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Short Communication

The Impact of Antibody Purification Methods and Applications

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DESCRIPTION

Supercritical Antibodies, also known as immunoglobulins, play a pivotal role in the immune system's defense against pathogens. With the advent of biotechnology, antibodies have become indispensable tools in various fields, including diagnostics, therapeutics, and research. However, the production of antibodies often involves complex biological systems, leading to the co-production of impurities such as Host Cell Proteins (HCPs), DNA, and aggregates. Purification of antibodies is thus essential to ensure their safety, efficacy, and regulatory compliance. This overview provides a comprehensive insight into antibody purification techniques, their underlying principles, applications, and current challenges.

Antibody purification techniques exploit the unique physicochemical properties of antibodies for their selective isolation and purification from complex biological matrices. Several principles underlie antibody purification, including affinity chromatography, ion exchange chromatography, size exclusion chromatography, and protein A/G/L affinity purification. The Affinity chromatography, in particular, uses specific binding interactions between the antibodies and ligands immobilized on chromatographic matrices, enabling high-resolution purification [1-3].

Antibody purification techniques

One protein A/G/L affinity chromatography: Protein A, G, and L are widely used ligands that specifically bind to the Fc region of antibodies, enabling efficient purification from various sources, including cell culture supernatants and serum. This technique offers high purity and yield, making it a cornerstone in antibody purification workflows.

Ion exchange chromatography: Ion exchange chromatography separates antibodies based on their net charge, exploiting differences in pH, ionic strength, and buffer composition. This technique facilitates purification by exploiting electrostatic interactions between antibodies and charged chromatographic matrices.

Size exclusion chromatography: Also known as gel filtration chromatography, this method separates molecules based on their size, allowing for the removal of aggregates and other high molecular weight impurities. Size exclusion chromatography is often employed as a polishing step to enhance antibody purity and stability.

Hydrophobic Interaction Chromatography (HIC): HIC separates antibodies based on their hydrophobicity, facilitating purification under mild conditions without denaturation. This technique is particularly useful for separating antibodies from contaminants with similar charges.

Affinity chromatography: Apart from protein A/G/L, other affinity ligands such as Protein L, Protein G', and specific antigen-antibody interactions are utilized for antibody purification, offering high specificity and purity. These affinity chromatography techniques are tailored to target specific antibody subclasses or antigen-binding regions.

Antibody purification finds widespread applications in biopharmaceutical production, diagnostics, and research. In the biopharmaceutical industry, purified antibodies serve as critical therapeutic agents for treating diseases such as cancer, autoimmune disorders, and infectious diseases. Additionally, purified antibodies are utilized in diagnostic assays, immunoassays, and research applications for biomarker detection, protein characterization, and target validation [4]. Despite advancements in purification techniques, several challenges persist in antibody purification. These include the presence of impurities such as HCPs, DNA, aggregates, and endotoxins, which can affect antibody stability, efficacy, and safety. Moreover, scalability, cost-effectiveness, and regulatory compliance of purification processes pose significant challenges in biopharmaceutical production [5].

Antibody purification is a critical step in the production of therapeutic antibodies, ensuring their safety, efficacy, and regulatory compliance. Various purification techniques based on affinity chromatography, ion exchange chromatography, and size exclusion chromatography offer efficient and selective purification of antibodies from complex biological matrices.

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Addressing challenges such as impurity removal, scalability, and cost-effectiveness remains essential for advancing antibody purification techniques and meeting the growing demand for therapeutic antibodies in healthcare and research.

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