Supplementary Information

Synthesis of handmade craft-paper from agricultural waste

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TAPPI test protocols

TAPPI T-258 om-02 is a test method developed by the Technical Association of the Pulp and Paper Industry (TAPPI) for determining the percentage of moisture in paper and paperboard.

TAPPI T-258 om-02: Moisture in Paper and Paperboard

Scope: This test method covers the determination of the moisture content of paper and paperboard.

Significance: The moisture content of paper and paperboard affects their physical properties and performance. Excessive moisture can lead to problems such as dimensional instability, reduced strength, and microbial growth.

Apparatus:

1. Oven

2. Analytical balance

3. Desiccator

4. Specimen container

Procedure:

1. Weigh the specimen container and record its weight.

2. Place a representative sample of the paper or paperboard specimen in the container and weigh the container with the sample.

3. Dry the specimen in an oven at a specified temperature for a specified time.

4. After drying, cool the specimen in a desiccator and weigh it.

5. Calculate the percentage of moisture content using the following formula:

$$\text{Moisture} = (W2 - W1)/ (W2 - W3) \times 100$$

Where: W1 = weight of the container, W2 = weight of the container with the sample before drying and W3 = weight of the container with the sample after drying

TAPPI T-211 is a test method developed by the Technical Association of the Pulp and Paper Industry (TAPPI) for determining the ash content of paper, paperboard, and pulps.

TAPPI T-211: Title: "Ash in Wood, Pulp, Paper and Paperboard: Combustion at 525°C"

Scope: This test method covers the determination of the ash content of paper, paperboard, and pulps.

Significance: The ash content of paper, paperboard, and pulps can indicate the amount of inorganic material present, such as fillers, sizing agents, and contaminants. It is an important parameter for assessing the purity and quality of the material.

Apparatus:

1. Muffle furnace
2. Desiccator
3. Analytical balance
4. Platinum crucibles

Procedure:

1. Weigh a clean, dry platinum crucible to the nearest 0.1 milligram and record its weight (W1).
2. Place a representative sample of the paper, paperboard, or pulp in the crucible and weigh it to the nearest 0.1 milligram (W2).
3. Place the crucible with the sample in a muffle furnace and ash the sample at 525°C for a specified time.
4. After ashing, remove the crucible from the furnace and place it in a desiccator to cool.
5. Weigh the crucible with the ash to the nearest 0.1 milligram (W3).
6. Calculate the ash content using the following formula:

$$\% \text{ Ash} = (W3 - W1) / (W2 - W1) \times 100\%$$

TAPPI T-207 is a test method developed by the Technical Association of the Pulp and Paper Industry (TAPPI) for determining the solubility of hot water in paper and paperboard.

TAPPI T-207: Title: "Water Solubility of Pulp and Paper"

Scope: This test method covers the determination of the solubility of paper and paperboard in hot water.

Significance: The solubility of paper and paperboard in hot water can indicate the degree of hydration and the presence of water-soluble components such as sizing agents, adhesives, and additives. It is an important parameter for assessing the quality and suitability of paper and paperboard for various applications.

Apparatus:

1. Beakers
2. Hot plate
3. Analytical balance
4. Glass rod or stirring rod

Procedure:

1. Cut a representative sample of the paper or paperboard into small pieces.
2. Weigh a clean, dry beaker to the nearest 0.01 gram and record its weight (W1).
3. Place the sample in the beaker and add hot water.
4. Stir the mixture using a glass rod or stirring rod until the paper or paperboard is completely dissolved.
5. Allow the mixture to cool to room temperature and then filter it through a fine mesh to remove any undissolved material.
6. Wash the filter with hot water and then dry it in an oven.
7. Weigh the filter with the residue to the nearest 0.01 gram (W2).
8. Calculate the solubility of hot water using the following formula:

$$\% \text{ Solubility} = (W2/W1) \times 100\%$$

TAPPI T-222 is a test method developed by the Technical Association of the Pulp and Paper Industry (TAPPI) for determining the acid-insoluble lignin content of wood and pulp.

TAPPI T-222: Acid-Insoluble Lignin in Wood and Pulp

Scope: This test method covers the determination of the acid-insoluble lignin content of wood and pulp.

Significance: Acid-insoluble lignin is an important component of wood and pulp and can provide information about the degree of delignification during the pulping process. It is an important parameter for assessing the quality and suitability of wood and pulp for various applications.

Apparatus:

1. Muffle furnace

2. Analytical balance

3. Desiccator

4. Glassware (beakers, flasks, etc.)

5. Filtration equipment (filter paper, Büchner funnel, etc.)

Reagents:

1. Sulfuric acid

2. Sodium sulfite

3. Sodium hydroxide

4. Distilled water

Procedure:

1. Weigh a representative sample of the wood or pulp to the nearest 0.1 milligram and record its weight (W1).

2. Place the sample in a glass flask and add a mixture of sulfuric acid and sodium sulfite.

3. Heat the flask in a boiling water bath for a specified time.

4. Filter the mixture through a Büchner funnel with a fine filter paper to separate the acid-insoluble lignin.

5. Wash the residue with hot water and then dry it in a muffle furnace.

6. Weigh the residue to the nearest 0.1 milligram (W2).

7. Calculate the acid-insoluble lignin content using the following formula:

Acid-Insoluble Lignin = (W2/W1) x100