Chapter 1. An Overview on Nanoemulsion

Aniket Satish Patare[1], Purva Balasaheb Pawar[1], Siddhesh Mahendra Pawar[1], Mayuri Dhanaji Salvi[1], Sanjana Sunil Salunke[1], Pranita Babusha Sarpate[1], Pooja Rajendra shegade[1]

[1]Department of Pharmaceutics, SGMSPM's Sharadchandra Pawar College of Pharmacy, Dumbarwadi (Otur), Tal- Junnar, Dist.-Pune, Maharashtra, India, 410504.

Abstract:

Nanoemulsions are nanoscale colloidal dispersions consisting of two immiscible liquids stabilized by surfactants and co-surfactants to form a uniform, single-phase system. These systems have attracted considerable attention in pharmaceutical research due to their remarkable stability, clarity, and enhanced drug delivery potential. Typically, nanoemulsions are oil-in-water formulations with droplet sizes between 5 and 100 nanometers, which provide a transparent or translucent appearance. Their small particle size improves drug solubility, absorption, and bioavailability, making them promising carriers for both hydrophilic and lipophilic drugs. This chapter provides an overview of formulation approaches, preparation techniques, and characterization methods such as particle size analysis, differential scanning calorimetry, and transmission electron microscopy. Evaluation parameters including pH, viscosity, refractive index, in vitro release, and stability studies are also discussed. Nanoemulsions represent an advanced and versatile delivery platform capable of overcoming several limitations of conventional dosage forms, supporting targeted, controlled, and efficient therapeutic delivery.

Keywords: Nanoemulsion, drug delivery, surfactants, stability, characterization, pharmaceutical formulation

Definition :

Nanoemulsion (NE): A nanoemulsion is a colloidal dispersion system consisting of two immiscible liquids (such as oil and water), stabilized by surfactants, where the droplet size of the dispersed phase typically lies in the 20–200 nm range.

Nanoemulsion = oil + water + surfactant (droplet size in nanometer range) used to deliver drugs effectively

Types of nanoemulsion

1. Water-in-oil nanoemulsions: Nanoemulsions in which water droplets are dispersed in continuous oily phase

2. Oil-in-water nanoemulsions: Nanoemulsions in which oil droplets are dispersed in continuous aqueous phase

3. Bi-continuous nanoemulsions: Nanoemulsions in which micro domains of oil and water are inter dispersed within the system i.e. O/W/O and W/O/W