WATER CLARITY – THE SOURCE OF THE PROBLEM!

A technical paper for closed loop mills or mills with little or no water discharge.

Enessco: A New Approach to System Balance

Over the last ten (10) years the ENESSCO family of environmentally friendly chemicals has been giving Paper, Board and Tissue mills the opportunity of operating under neutral Ph conditions and allowing mills to rethink the way in which they process waste paper and operate their systems. This has been made possible, mainly because of the combination of the cost effective treatment of the furnish with the patented ENESSCO products and the many ancillary benefits obtained over and above the primary functions of deinking, wax and stickies treatment which has meant that substantial benefits have been achieved.

The beneficial effects seen in waste paper stock preparation, during production and in the disposal of both solid and liquid effluent, have been the result in many cases, of adopting a new approach to balancing both the chemicals and the various components of each stage of the mill operation. As the action of ENESSCO helps to clean the whole system, one of the key factors to improving the "contamination problem" is to improve the water clarity. Since the water clarity can often be considered as the source of the problem, it is also necessary to consider all the components of the system design and their operation.

System Design:

The system design often allows the removal of rejects by screening and cleaning, where modern system designs incorporate both forward and reverse cleaning stages to account for the removal of lightweight and heavyweight particulate matter of different densities. However, the redirection of the "tailings" are often the key to the build up of stickie contamination within a particular control loop, and in some instances cleaner rejects can also be fed back into the system or are broken down by shear force and are carried with the water phase to the machine wire.

Another method of reject removal is that of flotation. While most mills deinking waste paper to produce recycled fibre, would now consider flotation cells to be an essential component of their system, many mills not normally in the deinked fibre market are investigating the removal of contaminants by the extraction of foam after chemical treatment of the furnish. [1,2]

Rejects such as ink, ash and stickies, can also be removed from the waste paper by washing. In this method the filler present in the waste paper is eliminated from the system in sufficient quantities to meet the product specification. Unfortunately, the act of thickening the stock is often confused with washing, and the removed water is often fed back into the system. This means that the water is not cleaned, and the filler is retained in the sheet often carrying the troublesome ink particles; which reduce the final brightness, the stickies; where are carried forward to later deposit on the wires, felts and dryer fabrics.

Increasingly mills are finding that they have a band of operating conditions within which they are forced to operate due to changes in the waste furnish. In fact these variations in the waste are responsible for affecting both the performance of the deinking plant and the water treatment plant often within a 24 hour period [(3)]. However, the treatment of the backwater is gaining acceptance as it has been shown that the use of ENESSCO buffers these negative effects.

The use of clarification of process streams on the waste paper treatment plant and paper machine in many cases is usually for fibre recovery to maintain the yield of the furnish. This is particularly true for printing and writings where the ash is considered as part of the yield of the waste paper. Unfortunately the fibre and ash recovered also usually carries the stickies and contaminants which have been gradually broken down by the attrition of the various pieces of equipment as the stock passes through the process. One school of thought is that the ash should be removed from the system as it has the capability of carrying many of the contaminants which are required to be removed from the system. The filler levels could then be later made up by the introduction of a "clean" source of loading to meet the paper specification.

In assessing how ENESSCO reacts in a system to give the ancillary benefits seen by many mills we must consider the following:

Firstly; we must look at the strongly anionic nature of the product, its ability to form crystalline complex salts, which cement together and act as a "builder" forming long anionic chains of high molecular weight. The long chain anions then sequester the "free" cations to form cation/anion bridges and produce a flocculating action of the fines. It is therefore likely that the chemistry involved, when applied to a deinking action does not rely on the traditional calcium floc mechanism of the saturated fatty acid soap system and operates at a lower Ph level [(3)].

Secondly; we review our mill experiences of operating with ENESSCO, where, the chemical action promotes the release of entrained air from the stock, by acting as a de-aerator reducing the amount of air in the stock but increasing the foams, thus allowing the mechanical action of flotation to be much improved. We have found that variations in the operational levels of deinking cells may be reduced as air is released from the liquid phase.

In the case of deinking flotation, one of the benefits of the operation of the system with ENESSCO-D is that it creates a different type of foam which is more dense and therefore carries more ink ash and stickies. The foam collected then lends itself to better sludge dewatering with resulting chemical cost savings because the fibres are not swollen due to the action of alkali and higher ash levels are present in the foams (see case study WT 002/4).

Similarly when ENESSCO-S is added to the system for the control of stickies, the contaminants are controlled by passivation and agglomeration. The natural turbulence of the system then allows the entrained air to be released and the foam normally present in the system can be used for the removal of the wax stickies and other contaminants.

In water clarification, such as in a dissolved air flotation unit, ENESSCO makes the entrained air rise without bursting the bubbles, and this leads to improved separation resulting in improved water clarity. This effect continues to give improvements later on in the system, because as any water containing ENESSCO will de-aerate more easily, the de-aerating effect can be used to utilize the mechanical design of the unit operation, and as this water is fed to a settlement clarifier the flocculated particulate material can settle more effectively to give further chemical savings (see case study WT 001/3/4).

Production Objectives:
In many cases the product specification dictates all the parameters for the operation of the recycled fibre plant and the paper machine. While the furnish yield will be governed by the contraries present and the desired reject rate to achieve the correct sheet appearance and colors stabilization from washing and flotation by chalk and clay removal to effluent. The incurred effluent losses should be such as to minimize the landfill waste by keeping the solids high. A combination of the ENESSCO chemistry and currently available polymeric technology allows a high solid content to be achieved, with reduced drain discharge.

The methods of control used on the paper machine may be governed by dryer capacity, mechanical speed limitation, ash or moisture content or even turbidity as examples. In fact there is sometimes a conflict between what a market expects and the financial constraints based on mill investments.

Chemical Additives & System Chemistry:
It is important that mills consider a balance between the use of dispersants used in the system, as they will tend to drive the particle size smaller. However there are areas where the use of caustic is necessary such as in "Drum Pulping" due to the low attrition action, or where heavily sized, wet strengthened and printed material is recycled. Strength additive use should be optimized by minimizing and interfering substances. In considering the charge in a system it is not enough to simply state cationic or anionic, the nature of the species needs understanding. When anionic absorbents or dispersants are used the system may move more anionic, but the level of stickies will reduce. Anionic coagulants may also impinge on the balance.

If a significant change is made to the ionic constituents a new centre line will need establishing for system balance.

Changing the Rules with ENESSCO:
In choosing to operate the mill under neutral conditions, many mills have to change the mill thinking to achieve results, as "going neutral" often highlights any shortcomings of the system and the efficiency of each unit operation.

One way to simplify the recycling operation is to make it easier to control by smoothing out the variations caused by the furnish. We believe that the mill can also stabilize the variability from waste paper by reducing the threshold level at which the machine will see a disturbance. This can be achieved by changing the chemistry of the system and removing the contamination as discussed earlier in this article.

After operating for a period of time under mill revised criteria, the mills are able to redefine their "best operating conditions", and optimize chemical use throughout the whole system to minimize costs. In particular the reduction of costly chemicals used in water treatment is achieved by using ENESSCO to act as a coagulating agent. The use of recycled fibre or the incorporation of a lower grade of waste will involve a new learning process as the new equilibrium level is reached.

The deinking plant described in case study WT 004 has been able to deink at a lower Ph value, to produce a cleaner deinked pulp with a higher yield. The water loop was closed up with a lower COD Kg load.

References:

1) S. Blum – "Vortex Ink Removal System", Paper, February, 34 (1995)
2) A. Harrison – "New Stickies Removal Chemistry Helps French Board Mill Reduce Sheet Breaks", Pulp & Paper, May (1993)
3) J. Anderson – "High Efficiency for Clean Deinking" Paper Technology, September, 13 (1993)
4) R.W.J. McKinney – "A Review of Stickies Control Methods, Including the Role of Surface Phenomena in Control", PIRA Conference, New Developments in Waste Paper Processing and Use. (1989)
5) Dr. A. Johnson – "Modern De-inking Systems – Design Aspects", Paper Technology, November, 20 (1994)
6) Results from trial work done at Celleco's lab in Atlanta Georgia (1997)