

Deinking of Waste Paper

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Waste paper can be recycled by deinking. Deinking of paper has been increasingly important primarily due to a number of factors such as (i) diminishing wood supply coupled with social concern over deforestation (ii) environmental pollution and (iii) greater global demand for paper.

RECYCLING OF WASTE PAPER

Basically, the recycling of waste paper can be done by reusing waste paper after pulping them by a machine called pulper and followed by removal of printing inks, a treatment specifically called 'deinking': The process of 'deinking' often involves a number of steps to produce a clean pulp from waste paper through the removal of printing inks and contaminants from the fibre substrate. A wide variety of chemical additives are used in the deinking process and this includes surfactants or deinking agents. The type of chemicals or process used depends very much on the type of inks and papers to be processed.

USE OF RECYCLED PAPER

About 80% of all waste paper comes from three main sources, *i.e.* newspapers, corrugated boxes and office papers. Most of the deinked papers are used in paper boards, chipboards and roofing materials where colour is not important. However, the waste papers which are deinked and used in newsprint, tissue or other bright grades are less than 20%.

DEINKING TECHNOLOGY

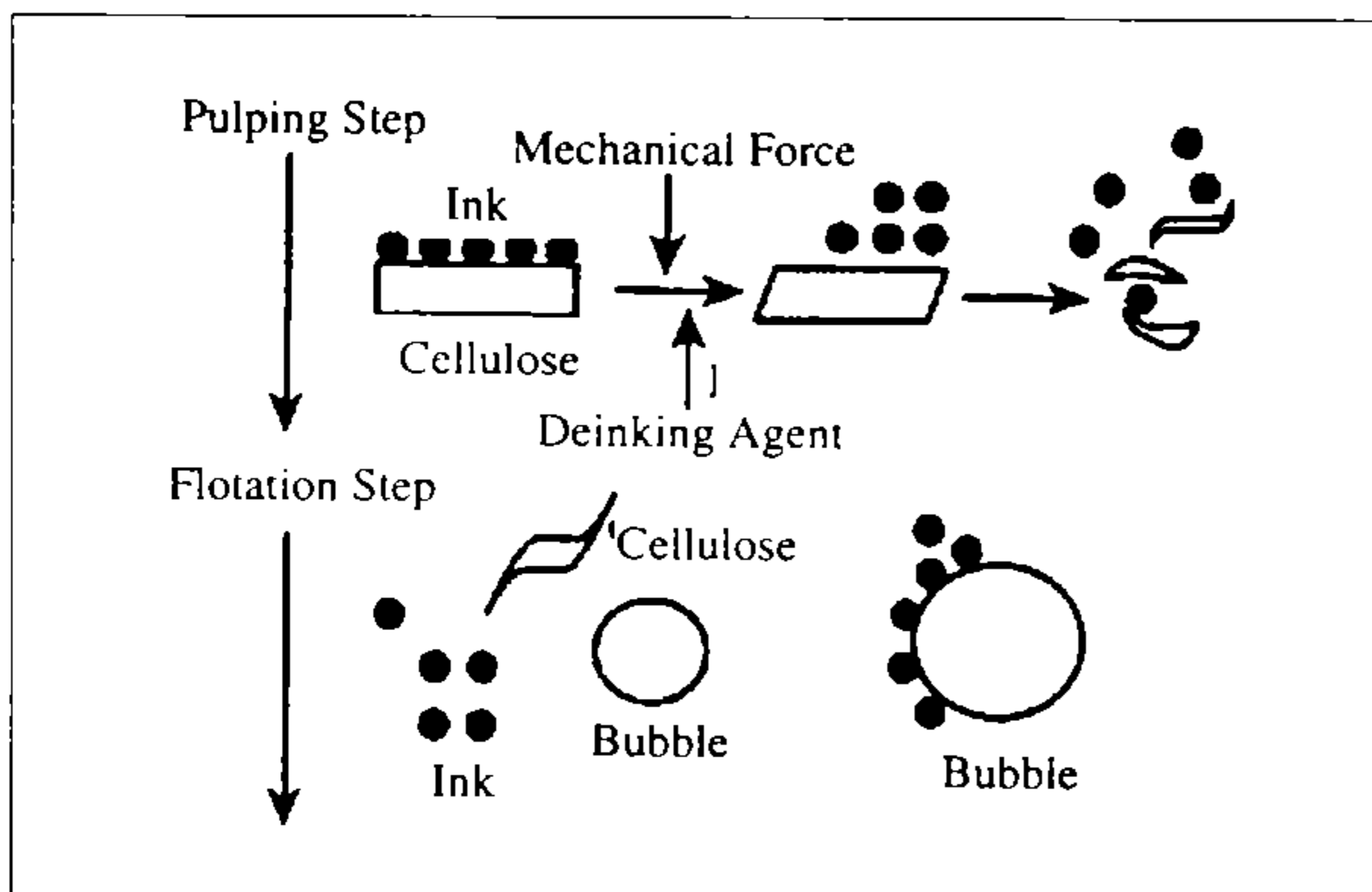
Generally, there are two basic methods currently in use for deinking newspapers *viz.*

- (i) flotation
- and (ii) washing.

In the flotation method, the first step involves pulping with the addition of deinking agents. The function of the deinking agent is to assist the mechanical separation of printing ink from the cellulose. The next step is flotation where the ink particles separated from the



Deinking of waste papers.



Schematic drawing of flotation.

cellulose is adsorbed onto air bubbles so that they can be removed from the system constantly. For effective adsorption, the ink particles must grow into homogeneous aggregates of 10–30 μm in diameter before contact with the air bubbles. Therefore, the main function of the deinking agent is to ensure a complete separation of ink from printed waste paper in the pulping step and ink aggregation in the flotation step.

However, in the washing method, the pulp slurry is diluted with plenty of water which is then subjected to repeated filtration and dewatering to remove ink particles from the system.

Nowadays, flotation method is more commonly used due to higher pulp yield, less waste water treating load resulting from less installation area and less use of reagents. This method is commonly practised in Europe and Asia. Several mills in North America also used this method.

MEASURING DEINKING PERFORMANCE

The most important characteristics of deinked pulp are paper brightness and the number of ink specks on a sheet surface. Brightness is measured by using a

reflectance device called brightness meter. The measurement of the number of ink specks is done by visual inspection of a unit area of paper under a magnifying lens. However, computer analysis of video images of paper surfaces is now more commonly practised and in this way the number of ink specks, their size and size distribution could also be determined.

Paper mechanical properties such as tear strength also needs to be determined in order to minimize the adverse effects of the recycling processes on the properties of the deinked paper.

The deinking performance can be improved in a deinking plant by using advanced technical equipment combined with an increase and an optimization of the deinking and bleaching chemicals.

DEINKING STUDIES OF NEWSPAPERS PRINTED WITH PALM OIL-BASED AND PETROLEUM-BASED INKS

Deinking of newspapers is very much dependent on the type of inks printed on it and the ageing process. For instance, one of the problems associated with the current deinking methods is that flexographic printed newspapers have been difficult to deink via the flotation

method. This is because a relatively large particle is needed for the ink to be effectively attached to air bubbles and removed from the froth since flexo inks are finely dispersed and their particles are much smaller.

It is generally reported that deinking is more difficult upon ageing and this is valid for mineral oil or vegetable oil-based inks. It is also obvious that high rub inks, whether vegetable or mineral oil-based will be a little more difficult to deink than conventional inks with a low rub resistance degree. On the other hand, a study from Western Michigan University, indicated that soy oil-inks are easier to deink than mineral oil-based inks even though it has a better rub-resistance. Perhaps this could be due to how the inks are made and the deinking methods used. It is also known that, American and Belgium paper recyclers have yet to experience any particular deinking problems involving newspapers printed with vegetable oil-based printing ink.

Some preliminary deinkability studies have now been carried out on paper printed with a palm oil-based ink and compared with those from a mineral oil-based inks. Several palm-based surfactants were also used for the study and some were found to be effective for deinking both the palm oil-based and mineral oil-based inks. The surfactants studied were palm-based α -sulphonated methyl esters (α -SME), palm-based soap, fatty alcohol ethoxylate (FAE) and linear

alkyl benzene sulphonate (LAS). The brightness of deinked newspapers was measured after deinking using simulated laboratory flotation method. The results generally showed that LAS is better than α -SME and calcium stearate when used for deinking newspapers printed with petroleum-based ink rather than those printed with palm oil-based ink. However, palm-based soap was found efficient in removing ink from paper printed with a palm oil-based ink. The deinked paper originally printed with palm oil-based ink was slightly greenish when FAE was used as deinking agent. It was also found that smooth cutting of the newspapers enhances the deinking process when compared to shredded paper. The unevenness and hairy edge of the paper can obstruct the ink to be floated by the air bubbles resulting in failure to produce good quality deinked paper of acceptable brightness.

CONCLUSION

Due to the low supplies of indigenous pulp resources, countries such as Taiwan, South Korea, United Kingdom, Japan and Germany are now extensively recycling waste paper for utilization via deinking. Increase usage of recycled paper can be expected due to the increasing volumes of newspapers, magazines, office waste paper and corrugated cartons and environmental concerns. In view of these factors, active research is in progress to improve deinking surfactants, bleaching chemicals, deinking process and equipment. ■