UNIVERSITY OF SAN CARLOS

TALAMBAN CAMPUS

CHE3110L Laboratory Simulation of Industrial Product Manufacture

# Actual Conduct of Experiment (ACE): Production of Paper


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## PHOTO DOCUMENTATION


*Figure 1 Materials and Equipment*

*Figure 2 Weighing of raw corn husks*

*Figure 3 Washing of corn husks*

*Figure 4 Draining of washed corn husks*

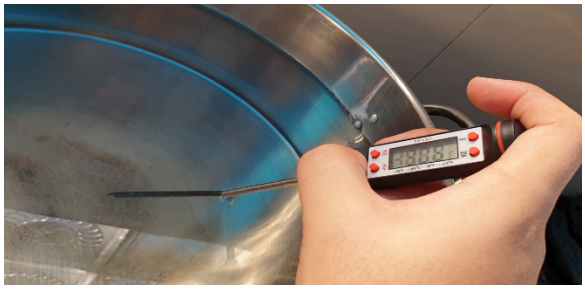

*Figure 5 Measuring of temperature of water*

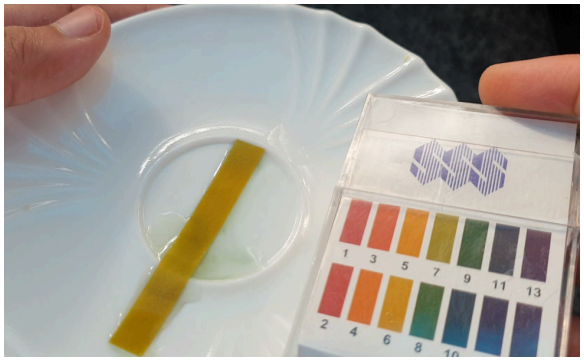

*Figure 6 pH test on water before making alkaline solution*

*Figure 7 Mixing of washing soda in water carefully*

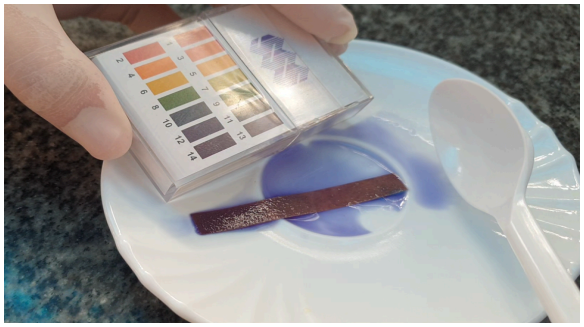

*Figure 8 pH test of alkaline solution*

*Figure 9 Corn husks after one hour of cooking*

*Figure 10 Corn husks after two hours of cooking*

*Figure 11 Washing of cooked husks*

*Figure 12 pH test after washing*

*Figure 13 Hammering of cooked husk*

*Figure 14 Pulping of cooked husk using blender*

*Figure 15 Corn husk pulp*

*Figure 16 Forming of sheets from pulp*

*Figure 17 Couching of pulp formed into sheets*


*Figure 20 Using an electric fan for drying*

*Figure 18 Pressing of sheets using heavy objects*

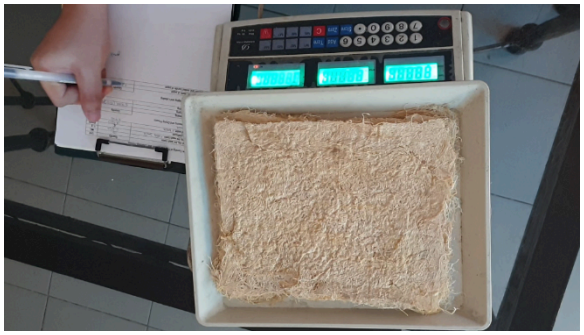

*Figure 21 Weighing of bundle of dried paper sheets made*

*Figure 19 Building of dryer stack for pressed sheets*

*Figure 22 Making of scrapbook and packing of papers product*


*Figure 23 Final products (Scrapbook and packaged product)*

## VIDEO DOCUMENTATION

Link for the short clip of the actual conduct of experiment:

https://drive.google.com/file/d/1JQzvXGu5TFfeUpcsmm-U7qg4jsBvO4kD/view?usp=sharing

Link for the google drive folder of the short videos of the actual conduct of experiment (all experiments):

https://drive.google.com/drive/folders/1baDEvNtOYWv4uZlR6s9HfqCxb6n0SwLF?usp=sharing

## DATA SHEETS

Table 1. Raw data from *Preparation of Fiber Source Process*

| | Quantity | Unit |
|---|---|---|
| Mass of raw street scorn with husks | | g |
| Mass of shucked corn cobs with kernels and some silk | | g |
| Mass of husks from shucking of corn ears | | g |
| Mass of removed unwanted parts | | g |
| Mass of corn husks | 0.420 | kg |
| Volume of tap water used in washing corn husks | 10 | L |
| Mass of cleaned and drained corn husks | 0.870 | kg |

Table 2. Raw data from *Pulping and Refining of Pulp Process*

| | Quantity | Unit |
|---|---|---|
| Mass of cleaned and dried large pot | 0.305 | kg |
| Volume of cold tap water used for cooking | 7 | L |
| Mass of pot with cold water | 7.87 | kg |
| Temperature of cold water in the pot | 30.3 | $^{O}C$ |
| pH level of cold water in the pot | 7 | |
| Total volume of soda ash added | 7.8 | tbsp |
| Total mass of soda ash added | 0.079 | kg |
| Mass of pot with alkaline solution | 7.949 | kg |
| pH level of alkaline solution in pot | 11-12 | |
| Temperature of alkaline solution in pot | 30.3 | $^{O}C$ |
| Temperature of boiling alkaline solution with corn husks | 91.1 | $^{O}C$ |
| Temperature of plant fiber with alkaline liquor | 60.7 | $^{O}C$ |
| pH level of plant fiber with alkaline liquor | 10-11 | |
| Mass of plant fiber with alkaline liquor | 7.701 | kg |
| Volume of water used in washing | 10 | L |
| pH levels of plant fiber while washing | Starts from 10-11 and after washing, pH level become ~7 | |
| Mass of washed and drained plant fiber | 1.175 | kg |
| Volumes of water added to blender per batch of drained fiber | 300mL per batch<br>X14 batches<br>4,200 mL | |

Table 3. Raw data from *Forming of Pulp into Sheets and Couching Process*

| | Quantity | Unit |
|---|---|---|
| Volume of water added into the wash basin | 10 | L |
| Mass of water added into the wash basin | 10.26 | kg |
| Total number of sheets produced | 5 | sheets |
| Mass of excess pulp and water | 13.950 | kg |

Table 4. Raw data from *Pressing and Drying Process*

| | Quantity | Unit |
|---|---|---|
| Mass of weight used in pressing | 31.15 | kg |
| Time and date of start of drying | 5:13 PM \| 15/11/2020 | |
| Time and date of end of drying | 3:00 PM \| 21/11/2020 | |

Table 5. Raw data from *Packaging and Labeling*

| | Quantity | Unit |
|---|---|---|
| Mass of bundle of dry sheets of paper | 0.100 | kg |
| Mass of packed and sealed bundle of paper | | g |

# APPENDIX

Date Started: 15/11/2020
Date Ended: 22/11/2020 → scrapbook making & packaging

## Raw Data Sheets

Table 1. Raw data from *Preparation of Fiber Source Process*

| | Quantity | Unit |
|---|---|---|
| Mass of raw street corn with husks | | g |
| Mass of shucked corn cobs with kernels and some silk | | kg |
| Mass of husks from shucking of corn ears | | g |
| Mass of removed unwanted parts | | kg |
| Mass of corn husks | 0.420 | kg |
| Volume of tap water used in washing corn husks | ~10 | mL |
| Mass of cleaned and drained corn husks | 0.870 | kg |

bought corn husks only!!

Table 2. Raw data from *Pulping and Refining of Pulp Process*

| | Quantity | Unit |
|---|---|---|
| Mass of cleaned and dried large pot | 0.305 | kg |
| Volume of cold tap water used for cooking | 7 | mL |
| Mass of pot with cold water | 7.87 | kg |
| Temperature of cold water in the pot | 30.3 | °C |
| pH level of cold water in the pot | ~7 | |
| Total volume of soda ash added | ~7.8 | tbsp |
| Total mass of soda ash added | 0.079 | kg |
| Mass of pot with alkaline solution | 7.949 | kg |
| pH level of alkaline solution in pot | 11-12 | |
| Temperature of alkaline solution in pot | 30.3 | °C |
| Temperature of boiling alkaline solution with corn husks | 91.1 | °C |
| Temperature of plant fiber with alkaline liquor | 60.7 | °C |
| pH level of plant fiber with alkaline liquor | 10-11 | |
| Mass of plant fiber with alkaline liquor | 7.701 | kg |
| Volume of water used in washing | ~10 | mL |
| pH levels of plant fiber while washing | Start: 10-11<br>End: 7 | |
| Mass of washed and drained plant fiber | (1.31 - 0.135) 1.175 | kg |
| Volumes of water added to blender per batch of drained fiber | 300 mL / batch<br>14 batches<br>4200 mL | mL |
| weight of cooked husk w/ strainer | 1.31 | kg |
| weight of strainer | 0.135 | kg |

~7.81949 US quarts
∴ use 7.8 tbsp. washing soda

took 35 mins to reach this temperature
boil @ 91.1°C for two hours

Neutralize with vinegar; it took 30 tbsp.

NNT-TTNL-1111



*Figure 24 Data tables page 1*

Table 3. Raw data from *Forming of Pulp into Sheets and Couching Process*

| | Quantity | Unit |
|---|---|---|
| Volume of water added into the wash basin | ~10 | mL |
| Mass of water added into the wash basin | (11.230 - 0.970) / 0.260 | kg |
| Total number of sheets produced | 5 | sheets |
| Mass of excess pulp and water (with basin 14.920 kg) | 13.950 | kg |

around: → 8.5" x 6.5"

Mass of wash basin: 0.970 kg
Mass of wash basin + water: 11.230 kg

Table 4. Raw data from *Pressing and Drying Process*

| | Quantity | Unit |
|---|---|---|
| Mass of weight used in pressing | 31.150 | kg |
| Time and date of start of drying | 5:13PM (15/11/2020) | |
| Time and date of end of drying | 3:00PM (21/11/2020) | |

Table 5. Raw data from *Packaging and Labeling*

| | Quantity | Unit |
|---|---|---|
| Mass of bundle of dry sheets of paper | 0.100 | kg |
| ~~Mass of packed and sealed bundle of paper~~ | | |

Weight in dryer stack:
Books: 6.870 kg
Dumbbells: 5.550 kg
12.420 kg

Mass of individual sheets:
0.015 kg
0.020 kg
0.025 kg
0.020 kg
0.020 kg
0.100 kg

granite slab: 8.755 kg

dishwashing gallon:
3.745 kg
3.845 kg
3.740 kg
3.835 kg
3.715 kg
3.515 kg
31.15 kg



*Figure 25 Data tables page 2*