Bib Numbers

One commonality in many sports is the need to distinguish between individual participants during the race. Bib numbers have been used for decades to label the individual racer during track, skiing, swimming and other events. What should the bib number be made of? Considerations include strength, water resistance, and the ability to move with the racer. Three choices include paper, polyethylene, and Tyvek®, a fabric made from polyethylene. This activity explores the relevant features of each of these materials.

Comparison of Paper, Polyethylene, and Tyvek®

How do different kinds of polymers compare in terms of strength, flexibility, and water resistance? In this activity students compare the properties of three polymers: cellulose, a natural polymer that is used to make paper; polyethylene film, a synthetic polymer; and Tyvek ®, a nonwoven fabric made from polyethylene fibers.

Recommended Grade Level……4-12
Group Size……1-4 students
Time for Preparation……none
Time for Procedure……Part 1: 10 minutes
Part 2: 15 minutes (+ 5 minutes per day for 3-5 days)

Materials

Procedure, Part 1

- Per Group
  - Container of water
  - Sharp pen or pencil
  - 10-cm x 10-cm (4-in x 4-in) square of each of the following:
    - Paper
    - Low-density polyethylene film (sandwich bag or dry-cleaning bag)
    - Tyvek® (computer-disk sleeve or express-mail envelope)

Procedure, Part 2

- 3 transparent plastic cups
- Modeling clay
- Permanent marker or grease pencil
- Sharp scissors
- Graduated cylinder or tablespoon
- 10-cm x 10-cm (4-in x 4-in) square of the following:
  - Paper
  - Low-density polyethylene film
  - Tyvek®

Procedure

Part 1: Comparing Strength

Conduct each of the following tests on the squares of paper, polyethylene film, and Tyvek® and record your results.

1. Determine the comparative strengths of each polymer by trying to tear each sample.
2. Determine the flexibility of each polymer by bending each sample in the same place repeatedly.
3. Determine the puncture resistance of each polymer by pushing the tip of a pen or sharp pencil through each sample.
4. Determine the water resistance of each polymer by soaking a piece of each sample in water and shaking off the excess water.

Part 2: Comparing Permeability

Perform the following procedure with a new sample of each material.

1. Trace the cup rim into each polymer sample. Use sharp scissors to cut out the circle.

2. Pour exactly 30 mL (2 Tbsp) water into the cup.
3. Use rings of modeling clay to seal the polymer circle over the cup.
4. Mark the water levels on the cups with a marker or grease pencil, and then place them in a warm spot.
5. Observe and record the water level in each glass over a period of several days. Compare the rate of evaporation of water through the different materials and record these observations.

Material	Strength	Flexibility	Puncture Resistance	Water Resistance	Evaporation of Water
Paper					Day 1- 2- 3- 4- 5-
Low-density polyethylene					Day 1- 2- 3- 4- 5-
Tyvek®					Day 1- 2- 3- 4- 5-

Additional Observations: