Report on Mint Leaves: Moisture, Water Activity, Particle Size & Sensory Analysis

Submitted by – RAHUL KUMAR SAHU
Submitted to-DR SIDDHARTH SINGHA

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Title- Practical Report on Moisture Content, Water Activity, Particle Size Analysis, and Sensory Evaluation of Mint Leaves

1. Introduction

Fresh Mint Leaves

Mint leaves (*Mentha spp.*) are commonly utilized in various industries, including culinary, pharmaceutical, and cosmetic sectors, due to their distinct flavour, refreshing aroma, and medicinal benefits. The quality, stability, and usability of mint leaves depend on multiple physicochemical properties, such as moisture content, water activity, particle size, and sensory characteristics. Analyzing these factors is essential for ensuring freshness, extended shelf life, and consumer preference in mint-based products.

Significance of Key Parameters

1. Moisture Content:
    - Plays a crucial role in defining the freshness, texture, and stability of mint leaves.
    - Higher moisture levels can lead to increased microbial activity and faster spoilage.
    - Reduced moisture content helps in prolonging shelf life but may alter the texture and essential oil concentration.
2. Water Activity (aw):
    - Represents the amount of free water available for microbial growth.
    - A higher water activity value (>0.6) encourages the growth of mold and bacteria, while a lower value improves product stability.
    - Helps in determining the ideal drying and storage methods to maintain quality.

3. Particle Size Distribution:
    - Affects the texture, solubility, and extraction efficiency of bioactive compounds in food and pharmaceutical applications.
    - Smaller particles enhance flavour release and dissolution rate, whereas larger particles may retain more volatile oils.
4. Sensory Attributes:
    - Includes factors such as appearance, aroma, taste, texture, and overall acceptability.
    - Variations in moisture content and particle size can modify the sensory profile, impacting consumer perception.

2. Objectives of the Study

This study aims to:

- Assess the moisture content of mint leaves and its impact on quality and shelf life.
- Evaluate water activity (Aw) to understand its role in microbial stability and preservation.
- Examine particle size distribution and its influence on texture and processing.
- Conduct a sensory analysis to determine aroma, taste, texture, and overall acceptability.

3. Materials and Methodology

Materials:

1. Moisture Content Determination
   - Fresh mint leaves
   - Weighing balance
   - Hot air oven (105°C & 60°C)
   - Desiccator
   - Aluminium moisture dishes

2. Water Activity Measurement
   - Water activity meter
   - Sample containers

3. Particle Size Distribution Analysis
   - Mechanical sieve shaker
   - Standard sieves (ranging from 1 mm to 106 µm)
   - Weighing balance

4. Sensory Evaluation
   - Coded sample containers
   - 9-point hedonic scale questionnaire

Methodology:

1. Moisture Content Determination (Oven Drying Method)

1. Sample Preparation: Fresh mint leaves were accurately weighed using an analytical balance.

2. Drying Process: The sample was placed in a pre-weighed aluminium dish and dried in a hot air oven at 105°C for 24 hours. Additionally, two other samples were dried at 60°C with initial weight readings taken every 30 minutes for the first five intervals, followed by longer intervals after 8 hours until a constant weight was reached.

3. Cooling and Weighing: After drying, samples were transferred to a desiccator to cool to room temperature before reweighing.

4. Calculation: Moisture content was determined using:

$$\text{Moisture Content (\%)} = (\text{Initial } \textit{Weight} - \textit{Final} \text{ Weight/Initial Weight}) \times 100$$

2. Water Activity Measurement (Digital Hygrometer Method)

1. Sample Preparation: Fresh mint leaves were placed in sample holders.
2. Measurement: Water activity readings were taken after equilibrium was reached.

3. Particle Size Distribution Analysis (Sieve Analysis)

1. Sample Preparation: Dried mint leaves were ground into powder.
2. Sieving Process: A known weight of the sample was placed in a stack of sieves with decreasing mesh sizes and shaken for 2 minutes.
3. Weighing and Data Analysis: Retained material on each sieve was weighed, and percentage distribution was calculated.

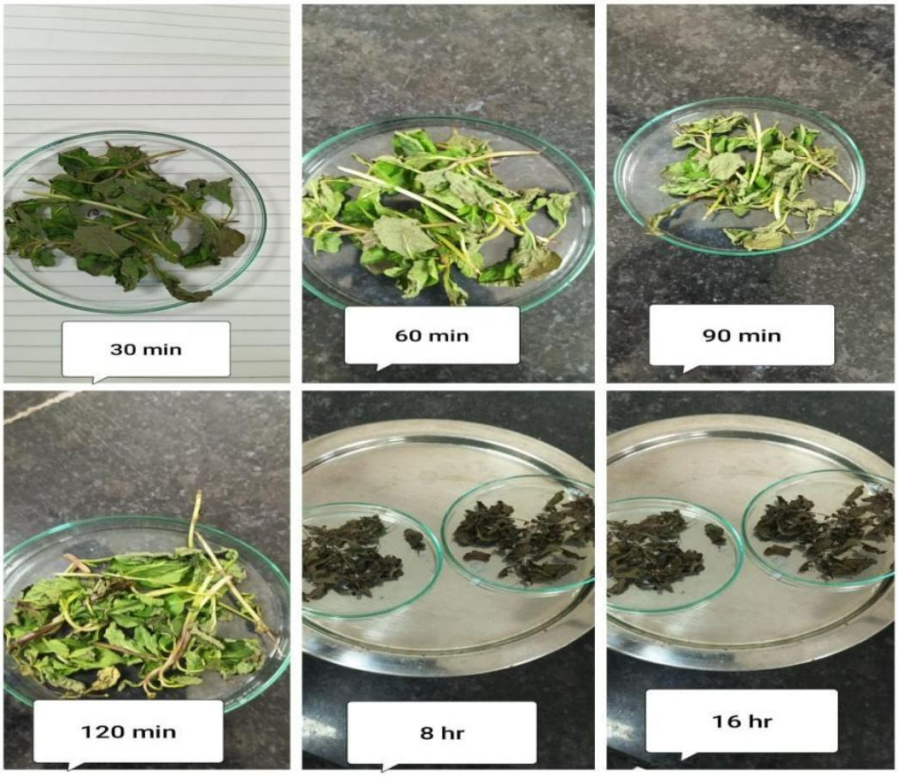
4. Sensory Evaluation (Hedonic Rating Scale)

1. Sample Preparation: Mint leaves were evaluated in dried form.
2. Sensory Testing Setup: Coded samples were presented to prevent bias.
3. Evaluation: A trained panel (n=6) rated attributes (colour, aroma, taste, consistency, overall acceptability) on a 9-point Hedonic Scale.
4. Data Collection: Scores were averaged to determine acceptability trends.

4. Result and Discussion

Results: 1. Moisture Content at 60^0 Celsius

For Sample1



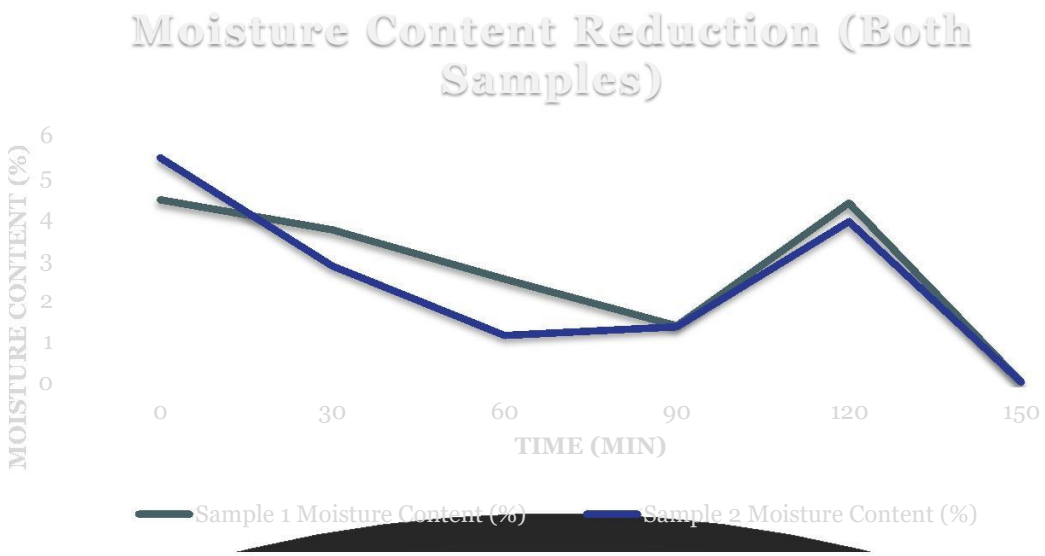
Dried Mint leaves at different intervals 60^0 Celsius

Time (min)	Initial Weight (g)	Final Weight (g)	Moisture Content (%)
0	48.2967	46.1565	4.431358664
30	46.1565	44.4494	3.698504003
60	44.9494	43.8258	2.499699662
90	43.8258	43.2277	1.364721237
120	43.2277	41.3458	4.353458546
150	41.3458	41.3458	0

For Sample2

Time (min)	Initial Weight (g)	Final Weight (g)	Moisture Content (%)
0	50.259	47.518	5.453749577
30	47.518	46.1777	2.820615346
60	46.1777	45.6555	1.130848873
90	45.6555	45.0432	1.34113086
120	45.0432	43.2845	3.904473927
150	43.2845	43.2845	0

Combined graph for sample 1 and 2:



Results: 2. Moisture Content at 105^0 Celsius

Sample	Initial Weight (g)	Final Weight (g)	Moisture Content (%)
1	51.284	44.285	13.65
2	50.987	44.3836	12.95

Dried Mint leaves at 105^0 Celsius

Sample 1 Sample 2

Results: 3. Water Activity (aw):

Parameter	Value
Method Used	Hygrometer/Huminometer
Measurement Time	20 minutes
Condition	After grinding and sieving
Temperature (°C)	21.7°C
Water Activity (aw)	0.466

Results: 4. Particle Size Analysis

Particle Size analysis

Sieve Size	Weight After Sieving (g)
106 µm	0.2203
250 µm	0.9979
600 µm	1.0603
1 mm	1.6748

Results: 5. Sensory Analysis (Hedonic Rating Test)

Prepared Test Infusion for Sensory Analysis

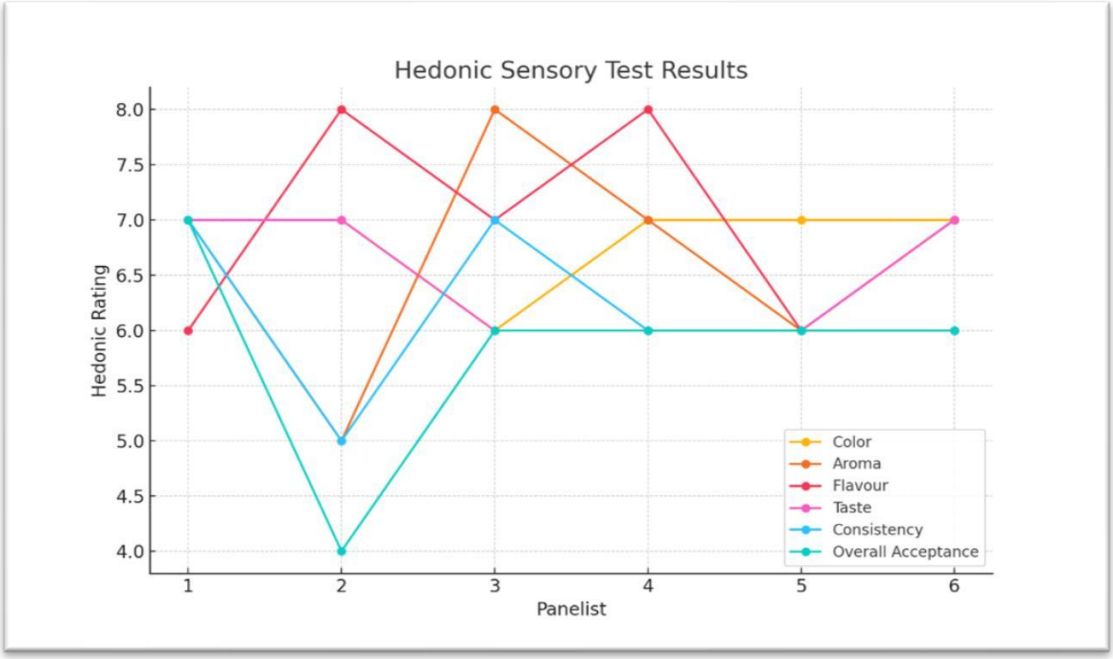
Panellist	Colour	Aroma	Flavour	Taste	Consistency	Overall Acceptance
1	7	7	6	7	7	7
2	7	5	8	7	5	4
3	6	8	7	6	7	6
4	7	7	8	6	6	6
5	7	6	6	6	6	6
6	7	6	7	7	6	6

Picture:1

Picture: 2

Sensory analysis

Hedonic Test Result Graph



DISCUSSION -

Tray drying is a method used to remove water from food to make it last longer. In this experiment, we studied how pudina (mint) leaves dry when placed in a tray dryer. We observed how fast the leaves lost moisture and how temperature affected the drying process.

At the beginning of drying, the leaves lost water quickly because moisture on the surface evaporated fast. But as time passed, drying slowed down. This is because the remaining water inside the leaves takes longer to come out. The drying rate kept decreasing as the leaves got closer to their final moisture level

Moisture Content (Oven Drying Method)

The amount of moisture in mint leaves affects their shelf life, freshness, and quality. Using an oven at 105°C helped measure the moisture content accurately, which ranged from 12.95% to 13.65%. Drying at a lower temperature (60°C) took more time. At first, the leaves lost moisture quickly, but the process slowed as they dried completely. This shows that oven drying is a good method for removing moisture while protecting important nutrients.

Water Activity (aw) Analysis

Water activity (aw) shows how much free water is available for bacteria and mold to grow. Fresh mint leaves had a high aw of 1.000, meaning they could spoil quickly. After drying, the aw dropped to 0.466, making them more stable and long-lasting. This proves that oven drying helps prevent microbial growth, keeping the leaves safe for storage. Keeping aw below 0.6 is necessary to avoid mold and bacteria, which is why proper drying and packaging are important.

Particle Size Analysis

A sieve test showed that most mint particles were around 250 µm, with some larger ones at 600 µm and 1 mm. The smallest particles (<250 µm) had a larger surface area, making them easier to mix in products but harder to dissolve. Larger particles held more essential oils, keeping the flavor strong but taking longer to release it. This shows that careful grinding and sieving are needed to get the best balance of aroma, solubility, and texture for different uses in food and medicine.

Sensory Evaluation

A taste test using a 9-point scale showed that people mostly liked the dried mint leaves. The drying process kept the aroma strong, with scores between 6 and 8. The color also stayed bright, meaning the leaves kept their natural green pigment. However, the smallest particles did not dissolve well, leading

to more residue in drinks. Overall, the leaves scored between 4 and 7, showing that oven drying keeps the important qualities of mint, but adjusting the particle size could make it even better.

Conclusion

This study confirms that oven drying is a good way to preserve mint leaves by lowering moisture and preventing spoilage. The moisture level and particle size affect the taste, smell, and how the leaves can be used. By improving drying conditions and controlling the size of the particles, the quality of the product can be further enhanced for food, medicine, and other industries.