

## Paper Recycling

by Carolyn Panuska

The purpose of this lab is:

1. To recycle newspaper or white computer paper.
2. To discover the problems inherent in paper recycling, including dye removal, waste disposal, water consumption.

### DESCRIPTION

The production of paper and paper products from virgin forests pollutes our streams, destroys our forests and habitat for woodland animals. Americans use 50 million tons of paper per year or 850 million trees. Much of this paper finds its way in the landfills where 36% of the space is occupied by paper. Recycling paper would not only save forests but also make more space available in the landfill for non-recyclable materials. Taking paper to a recycler isn't the whole story. As a society, we need to use and purchase recycled paper products. That means accepting paper of a coarser texture and perhaps an off-white color. Recycled paper is currently used for cereal boxes, paper towel and toilet paper rolls, some toilet and office paper.

### MATERIALS

• newspaper or computer paper • flour or corn starch • wire screen (window screen stapled to a wooden frame.) • blender or food processor • 400mL beaker • tray to fit under wooden frame • household bleach • glass stirring rod

### CAUTION

Wear goggles and aprons. Household bleach contains 5% sodium hypochlorite ( $\text{NaOCl}$ ), a skin irritant. It reacts with acid to evolve chlorine gas when heated. Toxic by ingestion. Avoid contact with organics.

### PROCEDURE

1. Tear paper into small pieces about 1 cm in diameter. (Do not mix newspaper and computer paper. Either may be used separately. It is interesting to compare the quality of the recycled paper that results from each. It is obvious why computer paper brings a better price from the recycling companies.)

2. Place paper pieces and 250mL of water and 50mL of bleach in the 500mL beaker. Allow the paper to soak for a few minutes until it becomes soggy. The bleach should help to remove the ink from the paper. The recycling companies use various chemicals to remove the inks. Some of these chemicals pose hazardous waste disposal problems.
3. Carefully pour off the water/bleach solution. The bleach solution may be poured down the drain with 10 fold excess of water.
4. Carefully wash the paper twice with clean water. Note the volume of water that is required.
5. Add 250 mL of water to the paper and pour into a blender or food processor. Blend on highest speed until the paper/water mixture is smooth.
6. Add about 10 grams of flour or corn starch. (It is interesting to compare the difference the two substances make in the quality of the paper.
7. Bind the paper/water/starch mixture until very smooth.
8. Pour the mixture over the screen. Be sure a pan is below to catch the water.
9. Use glass stirring rod to "roll" the paper out on the screen much like one would roll out cookie or bread dough. The thinner the "paper" the better. Try to get the "paper" as smooth and dry as possible.
10. Let the "paper" sit undisturbed for at least 24 hours. (More time may be required if the "paper" is thick.)
11. When the "paper" is dry, try writing on it. How does it compare to commercial paper made from virgin pulp? Note the texture, color and tear resistance.

#### COMMENTARY:

1. The bleaching process can require 20,000 gallons of water per ton of paper pulp processed.
2. Removing glues from such paper sources as telephone books, making the process more complicated, more polluting and more costly to the point of being uneconomical. Few recyclers accept telephone books for this reason. Perhaps in the future, the telephone directory will be on a personal computer disk and we won't use paper at all.
3. Adding flour/corn starch puts in some additional poly accharides that help strengthen the "paper". When the "paper" dries hydrogen bonds form between the cellulose fibers and the polysaccharides.

4. In order to make the smooth, white, high-quality paper, clays, waxes, resins are used.

5. Some problems students might encounter are: producing white paper, drying evenly and quickly, producing a thin, smooth sheet, producing a strong piece of paper.

#### REFERENCES

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