Student Project Paper for Final Class

University of Baghdad	Al-Khwarizmi college of Engineering	Biochemical Engineering Dept.	Project index:4	Date 25-6-2012
Project Name	**Production of Recombinant Human Serum Albumin**			
Student Name	**Mohammed Kassim Wadi & Mohammed Monir Ismaiel**			
Supervisor Name	**Dr. Ameel Mohammed Rahman**			

Aim of the work

The aim of the present project can be illustrated in the following points:

1- A literature survey.
2- Discuss the production processes.
3- Discuss the details mass and energy balances.
4- Design of some unit operations.

Abstract

Human serum albumin (HSA) is the most abundant protein in human blood, produced naturally in the liver with a concentration of 50mg/l. The presence of HSA at this concentration in blood served many functions, as maintains osmotic pressure, transports thyroid hormones, transports fatty acids (free fatty acids) to the liver, prevents photo degradation of oleic acid.

Various processes are available for HSA production, the most popular process is glycerol and methanol process. The production of HSA by this method is very efficient, cost effective and it is an environmental process due to low waste disposal. In the present project, the process glycerol and methanol was adopted in the production of 12.5 ton/ year of rHSA. The details calculation of mass and energy balances as well as units design were also discussed in this report.

Discussion

Human serum albumin (HSA) is applied to stabilize blood volume during surgery and during shock or burn cases. It is also used for the formulation of protein therapeutics, for vaccine formulation and manufacturing, for coating of medical devices, for drug delivery, etc. The worldwide sales of HSA from human blood are approximately $ 1–1.5 billion, requiring roughly 400–500 tons of HSA per year. One gram of HSA derived from human blood costs about $ 2–3.5. Potential expression systems for the production of recombinant human serum albumin are yeasts (*Saccharomyces cerevisiae*, *Kluyveromyces sp.*, *Pichia pastoris*), bacteria (*Escherichia coli*, *Bacillus subtilis*), and also transgenic plants and animals. The present project concentrates on the rHSA production using *P. pastoris*. The data were taken from patent and scientific literature. It is an example of a large-scale bioproduction of a recombinant protein for pharmaceutical applications, whose selling price is relatively low.

The case illustrates the important role of the expression rate of the recombinant proteins in the chosen host cell and the downstream processing strategy. The downstream processing has to have a high yield due to the low selling price, and, at the same time, provide a high purity due to the pharmaceutical use. Here, we focus on the application of expanded-bed adsorption (EBA) and compare it with the conventional purification method of proteins based on filtration and packed-bed adsorption (PBA).

The carbon sources and media components are converted into cell biomass, rHSA, and by-products. The bioreactor size is derived from the desired annual production, the overall downstream yield, the possible number of batches per year, and the final product concentration and recovery yield.

Future Work

1. The usage of the downstream equipment can be increased by addition of one or more bioreactors, which run in stagger mode. The impact of the addition of one additional bioreactor is described.
2. The process could be improved by achieving a lower level of the electrical conductivity of the fermentation broth to reduce the necessary dilution.
3. Discuss the production from other biomass.
4. Discuss the ability to increase the cell production rate to increase the process yield.