PARENTERAL FORMULATION DEVELOPMENT WITH CAPTISOL®

Singota® Solutions is a CDMO located in Bloomington, Indiana, USA that specializes in Parenteral, Early Phase Drug Development and Aseptic Filling projects.

Singota has conducted formulation development projects for its clients over the years, several of them requiring solutions and improvements to aid in solubility and drug stability performance. During the course of these projects, the use of Ligand's Captisol® technology has emerged as an important tool in achieving success in these formulation efforts for both small and large molecules. Captisol is a patent protected, uniquely modified cyclodextrin, with a chemical structure that was designed to enable the creation of new products by significantly improving solubility, stability, bioavailability and dosing of active pharmaceutical ingredients (APIs).

There are several key features of Captisol that enhance drug attributes.

1. **Solubility Enhancement**: Poor solubility is a major challenge faced by pharmaceutical scientists during drug development. Many promising drug candidates have low aqueous solubility, leading to difficulties in formulation and reduced bioavailability. The molecular structure of Captisol enables it to interact with drug molecules, enhancing their solubility in aqueous solutions. This improved solubility allows for the development of more effective drug product presentations, including oral, injectable (both liquid and lyophilized), and topical dosage forms. These formulations using Captisol typically result in the reduction of additional excipients, shortened lead times for formulation development, and improved safety over the use of cosolvents and surfactants.

2. **Stability and Protection**: Captisol plays a crucial role in stabilizing and protecting drug compounds. It forms inclusion complexes with drugs, preventing their degradation, hydrolysis, or oxidation. By capturing the drug molecule, Captisol shields it from environmental factors, such as light, moisture, and pH changes, thereby extending the shelf life and maintaining the drug's potency. This stability enhancement enables the development of long-lasting and reliable pharmaceutical products to be used both in the clinic and for commercialization.

3. Bioavailability Enhancement: Bioavailability refers to the extent and rate at which a drug is absorbed into the systemic circulation and becomes available at the site of action. The solubilizing properties provided by Captisol greatly improve drug bioavailability. By increasing the dissolution rate and maintaining drug concentration in the gastrointestinal tract, Captisol enhances drug absorption, ensuring a more predictable and effective therapeutic response. In the body, Captisol shows little to no absorption and is freely eliminated, while the freed and absorbed API is available to interact with plasma protein and active sites, and continue undeterred in its independent distribution, metabolism, and elimination journey. This bioavailability enhancement is especially beneficial for poorly soluble drugs, maximizing their therapeutic potential.

4. Formulation Flexibility: Captisol offers formulation flexibility, allowing for the development of a wide range of presentations as well as incorporation into many drug delivery systems. It can be utilized in various dosage forms, including tablets, capsules, oral solutions, injectables (both liquid and lyophilized), subcutaneous pens and pump patches, inhaled dosage forms, and topical formulations such as microneedle patches. Captisol provides compatibility with different drug compounds from small molecules to large proteins and various industry standard excipients that enable the formulation of stable and effective pharmaceutical products across diverse therapeutic areas. This versatility makes Captisol a valuable tool for formulation scientists, offering creative solutions to overcome formulation challenges.

5. Regulatory Compliance: Pharmaceutical manufacturing requires adherence to strict regulatory guidelines. Captisol has a well-established safety profile and is approved by regulatory authorities worldwide. Currently, there are 15 FDA-approved drug products and one recently approved product in Japan that have been approved using Captisol in their formulation. Ligand has extensive toxicology data which provides reassurance to clients and regulatory agencies and streamlines the drug development process. By utilizing Captisol in pharmaceutical formulations, clients can ensure compliance with regulatory requirements, expediting the approval and commercialization process for their drug products.

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Singota Solutions has worked and continues to work side by side with the Captisol team at Ligand and has gained in-depth knowledge when it comes to both formulating and testing Captisol. Because Captisol has become so widely used and well-established in the industry, both the United States Pharmacopeia (USP) – National Formulary (NF) and European Pharmacopeia (EP) have established robust testing methods for the characterization of Captisol. These tests are required for most regulatory submissions and universally benefit the pharmaceutical industry across the world to help develop safe products. Singota works directly with Ligand, manufacturer of Captisol, to validate and establish all the USP-NF and EP testing methods for Captisol. Singota continues to play an important role in keeping the methods up to date and optimized, routinely contributing to the methodologies provided by the organizations.

As the pharmaceutical industry continues to seek innovative solutions, Captisol stands out as a key component in enhancing drug delivery and improving patient outcomes. With new Captisol products in development, Singota will be at the forefront for offering services related to formulating and testing both current and future Captisol products.

Singota Solutions is a US based CDMO in Bloomington, Indiana. Singota specializes in formulation development and aseptic fill finish for injectable projects. Once a formulation is established, Singota utilizes state of the art robotic filling technology and focuses on smaller batch size requirements. For more information, visit Singota.com to explore how Singota has established itself as a one-stop solution for all your developmental needs.

Contact **solutions@singota.com** to schedule a meeting with our business development team to further discuss your current or future projects.