

# PHYSICAL PHARMACY

## Module 9: Rheology and Biorheology

### RHEOLOGY & BIORHEOLOGY

#### Objectives:

- Discuss the types of interfaces and their application to pharmacy and medicine
- Explain the difference between the liquid interfaces and the solid interfaces and their relation to the formulation and stability of pharmaceutical products
- Relate the application of the surfactants to absorption of drugs and their protective properties

#### Guide Questions:

1. Explain the fundamental principles of rheology.
2. Discuss the Newtonian and Non-Newtonian systems about the classes of flow.
3. Relate the application of rheology to the manufacture of pharmaceutical products.

#### Definition of Terms

- **Rheology** is the study associated with the flow of liquid matter and deformation of solid matter.
- **Biorheology** comprises the science of deformation and flow of biological systems or of materials of biological significance; notably, biological fluids.
- **Viscosity** is characterized as the resistance of liquid matter to flow.
- **Fluidity** is the reciprocal of viscosity and it describes the flow of materials.
- **Newtonian Systems** categorizes single-phase fluids made up of small molecules such as water, alcohol, and glycerin.
- **Non-Newtonian Systems** categorizes matter that do not fall under Newton's viscosity law; this system includes polymer solutions, paints, resins, asphalt, gel, and biological fluids among others.
- **Shear Rate** is the velocity gradient; and it refers to the difference of velocity,  $dv$ , between two planes of liquid separated by an infinitesimal distance,  $dr$ .
- **Shear Stress** is the force per unit area required for the material to flow.

### RHEOLOGY

- The term **rheology** was derived from the Greek terms "*rheos*" meaning 'to flow' and "*logos*" meaning 'study'.
- It refers to the scientific study of the deformation and flow properties of matter.
- It is associated with **elasticity, fluidity, and viscosity.**

### VISCOSITY

- It is defined as the measure of the resistance of matter to flow. It is classified into three (3):

#### a. Absolute Viscosity

$$\eta = \frac{F}{\dot{\gamma}}$$

- F refers to the shear stress;  $\dot{\gamma}$  refers to the shear rate.
- **Units:** Poise, Centipoise

#### b. Kinematic Viscosity

$$\nu = \frac{\eta}{\rho}$$

- The numerator necessitates the absolute value while the denominator,  $\rho$ , is the density of the substance in  $g/cm^3$
- **Units:** Stoke, Centistoke

#### c. Relative Viscosity

- It refers to the ratio of the viscosity of a solution to the viscosity of the solvent.
- It is a **unitless value.**

### FLUIDITY

- It is the reciprocal of viscosity.

#### TYPES OF FLOW AND DEFORMATION:

- **Newtonian Flow**
  - It has a linear relationship between shear rate and shear stress.
  - It has a constant viscosity with increasing rate.
  - **EXAMPLES:** Water, Ethanol, Glycerin, Acetone, Benzene

# Symp On Biorheology Part 4 Proc Of The

**AW Chickering**



**Symp On Biorheology Part 4 Proc Of The:**

## **Symp On Biorheology Part 4 Proc Of The** Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has been apparent than ever. Its ability to stir emotions, provoke thought, and instigate transformation is actually remarkable. This extraordinary book, aptly titled "**Symp On Biorheology Part 4 Proc Of The**," written by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound impact on our existence. Throughout this critique, we will delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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