

5.4. Rheopectic and Bingham Plastic Foods

Rheopectic and Bingham plastic behaviors are distinct non-Newtonian fluid flow properties found in some foods. Bingham plastics, like ketchup and mayonnaise, require a minimum shear stress (yield stress) to initiate flow, and their viscosity is constant once the yield stress is exceeded. Rheopectic fluids, conversely, exhibit a continuous increase in shear stress and apparent viscosity when subjected to a constant shear rate over time, as seen in some pastes and suspensions.

Bingham Plastic Foods: Definition:

Bingham plastics are non-Newtonian fluids that behave like solids at rest but flow like viscous fluids when a specific shear stress (yield stress) is applied.

Examples:

Ketchup, mayonnaise, chocolate, yogurts, and peanut butter are common examples.

Characteristics:

- They require a threshold stress to overcome a "yield point" before flowing.
- Once the yield stress is exceeded, the shear stress is directly proportional to the shear rate.
- They behave like solids when the applied stress is less than the yield stress

In Food Processing:

Bingham plastic behavior influences how foods are processed, packaged, and consumed, impacting factors like texture, flow during dispensing, and shelf life.

Rheopectic Foods: Definition: Rheopectic fluids are non-Newtonian fluids whose shear stress and apparent viscosity increase with time when subjected to a constant shear rate.

Examples: Some bentonite clay suspensions, certain pastes, and egg whites when beaten are examples.

Characteristics:

- The structure of the fluid builds up over time, leading to increased viscosity.

- The shear stress required to maintain a constant strain rate increases with time.
- This behavior is the reverse of thixotropy, where viscosity decreases with time.

In Food Processing: Rheopectic behavior can influence factors like the thickening of some sauces or pastes over time and can be manipulated during processing.