

Chapter 15

Novel and Advanced Drug Delivery Systems

Ms. Mitali Singh

Assistant Professor, Faculty of Pharmacy, Sahu Onkar Saran School of
Pharmacy, IFTM University, Moradabad

15.1 Introduction

Novel and Advanced Drug Delivery Systems (NDDS) represent a major advancement in pharmaceutical sciences aimed at improving the therapeutic effectiveness and safety of drugs. Traditional dosage forms such as tablets, capsules, and injections often deliver drugs without precise control over release rate, targeting, or duration of action. As a result, fluctuating plasma drug concentrations, increased side effects, and reduced patient compliance may occur. Novel drug delivery systems are designed to overcome these limitations by controlling the rate, time, and site of drug release. They aim to deliver the right drug concentration to the right site for the right duration. NDDS integrate principles of pharmaceutics, polymer science, nanotechnology, biotechnology, and pharmacokinetics to enhance bioavailability, reduce toxicity, and improve patient adherence.

The development of advanced drug delivery technologies has been driven by challenges such as poor water solubility, short biological half-life, instability in the gastrointestinal tract, and lack of site-specific targeting. Modern therapeutic strategies increasingly rely on controlled-release systems, targeted delivery systems, and smart drug carriers to achieve optimal clinical outcomes.

15.2 Need for Novel Drug Delivery Systems

Conventional drug delivery systems often produce rapid drug release, leading to peak plasma concentrations followed by rapid decline. This fluctuation may cause side effects at high concentrations and subtherapeutic effects at low concentrations.

Drugs with short half-lives require frequent dosing, which may reduce patient compliance. Some drugs degrade in the acidic environment of the stomach or undergo extensive first-pass metabolism, resulting in poor bioavailability.

Targeted drug delivery is particularly important in diseases such as cancer, where systemic administration may damage healthy tissues. NDDS address these challenges by providing controlled, sustained, and site-specific drug release.