

A Simple Flotation De-Inking Experiment for the Recycling of Paper

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Flotation de-inking is used in paper recycling processes to preferentially remove hydrophobic contaminants such as inks and toners from a slurry of fibers in an aqueous phase. In the process, fine air bubbles are introduced into the suspension and the hydrophobic contaminants preferentially attach to the bubble-water interfaces and float to the surface. The foam on the top of the surface laden with contaminant is skimmed away resulting in the separation.

This article describes a laboratory exercise for the flotation de-inking of wastepaper. The exercise consists of disintegrating printed wastepaper in a blender and then removing the ink or toner contaminants by pumping air bubbles through the suspension using an aquarium pump (Figure 1) or other source of air bubbles. Foam is taken off the top of the container that is rich in ink (the reject sample) while the cleaned fiber remains in the container (the accept sample). After the experiment the accept and reject samples are analyzed for ink concentration and for fiber content.

Common, inexpensive equipment and no chemicals (other than a surfactant to enhance foaming) are needed for the exercise. The experiment is useful for middle or high school science courses or introductory-level college environmental, chemical engineering, or chemistry courses in need of a simple experiment that demonstrates, for example, concepts in separation technology, surface science, or mass balances. The experiment can be run as a demonstration, assigned as a lab exercise, or be used as the basis for an independent research project. The experiment has been executed hundreds of times in our department. It has proven to be extremely reliable and consistent in its performance. The removal efficiency of toner and the fiber yield of the process are both usually in the range of 60–80% and vary with the

wastepaper disintegration process, the type of paper, the type and quantity of foaming agent, and the type of toner or ink.

The laboratory demonstrates several phenomena involved in surface science, separation technology, and chemical engineering. One of the strengths of the lab is that it is visually stimulating; the students can easily observe surface science phenomena at work in an important technological separation process. The recycling aspects of the experiment are important, as students are motivated to learn about recycling and environmentally responsible processes.

This laboratory experiment description is the first known by the author pertaining to flotation de-inking for paper recycling (nonresearch). Relative to some related laboratory exercises in flotation separations (1–3), this laboratory experiment has several advantages including the use of common inexpensive equipment, simple methods for analysis, and safe and simple procedures. This, combined with the pertinence to recycling and the environmental conservation of resources, makes the experiment an enjoyable, educational hands-on experience.

A host of complementary information pertaining to the manufacturing and recycling of paper and many other paper making and paper recycling activities can be found at the following Web site: <http://www.cfr.ncsu.edu/wps/k12activities/lectures.htm> (accessed Feb 2004).

Hazards

Care must be taken in operating a blender. Never stick your hand into a blender cup that is installed on the motor. Always blend with the cover on.

Supplemental Material

A detailed version of the laboratory experiment, including questions and further activities, are available in this issue of *JCE Online*.

Literature Cited

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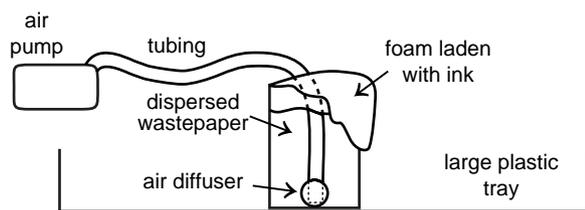


Figure 1. Schematic drawing of the laboratory flotation experiment.