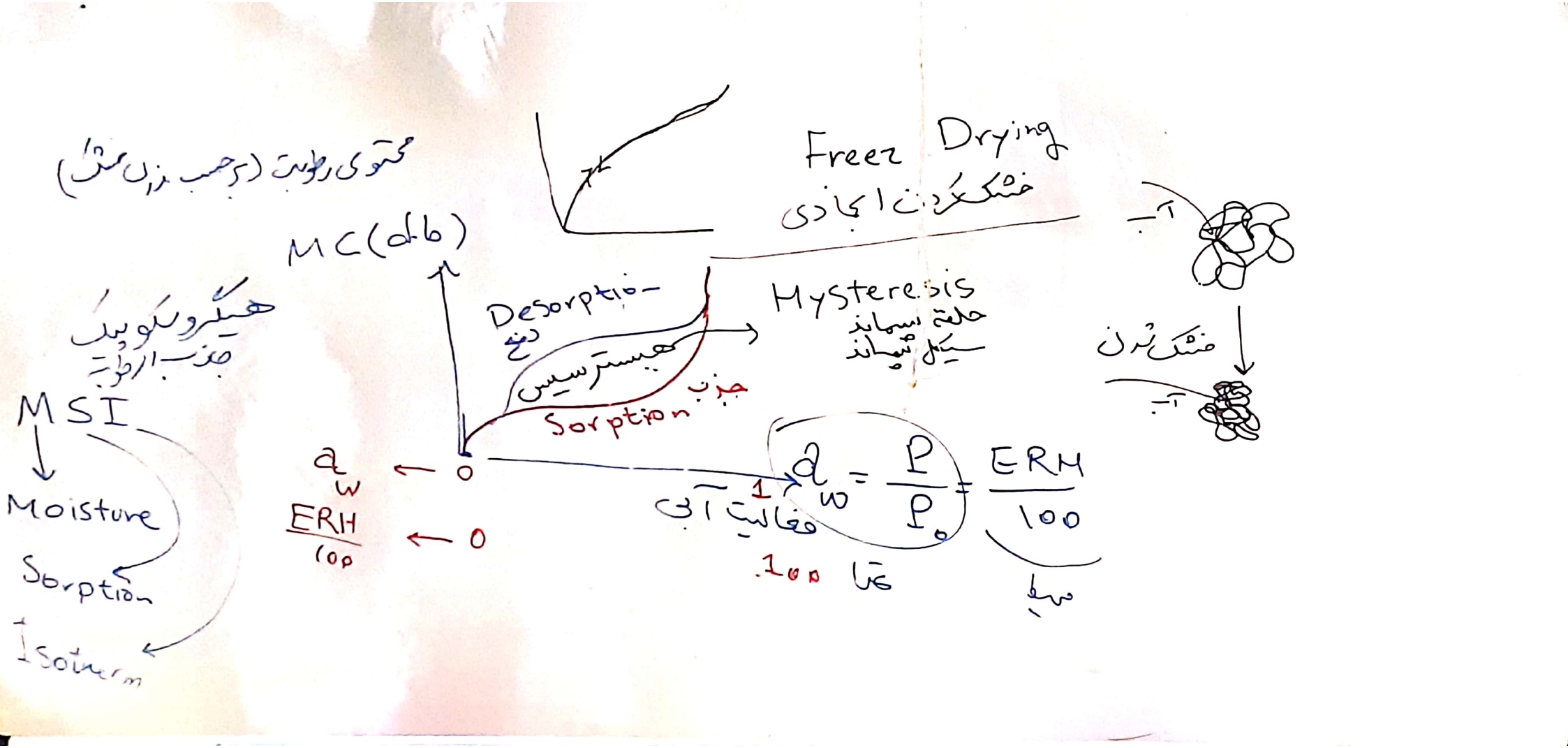
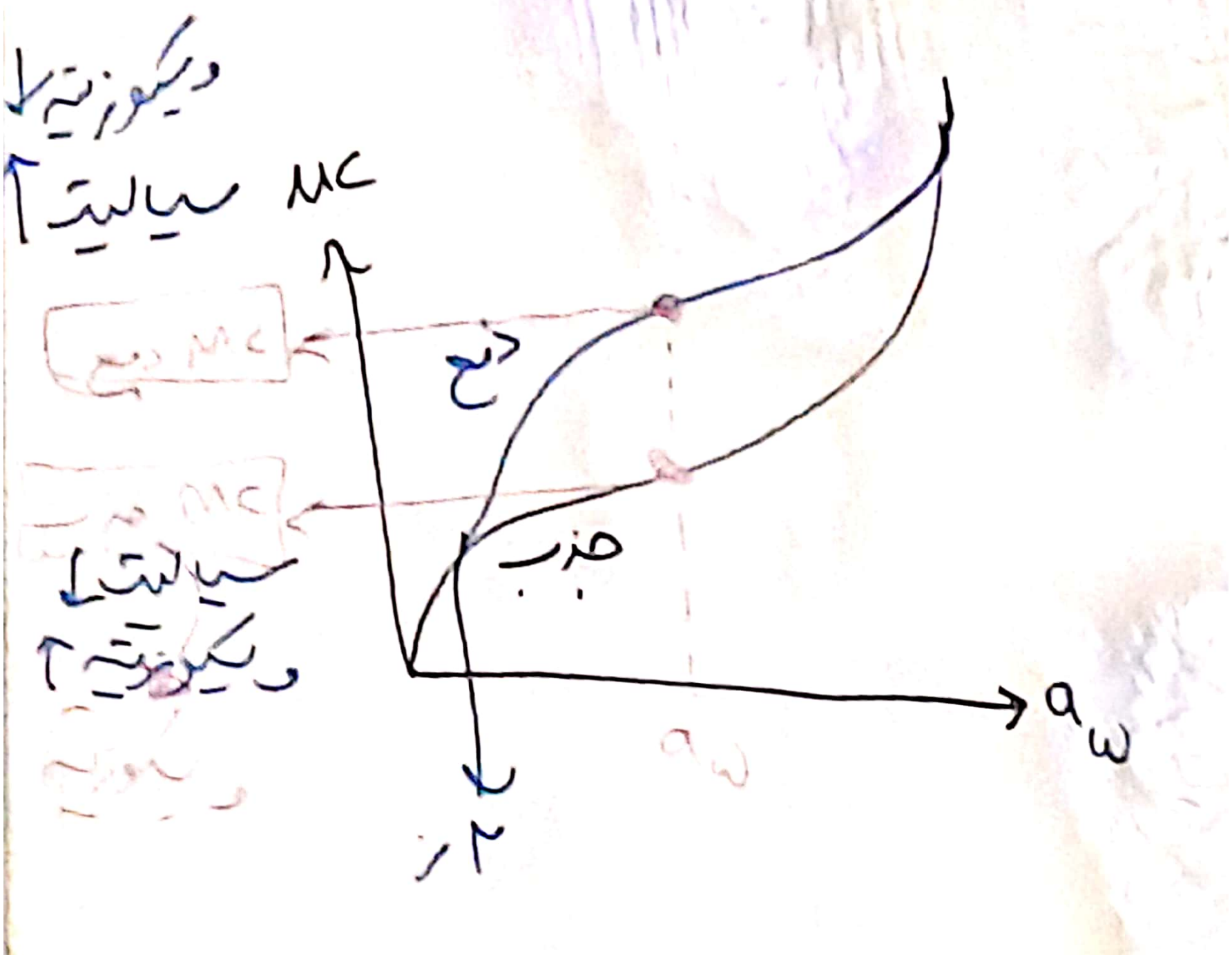
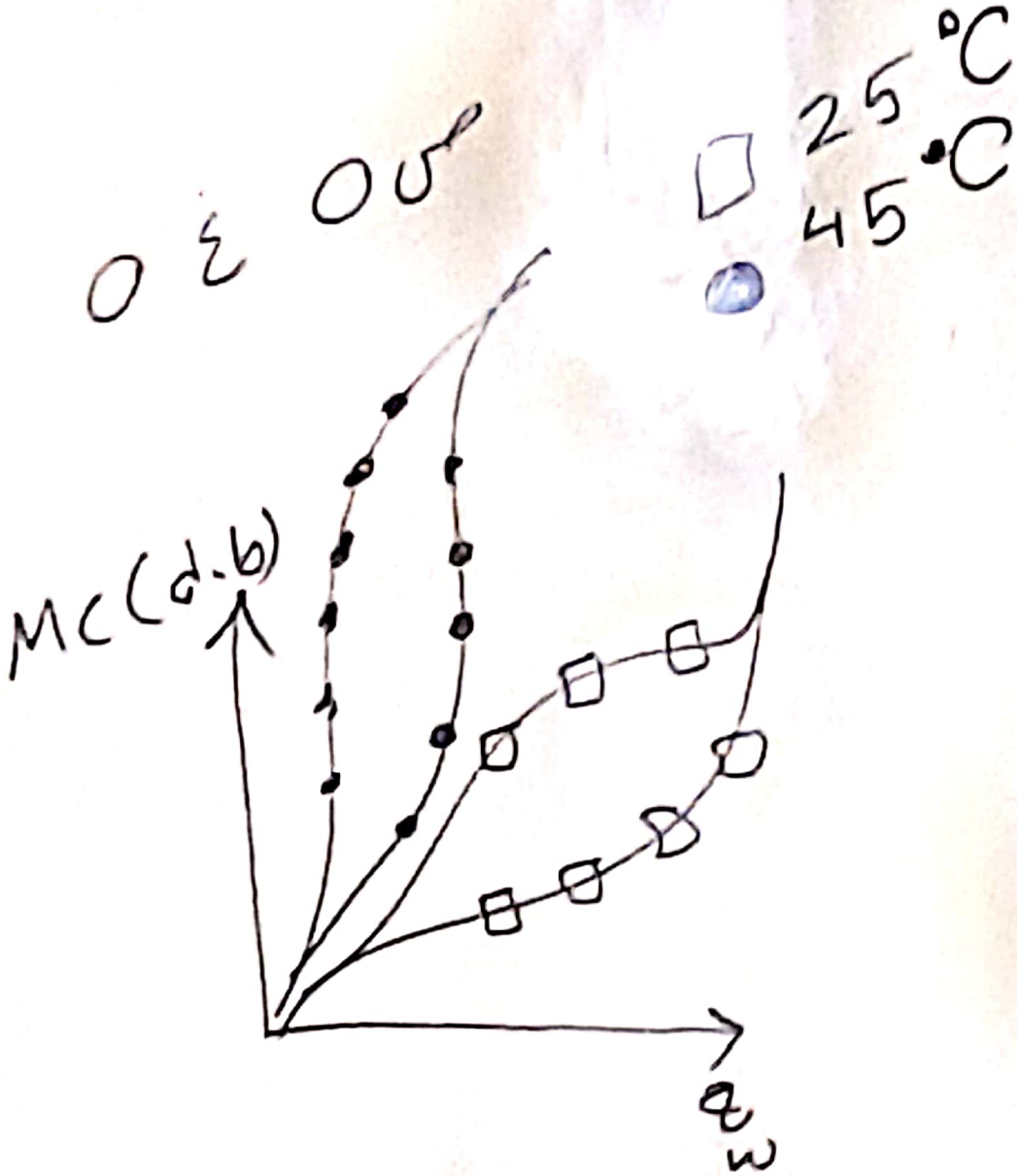
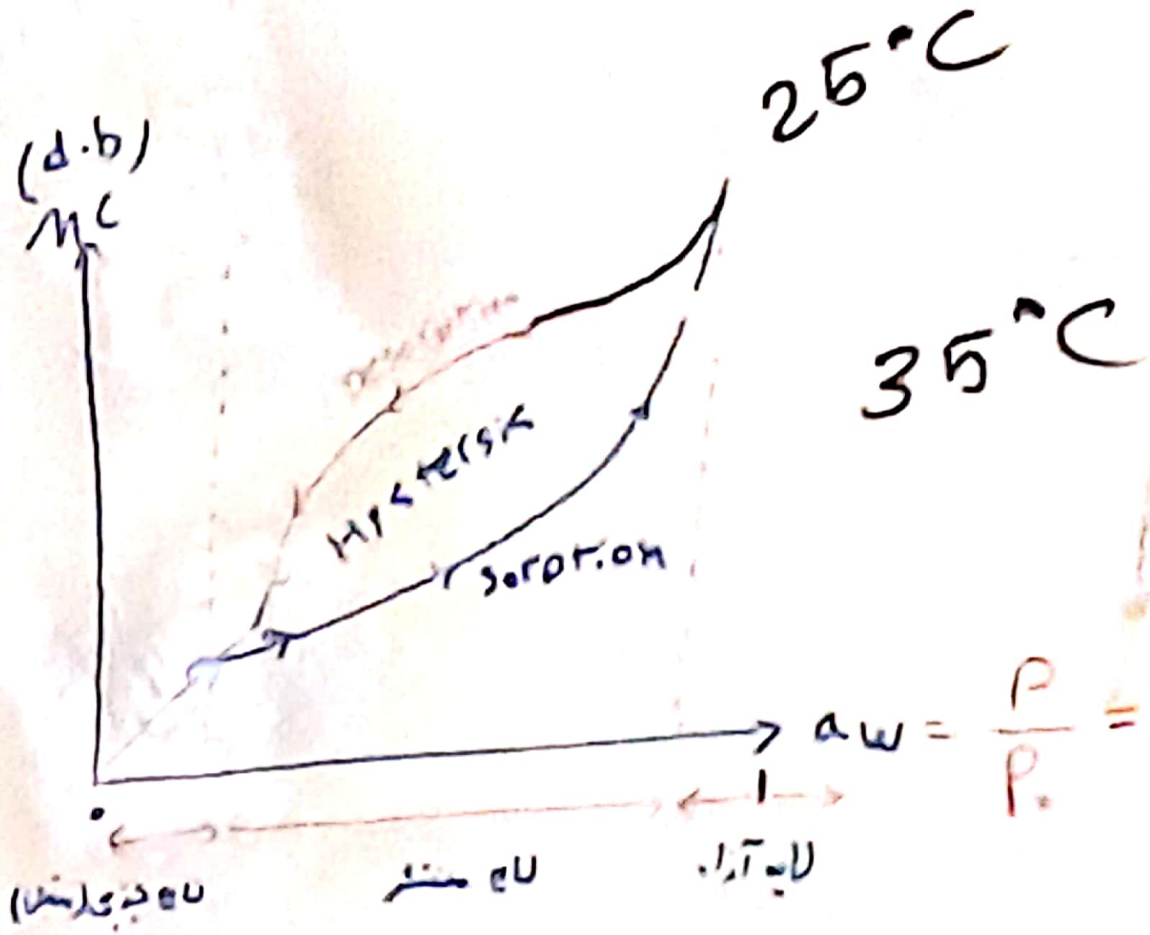
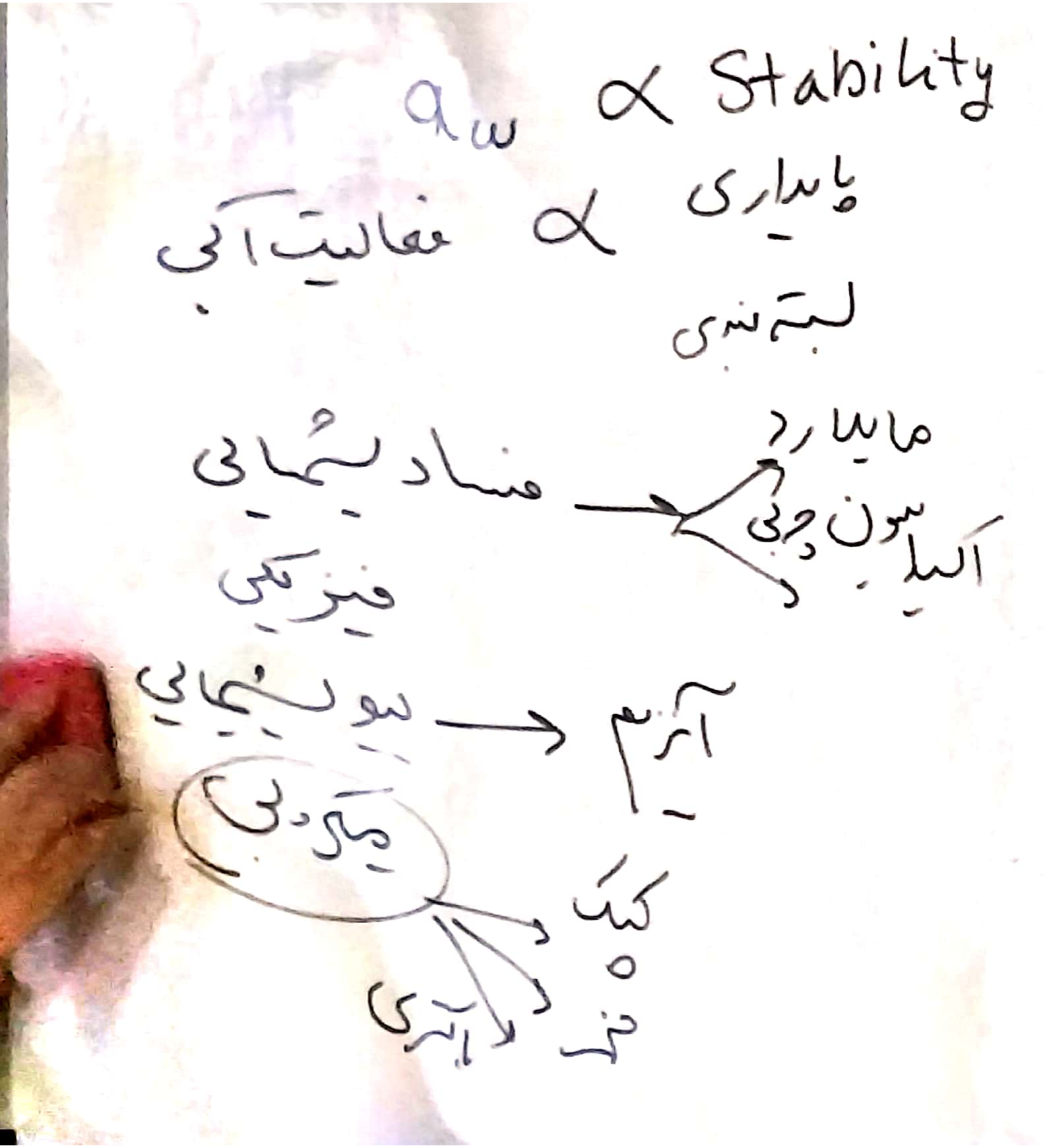
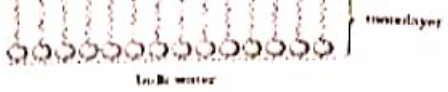












Monolayer water:

- Bound to the surface of the protein molecules by hydrogen bonding or dipole interactions.
- It represents 4-9% of the water associated with the protein.
- It has kinetic and thermodynamic properties which are different from that of the pure water.
- Not available as solvent.
- May be available for certain reactions.
- Hard to remove from food.

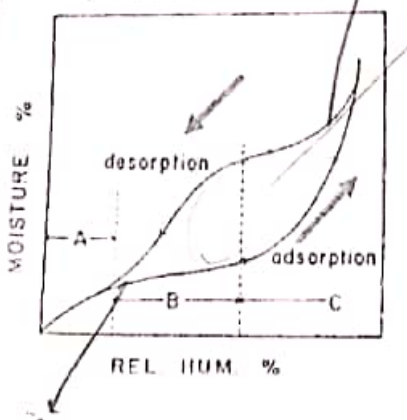
Multilayer Water:

- Additional layer of water around food particle.
- Not as hard to remove as the monolayer.

– Sun. Oct 20 –

Sorption Isotherm of Water

- Hysteresis
- Resorption or adsorption
- Desorption
- Superimposability
- Hysteresis loop



- Relative humidity can be simply defined as the ratio of the actual amount of water in the air compared to how much the air can hold at a specific temperature
- When the water content of food and relative humidity of the enviroment are not equal, the food gains or loses water.
- Desorption: Lowering water content of moist foods to reach equilibrium with its surroundings
- Adsorption: Increasing water content of dry foods to reach equilibrium with its surroundings
- The water content of food and enviroment are same at equilibrium stage. After the equilibrium is reached, the water content of food does not change.

Aw × Stability

Table 2 Water Activity and Growth of Microorganisms in Food*

Range of a_w	Microorganisms Generally Inhibited by Lowest a_w in This Range	Foods Generally within This Range
1.00 – 0.95	*Pseudomonas, Escherichia, Proteus, Shigella, Klebsiella, Bacillus, Clostridium perfringens*, some yeasts	Highly perishable (fresh) foods and canned fruits, vegetables, meat, fish, and milk
0.95 – 0.91	*Salmonella, Vibrio parahaemolyticus, C. botulinum, Serratia, Lactobacillus, Pediococcus*, some molds, yeasts (*Rhodotorula, Pichia*)	Some cheeses (Cheddar, Swiss, Muenster, Provolone), cured meat (ham)
0.91 – 0.87	Many yeasts (*Candida, Torulopsis, Hansenula*), *Micrococcus*	Fermented sausage (salami), sponge cakes, dry cheeses, margarine
0.87 – 0.80	Most molds (mycotoxigenic penicillia), *Staphylococcus aureus*, most *Saccharomyces* (baril) spp., *Debaryomyces*	Most fruit juice concentrates, sweetened condensed milk, syrups
0.80 – 0.75	Most halophilic bacteria, mycotoxigenic aspergilli	Fudge, marmalade, marzipan, glacé fruits
0.75 – 0.65	Xerophilic molds (*Aspergillus chevalieri, A. candidus, Wallemia sebi*), *Saccharomyces bisporus*	Jelly, molasses, raw cane sugar, some dried fruits, nuts
0.65 – 0.60	Osmophilic yeasts (*Saccharomyces rouxii*), few molds (*Aspergillus echinulatus, Monascus bisporus*)	Dried fruits containing 15-20% moisture, some toffees and caramels; honey
0.60 – 0.50	No microbial proliferation	Dry pasta, spices
0.50 – 0.40	No microbial proliferation	Whole egg powder
0.40 - 0.30	No microbial proliferation	Cookies, crackers, bread crusts
0.30 - 0.20	No microbial proliferation	Whole milk powder, dried vegetables

* Adapted from Beuchat (1981).

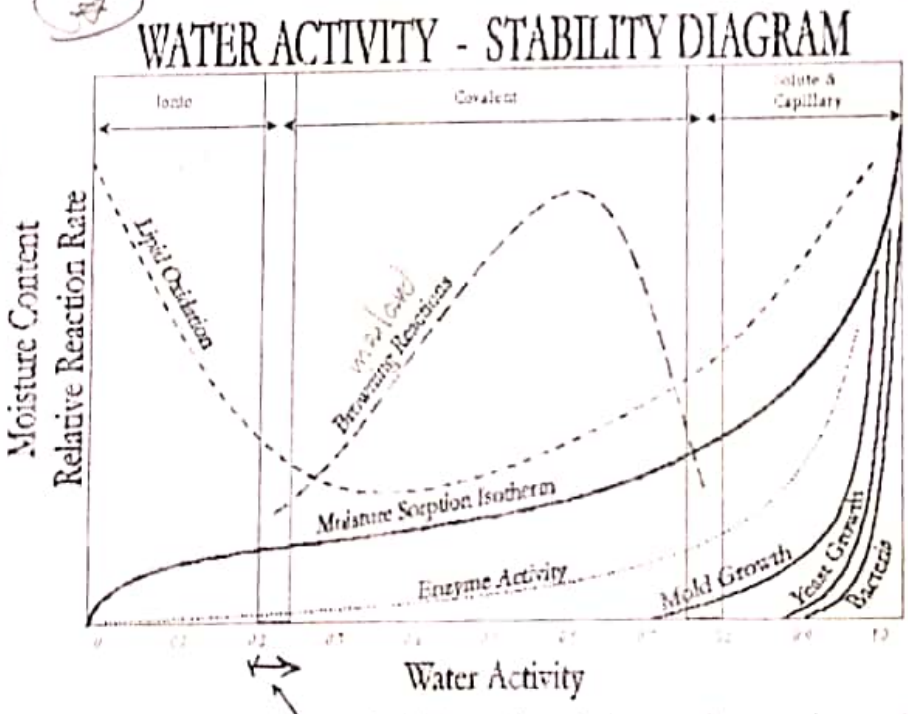


Figure 1. Water Activity – Stability Map (adapted from Labuza, (1970))