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Commentary

Technological Improvements in Antibody Purification

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1. Description

Modern medicine, lab-based science, environmental monitoring has all been changed by the use of antibodies as medicines, diagnostic tools and biological sensors. All of these specialized uses for Monoclonal Antibodies (mAbs), polyclonal antibodies, recombinant antibodies and antibody fragments for various purifying procedures. The ability to produce antibodies using recombinant methods has increased the demand for purification on a greater scale (up to 100 kilogram batches) necessitating the development of novel purification procedures [1]. Affinity chromatographic bio-affinity ligands are frequently employed to meet current industry standards for antibody purification. However, there is currently a trend away from using bio-affinity ligands like Protein due to a number of limiting factors, including the leakage of Protein from the column with associated product contamination, high cost, low resin reusability and potential antibody aggregation during low pH. A genetically fused purification tag can also be employed to achieve purification the most popular of these is a poly-histidine tag (poly-His or His6) which is used in Immobilized Metal Affinity Chromatography (IMAC). Although creating a poly-His tag places little metabolic strain on the host, it is less precise than affinity chromatography. Protein A-based chromatography has been replaced with ion-exchange chromatography employing a Multicolumn Counter Current Solvent Gradient Purification (MCSGP) technology.

It was demonstrated that ion-exchange MCSGP may produce high-purity antibodies at industrial yields of antibodies by recycling partially purified fractions utilizing an experimental setup and simulation model. Alternative purification techniques, including improvements and enhancements are already employed techniques, have been developed to achieve cheaper and more effective antibody purification on an industrial scale [2]. There are upstream and downstream processes involved in the synthesis of antibodies.

There are several types and sizes of antibodies. The distinctive Y-shaped structure of antibodies was first explained by Rodney Porter and Gerald M. Edelman. For their discoveries, they received the Nobel Prize in Medicine and Physiology in 1972. Eventually, it was determined that these Y-shaped molecules were Immunoglobulin G (IgG) which has a structure made up of four polypeptide chains two heavy (50 kDa) and two light chains (25 kDa) chains connected by non-covalent connections and di-sulfide bridges. The antigen-binding (Fab) and Fragment Crystallizable (Fc) sections are the primary functional antibody components. The variable heavy (VH) and variable light (VL) sections make up the antibody-binding area, whereas the constant heavy regions make up the Fc component which is crucial for immunological signaling and effector activities. IgG, IgE, IgA, IgD and IgM which naturally occur in mammals as well as a variety of additional immunoglobulin forms are found throughout the animal kingdom [3]. Combinatorial DNA technology has made it possible to create recombinant antibodies in addition to naturally occurring antibody formats. Examples include Fragment Variable (Fv), disulfide-stabilized Fv antibody fragment, Single-Chain Fragment Variable (scFv), Fragment Antigenbinding (Fab), single-chain antibody fragment, and divalent antibody formats.

Technological improvements in chromatography based purification. The reversible adsorption of a target molecule onto a solid support may be used in chromatographic techniques. Because of the great selectivity and purity that can be attained to meet regulatory and quality-control

criteria affinity-based technologies more particularly are frequently the method of choice for antibody processing. While improvements to established approaches, such as based on biological ligands are always being researched, complementary chromatographic techniques are now beginning to attain purities that are comparable to affinity-based techniques [4]. Improvements in non-chromatographic techniques. Methods for non-chromatographic purification might be affinity tag or non-tag based. Methods without tags rely on the physicochemical properties of the target protein and the environment [5]. Due to their potential application in large-scale purification platforms, non-chromatographic technologies have attracted a lot of interest. However, they must first get over the low purities that have been connected to these techniques.

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