



Unit III – Topic II

Moisture content – free moisture – Bound and Unbound Moisture

What is Moisture Content in Food?

Moisture content in food can be defined as any water within the food product. Excess moisture can get into the food from several sources such as the atmospheric moisture from the production and packing areas, packaging method or food storage.

Food and Moisture

Food is any substance consumed to provide nutritional support for the body. It is usually of plant or animal origin, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals. All foods contain solids, water and other chemicals. The moisture contained in a material comprises all those substances which vaporize on heating and lead to weight loss of the sample. The weight is determined by a balance and interpreted as the moisture content. According to this definition, moisture content includes not only water but also other mass losses such as evaporating organic solvents, alcohols, greases, oils, aromatic components, as well as decomposition and combustion products. The moisture content also called as moisture assays is one of the most important analyses performed on most of the food products. Table 1 gives the general idea about the moisture content of different foods. Water activity measurements parallel to the moisture content is also an important parameter for quality and stability of food.



Table 1: Water Contents of Various Foods

<i>Food</i>	<i>Water Content (%)</i>
Meat	
Pork, raw, composite of lean cuts	53–60
Beef, raw, retail cuts	50–70
Chicken, all classes, raw meat without skin	74
Fish, muscle proteins	65–81
Fruit	
Berries, cherries, pears	80–85
Apples, peaches, oranges, grapefruit	90–90
Rhubarb, strawberries, tomatoes	90–95
Vegetables	
Avocado, bananas, peas (green)	74–80
Beets, broccoli, carrots, potatoes	85–90
Asparagus, beans (green), cabbage, cauliflower, lettuce	90–95

Source: Fennema, O.R. in *Food Chemistry*, Marcel Dekker, New York, 1996, 17–94.

1.2 Types of bonding of moisture in the product

The moisture in food can be present in different forms which are decided by type of bonding with solids (Fig 1). It is available in following forms:

Free water: water on the surface of the test substance and it retains its physical form

Absorbed water: water in large pores, cavities or capillaries of the test substance

Water of hydration: Occluded in lattice ions or water of crystallization coordinately bonded to ions.

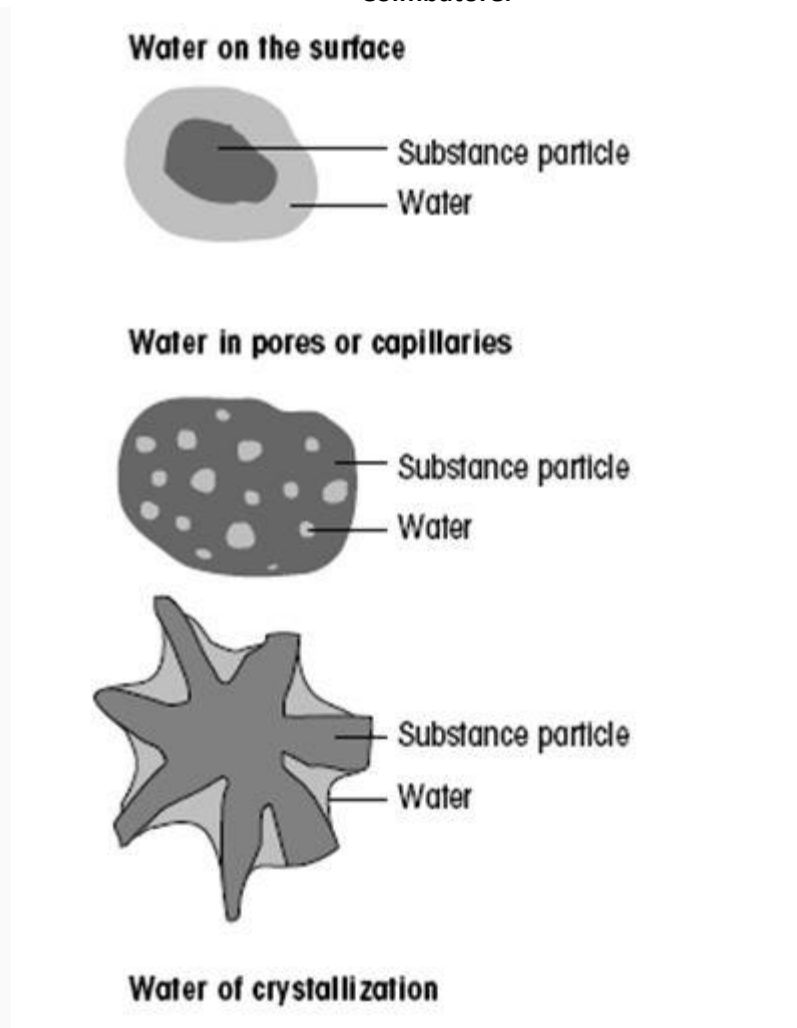


Fig 1.1 Types of bonding of moisture in food products

1.3 Estimation of Moisture Content

Moisture content is the quantity of water contained in a food material. Moisture content is used in a wide range of scientific and technical areas, and is expressed as a ratio, which can range from 0 (completely dry) to the value of the materials' porosity at saturation. It can be given on a volumetric or mass (gravimetric) basis. Moisture content is expressed as a percentage of moisture based on total weight (wet basis) or dry matter (dry basis). Wet basis moisture content is generally used. Dry basis is used primarily in research. The moisture content is expressed by following formulae.

$$M_w(\text{wet basis}) = \frac{w - d}{w} \times 100$$

$$M_d(\text{dry basis}) = \frac{w - d}{d} \times 100$$



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where, M is moisture content on a percent basis, w is total weight (also called as wet weight) and d is dry weight.

Based on the different forms of moisture present in the food the method used for measurement of moisture may estimate more or less moisture content. Therefore, for different food products *Official Methods* of moisture measurement have been given by agencies like AOAC (Association of Official Analytical Chemists), AACC (American Association of Cereal Chemists) and BIS (Bureau of Indian Standards).

1.4 Importance of Moisture Content in Foods

Proper moisture content is essential for maintaining fresh, healthy foods. If a food is too moist or too dry, it may not be suitable to eat and will not taste as good as it would if it had the correct moisture content. Most of the food products contain moisture. The moisture content per cent is seldom of interest. Rather, it shows whether a product intended for trade and production has standard characteristics such as:

1. Storability
2. Agglomeration in the case of powders
3. Microbiological stability
4. Flow properties, viscosity
5. Dry substance content
6. Concentration or purity
7. Commercial grade (compliance with quality agreements)
8. Nutritional value of the product
9. Legal conformity (statutory regulations governing food)

In addition to above characteristics, the determination of moisture content plays important role commercially with respect to following aspects:

1. Freshness

Fresh, ripe fruits and vegetables are moist to the touch. As they age and begin to rot, some dry out and some pick up excess moisture and begin to mold.

2. Labeling

Food industries require a minimum or maximum percentage of moisture on certain foods in order for them to be packaged and labeled. If they don't fit to these standards, the foods cannot be sold.

3. Cost



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In processed foods, the percentage of water in a product can determine its final price. Generally, a product with more water will cost less.

4. Processing

Biologists and manufacturers need to know the moisture content of food to ensure that it's processed and packaged in a safe, stable way.

5. Quality

Moisture content determines the way most foods taste, feel and look. It is one of the important ways to measure food quality.

6. Shelf life

Shelf life of product depends on its moisture content at the time of packaging and rate of moisture gain during storage which is also called as sorption isotherm study.