurement

The ERIC (Effective Residual Ink Concentration) measurement has become a paper industry standard for the measurement of residual ink in recycled pulp and paper using recycled pulp. The interpretation of the results obtained from the ERIC measurements is not uniform among all of the users. The purpose of this paper is to clarify some of the basic questions about the ERIC measurement and to make this a more useful tool for the recycled pulp and paper industry. Specifically this paper will address the following subjects:

1. What exactly is the ERIC measurement?
2. How is the ERIC measurement used in practical applications?
3. What is inkless brightness?
4. How is inkless brightness used in practical applications? What are the absorption measurements and how are they used?
5. What is the difference between ERIC and dirt count? What does this mean to the pulp and paper maker?
6. How is the ERIC measurement properly made?

1. What exactly is the ERIC measurement?

The ERIC measurement takes advantage of a fortuitous situation – of all the various components that are found in recycled pulp, ink and only ink absorbs light at 950mm.

ERIC is a measure of the darkening effect of the remaining ink in a paper sample, not the actual amount of ink. Subvisible ink particles have a large affect on the visual appearance of paper because the number of particles can be quite numerous and the surface area of these particles is maximized, which causes the ink particles to become very effective absorbers of light energy.

Consider the following analogy: A lump of sugar is dropped into a glass of iced tea. If the tea is tasted immediately, the effect of the sugar is very slight. However, if the tea is stirred for a period of time, causing the sugar to be dissolved and dispersed, its effect upon the taste of the tea is much greater. Note that in both taste tests, the same amount of sugar is present. The effect is the same when ink is dispersed rather than agglomerated. Applying this analogy to the ERIC we find:

- If all residual ink particles are agglomerated into a few large specks, its affect on the overall reflectance (i.e. the appearance) of the paper is relatively small. The paper would appear brighter or lighter, resulting in low ERIC readings.
- If all the ink particles are uniformly distributed or dispersed in the sheet, the effect of the particles is much greater and the overall appearance of the sheet is much darker than when the particles were agglomerated, and the ERIC readings will be much larger. (This affect is not clearly shown through the effective black area on dirt counters.)

The ERIC reading measures the overall darkening affect due to the residual ink, not the actual amount of ink present.

2. How is the ERIC measurement used in practical applications?

The ERIC measurement is one process tool for optimizing the ink removal process in recycling. ERIC measurements made after each stage in the deinking process allow for standards to be established for monitoring the process and early detection of upsets in the process. When a floatation cell's efficiency (in terms of ink removal) suddenly goes down indicated by rising ERIC readings, action must be taken to correct the situation quickly. The ERIC reading provides an unbiased, consistent measurement of the recycling process.

The ERIC measurement is also a good tool for evaluating process changes and improvements. Some of the questions that are commonly evaluated using the ERIC measurement include:

- Which sequence of bleaching and ink removal works best in my mill?
- Where are the most effective chemical addition points?
- What throughput levels and wash water flows provides the best results?
- Which chemicals in which combinations are the most effective?
- Have I met my commercial promises to my customers?

3. What exactly is inkless brightness?

Inkless brightness represents what the potential brightness of the sample would be if all of the residual ink were removed.

4. How is inkless brightness used in practical applications? What does the absorption measurements at various wavelengths mean and how are they used?

Without bleaching of some kind, inkless brightness represents the maximum brightness that can be achieved through ink removal. If the target brightness that has been entered by the operator is greater than the computed inkless brightness it is obvious that something in addition to ink removal must be considered.

If the inkless brightness is higher than the target brightness, the papermaker has to use his or her knowledge of the process and the absorption values at 457nm to determine how much more ink can be removed and how much bleaching needs to be done to obtain the target brightness. Many times this decision is based on the equipment limitations and the cost of deinking vs. bleaching.

The absorption @ 457nm can be useful for determining the next steps for processing recycled pulps. The "Residual Ink" absorption represents how much light energy is being absorbed @ 457nm by the remaining ink in the sample. The "Lignin & Dyes" absorption is representative of the light energy absorbed by the other chromophores in the sample.

The absorption total is simply the combined absorption from the "Residual Ink" numbers and "Lignin & Dyes". A target number can then be established by grade and quick reference can be made to a mills normal target number and the current situation to evaluate what the appropriate steps would be for further processing.

5. What is the difference between ERIC and dirt count? What does this mean?

ERIC is a measurement of the overall optical effect that residual ink, mostly of subvisible size, has on the appearance of the sheet. Dirt count measures the number and sizes of observable "spots" left on a sheet. Put another way, dirt is a small-scale phenomenon where ERIC is an overall appearance impression from a sheet.

Perhaps this is best expressed in the article "Measuring the Concentration of Residual Ink in Recycled Newsprint", by B.D. Jordan and S.J. Popson, Journal of Pulp and Paper Science, Vol. 20, No. 6, June 1994:

"In the event this concept is not clear, consider as an example two pieces of paper, both of which contain the same amount of residual ink. However in case (1) all of the ink is agglomerated into one large blob, and in case (2), the ink is broken down into small particles and is uniformly dispersed through the sheet. In the first instance the effective residual ink content, as measured by the ERIC 950, is going to be relatively low because most of the ink particles do not have the capacity for absorbing light because they are surrounded by other ink particles. In the second case, each individual ink particle has its light absorption characteristics nearly maximized; therefore, the effective residual ink content is going to be substantially higher."

6. How is the ERIC measurement properly made?

The ERIC reading is dependent on a good and representative sample for analysis. In addition to obtaining a representative sample, for the ERIC reading to be most effective the following elements should be present:

- The sample should be uniform in terms of ink distribution, formation, and basis weight.
- The opacity should be less than 97%. Note: The Kubelka-Munk Equations involve the reflectance of a single sheet with no paper backing (Ro) and the reflectance with infinite pad backings (R∞). Ro must be sufficiently smaller than Rx for meaningful results. (This is why the software asks you if the opacity is less than 97%.) If the sample opacity were over 97%, the formulas would try to divide by a number very close to zero, which causes accuracy problems. If the opacity is over 97% predetermined constants are used where needed for the calculations.
- The sample preparation process should insure that the ink is not dispersed on one side more than the other i.e. there should be not two-sidedness in the sample. See the attached Technical Information Bulletin # 132 entitled "ERIC Sample Preparation".
- The pH should NOT be adjusted, but should be noted and included in the report of results.

- The stored default values for ink absorption are for standard black flexographic and offset inks.
- Optical brightening agents (OBA's) can cause problems with the analysis. If working with a Color Touch the analysis should be done with the UVEX source, thus eliminating the fluorescent effect.

Conclusion

The ERIC measurement has many uses for R&D, process control, competitive analysis, and final product specification. If you have any further questions, please feel free to call Technidyne at (812) 948-2884 for further assistance.