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IOP Conference Series: Materials Science and Engineering PAPER • OPEN ACCESS Modeling Biopolymer and Glucose as Carbon Source Using Artificial Neural Network To cite this article: M Riza et al 2019 IOP Conf. Ser.: Mater. Sci. Eng. 536 012044 View the article online for updates and enhancements. This content was downloaded from IP address 114.125.41.56 on 14/08/2019 at 14:45 Modeling Biopolymer and Glucose as Carbon Source Using Artificial Neural Network M Riza1,2, Mukhlishien2, P D Sentia3,4, Andriansyah3,4, R Dewi5 1Department of Doctoral Engineering Science, University of Syiah Kuala, Darussalam, Banda Aceh 23111, INDONESIA 2Chemical Engineering Department, University of Syiah Kuala, Darussalam, Banda Aceh 23111, INDONESIA 3Industrial Engineering Department, University of Syiah Kuala, Darussalam, Banda Aceh 23111, INDONESIA 4 Laboratory of Industrial Computation and Optimization, Industrial Engineering, University of Syiah Kuala, Darussalam, Banda Aceh 23111, INDONESIA 5Chemical Engineering Department, University of Malikussaleh, Muara Batu, Aceh Utara 24351, INDONESIA Email: primadennysentia@unsyiah.ac.id Abstract.

Biopolymer is one of the fascinating biotechnology items and a promising class of biomaterials, which can be normally happened or delivered by microorganisms. The creation of the biopolymer by bioprocess innovation requires the utilization of substance designing standards, for example, upstream procedures, aging, and downstream procedures. Hyaluronic Acid (HA), additionally called as hyaluronan is an interesting biopolymer.

HA is utilized in restrictive pharmaceutical items, for example, viscoelastic liquids in ophthalmological medical procedure. The creation option of HA from creature tissues is by maturation. In this investigation, glucose is utilized in aging as the carbon hotspot for a trial. Fake Neural Network (ANN) is utilized for demonstrating the utilization of glucose to deliver HA from the trial study.

ANN is a system consisting of many simple processing elements connected in parallel. The mean square error (MSE) in this study if0.09830%. Introduction Biopolymer is an alluring biotechnology item and promising biomaterial class, which can happen normally or created by microorganisms. It is as a rule generally applied in medication and in the food and beauty care products industries.

Applications incorporate careful gadgets, embeds, and supporting materials tranquilize conveyance frameworks with an alternate organization and configuration courses, transporters for debilitating compounds and cells, biosensors, analytic test parts, visual gadgets, and materials for orthopedic applications. Biopolymers can be orchestrated to have the correct concoction, physical, biomimetic interface attributes, which permit an assortment of explicit applications and can be designed to meet certain end-use requirements [1].

In recent years, in developing countries such as Japan, Korea, Europe, and the United States, considerable research efforts by several private and public sectors have Content

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<u>been made to produce biopolymers based on bioprocess technology. Biopolymer</u> research has two fundamental center regions: (I) to create degradable material that fills in as a substitute for customary product plastics and (ii) to create biomaterials for biomedical applications (US Congress, OTA. 1993).

Biopolymer production by bioprocess innovation requires the utilization of substance building standards, for example, upstream procedures, maturation and downstream procedures (extraction and purging advances). During the maturation stage, this procedure is found regarding building variables, for example, mass exchange, heat move and energy [2].

The real technique utilized for downstream handling relies upon the idea of the item and stock and can utilize physical, compound or organic strategies. Hyaluronic Acid (HA) is utilized in selective pharmaceutical items, for example, viscoelastic liquids in ophthalmological medical procedure: eye-medical procedure, glassy substitute, and in thick valuable items for orthopedic issues: osteoarthritis treatment and sports medication [3].

HA and its subordinates have been generally utilized in different applications including, time-discharge medicate conveyance frameworks, in makeup as an enemy of maturing and dampness holding operator, and in neuron and plastic medical procedure [3]. HA was disconnected just because from a cow-like glassy body by water-CH3)2CO extraction and from human umbilical by chloroform extraction.

HA can be economically delivered by two strategies: compound extraction of creature tissues and microbial maturation [4]. However, HA is produced by the previous course, transcendently from chicken brushes [5]. This paper is discussed modeling production HA by StreptococcusZooepidemicus ATTC 39920 using Artificial Neural Network (ANN).

Numerous strategies have been made to plan connections between at least two factors. In this examination, ANN will be utilized to foresee the creation of HA against the measure of glucose included. Experimentally, this will take a very long time to do because HA production will continue to change as time changes.

This research uses the backpropagation calculation in ANN. Backpropagation or opposite spread ANN is the least difficult and most straightforward technique to comprehend from different strategies. In backpropagation, the actuation work utilized must satisfy a few conditions, to be specific: ceaseless, differentiable effectively and is a capacity that doesn't go down[6]. This calculation will change the inclination weight to lessen the contrast between organize yield a yield target. After the preparation is finished, trying of the system that has been prepared is done. Learning neural system calculations requires propelled proliferation and is trailed by in reverse engendering. Both are accomplished for all preparation patterns[7]. Research Methodology Data used in this research is fermentation data of shake flask experiment. There are two kinds of data used with various glucose inputs.

The particular of the investigation completed is temperature = 370C, RPM of shaker = 150, culture volume 150 RPM. Data can be found in table 1 and table 2. The backpropagation algorithm is used in this simulation. The reproduction utilizes "nntool" on the Matlab Toolbox. The boundaries utilized are default. The input used in this experiment is time and output is HA.

Results and Discussion Based on Figure 1, 2 and 3, it can be seen the results of the backpropagation ANN process showed in graphical structure. In Figure 1 shows the learning procedure at every epoch. In this process, the iteration is stopped at the 7th epoch, because the limit of the desired epoch has been reached and (MSE = 0.000983 <0.001) where this MSE is the MSE that shows up when the preparation is finished as per the predetermined emphasis. The best approval test is in epoch 1.

Figure 2 shows the connection among targets and system yield in preparing information. From testing the preparation information for the match between network output and target, the correlation coefficient (R) is 0.9363 where the best outcome is worth 1.

__ Table 1.

Data 1 for shake flask at an initial glucose concentration of 20 g/l

Time _Glucose _Hyaluronic Acid

(h) (g/l) (g/l) 0 _21,32 _0 _ 2 _20,13 _0,06 _ 4 _17,81 _0,12 _ 6 _13,61 _0,25 _ 8 _5,89 _0,39 _ 10 _0,73 _0,42 _ 12 _0,53 _0,44 _ 14 _0,50 _0,61 _ 22 _0,44 _0,52 _ 24 _0,36 _0,52 _ 28 _0,33 _0,50 _ 36 _0,30 _0,42 Table 2.

Data 2 for shake flask at an initial glucose concentration of 40 g/l Time (h) _Glucose (g/l) _Hyaluronic Acid (g/l) _ 0 _41,63 _0 _ 2 _39,67 _0,02 _ 5 _36,91 _0,17 _ 7 _29,27 _0,30 _ 9 _23,33 _0,31 _ 11 _15,12 _0,27 _ 13 _5,04 _0,28 _ 23 _0,33 _0,30 _ 25 _0,33 _0,33 _ 27 _0,24 _0,26 _ 31 _0,16 _0,30 _ 36 _0,08 _0,31 _ / _ / _ Figure 1. Best validation of data 1 _Figure 2.

Training result of data 1 _ _ Conclusion Based on the visualization of the given graphs, it can be seen that the results data pattern recognition by backpropagation ANN would be better if you use a smaller error rate and a large amount of data so that the accuracy of the identification is greater. This proves that the ANN is very strong in recognizing the patterns of data provided.

This means that the smaller the target error that is wanted and the more noteworthy the measure of information gave, implying that the littler the deviation of recognizable proof outcomes with the ideal outcomes, so the precision of the figure aftereffects of the system preparing gauge will be much higher.

___ The difficult that regularly happens is that the training process requires a lot of iteration so further exploration can use better strategies, for example, genetic algorithm particle swarm optimization and so on. Figure 3.

Regression result of data Acknowledgment This research is supported by the University of Syiah Kuala, Ministry of Research, Technology, and Education of Indonesia, in accordance with the Letter of Appointment Agreement of Research Professor of Fiscal Year 2018 Number: 05/UN11.2/PP/PNBP/SP3/2018 Date February 2, 2018. Thanks and high appreciation to Rector and Head of LPPM University of Syiah Kuala. Appendix / _ / _ _Figure 4. Best validation of data 1 _Figure 5.

Training result of data 1 _ _

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