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Chapter 12: A Role of AI in NDDS (Novel Drug Delivery System)

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Abstract: The Novel Drug Delivery Systems (NDDS) have been developed as alternatives to eliminate the limitations of the traditional drug delivery regimens which include low bioavailability, high dosage, and systemic side effects. NDDS make use of advanced carriers, such as liposomes, niosomes, nanoparticles, dendrimers, and microneedles to obtain a controlled, sustained, and targeted drug delivery. Not only do these systems increase the efficacy of the therapeutic process but also patient compliance is increased, dosing frequency decreased and adverse effects minimized. The uses of NDDS cut across many applications such as cancer treatment, vaccine delivery, diabetes treatment, central nervous system target applications and even cosmetic formulations. Although the benefits are very high, aspects like formulation stability, large scale production, prohibitive cost, and regulatory impediments are major obstacles to clinical translation. The next generation of technologies is the creation of smart, sensor-based, and individual drug delivery systems that will combine technologies such as nanomedicine, 3D printing, and artificial intelligence. All in all, NDDS is a bright move to patient-centered therapy and the development of the contemporary pharmaceutical care.

Keywords: NDDS, Artificial Intelligence, Niosomes, Liposomes, Nanoparticles, Regulatory aspects.

12.1   Introduction

The development of effective drug delivery systems has always been a fundamental goal in pharmaceutical research and development. While conventional drug delivery methods such as oral and parenteral routes have been widely used, they often come with significant limitations, including poor bioavailability, rapid drug degradation, systemic side effects, and frequent dosing requirements. These challenges can lead to reduced therapeutic efficacy and poor patient adherence, particularly in chronic and complex diseases. In response to these issues, the pharmaceutical industry has increasingly turned its attention to Novel Drug Delivery Systems (NDDS). NDDS represent a modern and