Which Liquid Works Best for Evaporative Cooling?

Experimental Procedure

This project follows the Scientific Method. Review the steps before you begin.

1. Fill a measuring cup with tap water and allow it to come to room temperature.
    a. The rubbing alcohol and the oil should also be at room temperature.
    b. This step is just to ensure that the liquids are at the same temperature at the start of the experiment.
2. Place four disposable plastic plates, with the up sides down, on a work surface.
    a. Use a waterproof surface (such as tile or laminate) since you will be using alcohol that could damage wood finish.
3. Fold each paper towel in half twice so that each has four layers.
4. Place a folded paper towel on top of each plate.
    a. The plates keep the towels from being in contact with the work surface, which would affect their temperature. You could also use Styrofoam™ or other insulating material.
5. Tape the edges of the paper towels to the plates.
6. Label the paper towels 1–4.
    a. In the next step, the paper towels will be treated as follows:
        - 1: no liquid
        - 2: water
        - 3: rubbing alcohol
        - 4: oil
7. Take the temperature of the paper towels with the infrared thermometer.
    a. Take three readings of each paper towel.
    b. Keep the direction and distance between the thermometer and each plate the same.
    c. Record the temperatures and times in a data table in your lab notebook. See Table 1 for an example.
8. Slowly pour liquid onto three of the paper towels. Pour just enough liquid to wet them completely, but not so much that the paper towels are completely saturated and liquid starts pooling on top or dripping from the sides.
    a. Pour water onto paper towel #2.
    b. Pour rubbing alcohol onto paper towel #3.

c. Pour oil onto paper towel #4.

9. Start the stopwatch.
10. Take the temperature of each paper towel, and record the temperature and time in your lab notebook.
11. Repeat the temperature readings three more times, at 2-minute intervals.
12. Which paper towel has the lowest temperature? What was the largest temperature difference between two paper towels that you noted? Record all observations in your lab notebook.
13. Repeat steps 1-14 two more times, with fresh paper towels, but you can rinse and reuse the plates. You will need a new data table for each trial. Average the results in your final report.
14. Repeat steps 1-15 three more times, only for these trials, with the fan gently blowing over the paper towels. Make sure you clearly label your data tables so you know which ones have data for the fan. If the plates or paper towels blow away, reduce the fan speed or move it farther away. You can also tape the plates down. If you do not have a fan, use a paper plate as a fan. Your helper can fan as you take and record the temperature at 2-minute intervals. Did the fan change the results? Why?
15. Based on your results, which liquid would you recommend for a building's evaporative cooling system? Remember that you may need to consider other factors beyond which liquid got the coldest. For example, would any of these liquids pose a safety or health hazard? Which liquid is the cheapest and most readily available?

	Dry			Water			Alcohol			Oil		
	Measurement #			Measurement #			Measurement #			Measurement #		
Time	1	2	3	1	2	3	1	2	3	1	2	3
0 minutes (before adding liquid)												
0 minutes (after adding liquid)												
2 minutes												
4 minutes												
...												

Table 1. Example data table.

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