Condensation Experiment

Written by Dr. Zhengyang Liu

1 Preferential condensation

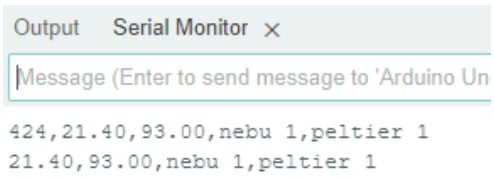
1. **Prepare**. Mature fungal culture, thermal paste, pretreated aluminum foil.
    a. **Check the status of fungus**: it should develop dark green hairy / powdery structures
    b. **Check the humidifier water level**: If not full, add using the syringe.
    c. **Create a log file** in the data storage folder, name it [month][date].txt, e.g. may17.txt. Use this template for an experiment log.

```
05172024
========

Image with the fungus/condensation setup for the first time.

Data list
---------
Exp1: 4V, 3 mm, 0.1 fps, [calibration]

Observations
------------
E.g. droplets are smaller near the fungal patch.

Problems/Questions
------------------[Things to be improved]
1. We don't know which part of the plate is being imaged.

2. ...
```

    d. **Turn on the power strips**. It should switch on
        i. water chiller (beep)
        ii. Nebulizer (check the fog coming out of the black tube)
        iii. relay Arduino (green indicator light turns on)
        iv. Power supply
        v. LED light (need to press the button on the cord)
        vi. Camera (the screen on top of the camera should turn on)

    NOTE: always double check if all of them are on …
    e. Adjust the following settings in the **camera software**:
        i. Exposure 1: Shutter speed: 1/125 sec
        ii. Exposure 2: ISO sensitivity: 2V over 6400
        iii. Exposure 2: Option: Normal
        iv. Storage: Image Area: DX (24x16)
        v. Storage: Image Size: Large (3936x2624)

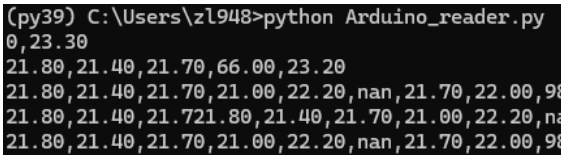
    Then, take an image to see if the quality looks normal.
    f. **Prepare a command prompt window** for the python script that controls the humidity and temperature.
        i. Open Command Prompt (Win+R, cmd)
        ii. Type `conda activate py39` (you should see (py39) in the next line).
2. **In the Arduino IDE**, open the sketch "multiple_dht_sensor_print.ino" (can be found here) and set the humidity range and temperature cycle according to the experiment design. By default we have



```
// User settings
// humidity settings
int h_low = 85;
int h_high = 95;
// temperature time cycle
long t_room = 20; // room temp time
long t_low = 20; // low temp time
```

If you change the target humidity, remember to **UPLOAD** the sketch.

3. Activate Arduino to **pre-humidify the chamber**: In the Arduino IDE, if you press Ctrl+Shift+M to call Serial Monitor. Later, we will use a Python script to read the data to a file. Make sure to **close the Serial Monitor** before running the Python script to avoid error.
4. **Cut a piece of treated Al foil** (~ 4 cm) using scissors. The treated foil papers are stored in the drawer (label later).
5. **Cut a small patch of fungus** (~ 2 mm) and, trim the agar, and put the fungal patch at the center of the treated aluminum foil.
6. **Load** the fungal patch and the aluminum foil to the sample plate. apply more thermal paste to adhere the foil if necessary.
7. **Adjust sample position** using the knobs of the linear stage. Lower the magnification of the lens to locate the sample, center it, then adjust the magnification to “2”. Move the sample, so that it only occupies ¼ of the left of the image.
8. **Calibrate**. Normally, we need to calibrate whenever we take images. However, if you make sure the magnification is set at exactly “2”, you may skip this step.
9. **Start recording.** A and b should start simultaneously.
    a. Run the “Arduino_reader.py” script (can be found here) by typing `python Arduino_reader.py` in the command prompt. It should start to show numbers delimited by comma, like below:



    a. In the camera software, exit “lv” mode, click “Camera->Interval Timer Shooting”. Set “Shots” as 180 and “Delay” as 10 seconds.
    b. **press On/Off button on the power supply.** You should see a non-zero number in the bottom display, which shows the current (A).
10. Once recording is **finished**, stop the humidity / temperature readings by Ctrl+C in the Command Prompt (or simply close the window by clicking “x”).

2 After experiment

1. **Log**. Make a list of data files generated, highlight the key observations and ask questions.
2. **Switch off the power strip**.
3. Toss away the fungus sample.
4. Convert time lapse images to a video using

   ```
   ffmpeg -framerate 25 -start_number [number] -i [filename]
   exp#.mp4
   ```

   E.g. [number] = 1000, [filename] = exp#\ Img%04d.jpg

5. Batch stack (folder prep):

   ```
   python stackshot_preprocess.py [image_folder] 11
   python stackshot_preprocess.py [image_folder] 11 -r 1 (reverse)
   ```

3 Fungus maintenance

Currently, we use the green mold I isolated from my beet sample as the model fungus for the condensation experiment. When growing on an agar plate, it forms a hairy / powdery green structure on the surface, and develops white / brown mycelium structure inside the agar gel. See the picture below for an idea of what the fungus looks like when growing on agar.

At different stages of growth, the physical properties of the fungus vary. For example, younger ones are more organic and hairy above the surface, while older ones are more stale and powdery. To make the experiment more consistent, **we reinoculate once a week, and use the sample on the 4-7 days after inoculation.**