ANALYSIS OF COMMERCIAL FETAL BOVINE SERUM (FBS) AND THEIR SUBSTITUTE FOR THE DEVELOPMENT OF CULTURED MEAT

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I. INTRODUCTION

In recent years, interest in alternative livestock products has been increasing, and in particular, interest in the development and industrialization of cultured meat has been growing. Nevertheless, the full-scale industrialization of cultured meat has not yet begun. In order to industrialize cultured meat, there are two main problems to be solved [1]: the first is to lower the production cost, and the second is to increase the cultivation efficiency. For these reasons, our team has been conducting research over the years to lower the production cost of culture mediums used to manufacture cultured meat, by analyzing various materials to replace Fetal Bovine Serum (FBS), which accounts for more than 60% of the culture medium price. In order to develop new substances that can effectively replace FBS, research on the components of commercial FBS to guide in manufacturing FBS substitutes with similar components, resulting to increased cell culture efficiency. Therefore, the purpose of this study is to reduce the cost of cultured meat production through FBS replacement.

II. MATERIALS AND METHODS

1. Preparation of commercial serums and FBS substitute from animal by-products

Commercial FBSs were purchase from Biowest (Nuaillé, France), Corning (New York, USA), Cytiva (Emeryville, USA), Gibco (New York, USA) and Sigma (St. Louis, USA). Commercial hores serums (HS) were purchase from Biowest (Nuaillé, France) and Gibco (New York, USA). FBS substitutes were developed by our research group by using livestock by-products and applied for patents and trademarked. Since this study is a comparison between commercial products and patent-pending products, detailed manufacturing methods are not presented.

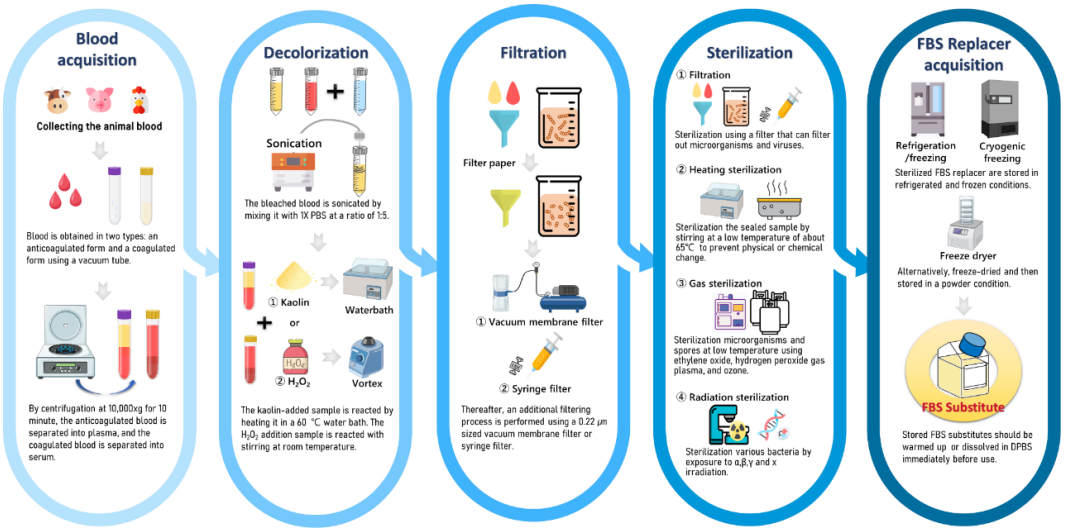

Figure 1. Manufacturing procedures of FBS substitute

2. Lists of serum analysis

- Major blood components in commercial FBS, commercial horse serum and FBS substitute
- Protein concentration in commercial FBS, commercial horse serum and FBS substitute
- Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) of commercial serum and FBS substitute
- Free amino acid in commercial serum and FBS substitute
- Fatty acids in commercial serum and FBS substitute

III. RESULTS AND DISCUSSION

After relevant analyses, the main finding is that the major components of commercial FBS shown to have very similar regardless of the companies, brands, origin or the manufacturing batch serial number. We analyzed the serum composition using bicinchoninic acid analysis, SDS-PAGE, and quantification of free amino acids and fatty acids of 12 types of of FBS, 2 types of HS, and 3 types of FBS substitutes. In particular, in the BCA and SDS-PAGE results, the protein concentration and protein band size trends were almost completely similar among commercial FBS. It is not clear why all commercial FBS have the same ingredient content, even though potential sources of difference such as manufacturer, date of manufacture, and region where FBS was acquired are different. However, we assume several possible mechanisms, the first being that for the safety of the fetus growing in the mother's womb, fetal blood components remain constant without being affected by conditions such as livestock breed and feed intake or environmental conditions. The second possible mechanism is thought to be due to the manufacture of FBS after mixing all the obtained FBS. This assumption came after our research team analyzed each FBS using 16S rRNA sequence and found that the blood or serum of several individuals were mixed. The third possible mechanism is that manufacturing companies maintain the same quality, which is considered a little less credible because it is difficult for all companies to maintain the same quality.

IV. CONCLUSION

We found that since all commercial FBSs purchased and used by our research team were found to have very similar main ingredients, the effect is not expected to be significantly different no matter what product is used for cell culture. The commercial horse serum was also found to have no difference between the company and the brand. Meanwhile, the FBS substitute developed by our research team was found to have a slight difference in content from commercial FBS. Moreover, as mentioned above, we are still not certain about the differences in components between commercial FBS and the FBS substitute we developed means, and how each component of the culture medium plays a key role in cell culture. Therefore, more research will still be needed to replace commercial FBS or manufacture serum-free media.

REFERENCES

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