

Student experiment  
(5th - 10th grade)

## Paper chromatography of felt-tipped pens

🕒 Time: max. 15 min.

### Safety:

safety glasses



### Instruments:

- felt-tipped pens
- round filter paper
- beakers, crystallization dish or marmalade jars

### Chemicals:

- ethanol (H: 225; P: 210)
- water

### Experiment:

- Punch a roughly 1 cm wide hole in the middle of the filter paper. Color the edges of this hole with a felt-tipped pen so that a complete circle results.
- Roll a second filter into a wick and stick it up through the hole.
- Place the filter paper and its wick over the mouth of a narrower vessel filled with a mixture of ethanol and water. The colored circle should face upwards and the wick should be placed so that its lower end is dipped into the water below.

### Observations:

The wick pulls the water upwards and allows it to expand on the filter surface. The colors in the ink begin to separate from one another in rings.

**Results:**

Paper chromatography is simply a variant of separation chromatography. The stationary phase is cellulose, which pure paper is composed of. As a carrier agent (the mobile phase), a solvent (or mixture of solvents like our ethanol-water mix) is used to dissolve the test substance.

Caused by capillary action in the cellulose fibers of the paper, the mobile phase moves through the paper, thus threading its way through the stationary phase.

Adsorption of the colored pigments takes place on the surface of the cellulose fibers themselves. The most-highly attracted pigments are quickly adsorbed upon contact with the fibers and do not travel far from the center before stopping. The more-loosely held pigments (and those with higher solubility in the solvent) are more quickly desorbed from the original colored ring and transported farther and faster by the mobile phase before finally being adsorbed. This results in a physical separation of the pigments in a series of rings at various distances from the center, based on both adsorption rates and ease of transport by the solvent. But other, colorless substances can also be separated using this method. However, the final separation becomes a problem at the finish. One solution is the use of spray able detection tests to identify the products. Spectroscopic methods are also used. Detection of substances can often be achieved through *fluorescence*, which occurs when they are irradiated by UV rays.

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**Disposal:**

The filter papers can go into the normal trash; the ethanol-water mix can be poured down the drain.

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