Super Bacteria: A New Hope of Manufacturing Spider Silk in an Efficient Way

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ABSTRACT

The important properties of spider dragline silk and other protein polymers will find many applications. We have demonstrated the production of spider silk, which has many important properties, are produced from the bacteria including Escherichia coli. The productions of high molecular weight spider drag line encoded by synthetic genes. Silk protein can be efficiently produced by the microbial system has become an advantageous method like quick secretion and simple product recovery has become an efficient method. From the observation of various experiments done by several scientists has shown silk made in laboratory. The study of RIKEN centre for sustainable resource science has shown that spider silk can be produce huge amount. Observation shown that joining of the fragments by split intein sequence which then cut itself to yield full name protein. Spun into fibers make the microbial spider silk tough, stretchable and stronger. Better modification of bioengineering can increase the amount of production.

Keywords- RIKEN centre for sustainable science, spidroin, split intein

I. INTRODUCTION

The most important predator of insects are the spiders. Spider has many important benefits for example spider benefit crops. Spider venom has the potential to replace opiates and the most important one is the spider silk also consist medicinal qualities. Spider silk has a lot of essential value. From observation of various experiments done by several scientists has shown that silk made in laboratory can be beneficial for manufacturing bullet proof clothes, parachutes, nets and more. Drag lines are strong and light weight threads made up of silk protein produced by spiders. A large number of beneficial stuffs can be produced in huge amount by the help of spider silk but by producing small amount is not enough to meet the requirement.

The new study of RIKEN centre for sustainable resource science (CSRs) has shown that spider silk using a marine photosynthetic purple bacterium named Rhodovulum sulfidophilum. This technique can be used for producing huge amount of spider silk as it is difficult to produce because spider feed each other. Some photosynthetic microorganisms such as cyano bacteria, purple bacteria and microalgae has great value in promising platforms for biochemicals and polymers.

II. METHODOLOGY

The scientist has observed that R. sulphiophiilum which has qualities that make ideal for establishing a sustainable biofactory. This bacteria grows in sea water, requires carbon dioxide and nitrogen from the atmosphere and uses solar energy which is inexhaustible and it present in the environment as abundantly. R. sulphiophiilum grows up by utilizing renewable abundance non food bioresources such as seawater, gaseous carbon dioxide and atmospheric nitrogen gas and sunlight, thus making the photosynthetic microbial cell factory and essential green and sustainable production of proteins like polymers like spider silk. Masp1 and Masp2 produced by ampullate gland of spider are two main essential components of spider silk. This ampullate spidroin is produced artificially by heterotrophic production of Masp in R. sulphidophilum under both photoautotrophic and photo heterotrophic growth conditions. An alternative method of producing silk is of artificial sea water, bi carbonate, salt, nitrogen gas, yeast extract and by irradiation with near infrared light, which allows R. sulfidophilum to produce the silk protein efficiency.

III. PRIOR APPROACH

Malagasy spider formed for making webs with strands near 25m long C. darwini silk is more than twice as tough as any previous; y described silk. Silk worms were genetically altered to express spider proteins and fibres. Syringe and needle were used to make fibres successfully. Fibers created using this method may be required for post stretching of the fibre to attain fibres with desirable properties. To artificially synthesise spider into fibres are two methods used such as synthesis of feedstock where the unspun silk dope in spiders and another is to synthesis of spinning conditions.
IV. OUR APPROACH

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Observation has shown that the genes are very unstable, often getting alters by the hosts cellular machinery. To get over this issue some scientists recently have broken the long sequences into shorter block which bacteria could handle and translate into proteins then shorter protein are assembled into longer spider silk fibre. At first, they introduce gene to bacteria that encoded two pieces of that spider silk protein by the help of bioengineering. Each piece has a sequence called *split intein* on its end. The researcher broke open the bacteria, purified the short pieces of spider silk protein and incubated them together. Joining of the fragments are done through the glue of the *split intein sequence*, which then cut itself out to yield the full name protein. Spun into fibers make the microbial spider silk tough, stretchable and stronger.

V. CONCLUSION

Microbial silk production can be very beneficial for the textile industry but better modification of bioengineering can increase the amount of production. As the genes are very unstable, it often gets altered by the host cellular machinery. As spider eats each other, the spider silk cannot be produced in large amount. But with the help of bioengineering, an alternative form of spider silk can be produced in huge amount by manipulating the genes of essential microbes.

REFERENCES

[1] LATEST TRENDS. (2021, January 29). Splice. https://www.splice-bio.com/

[2] Zhou, J., Zhu, T., Cai, Z., & Li, Y. (2016). From cyanotoxins to cyanofactories: a review and perspective. *Microbial cell factories, 15*, 2. https://doi.org/10.1186/s12934-015-0405-3

[3] Rising, A., Nimmervoll, H., Grip, S., Fernandez-Arias, A., Storckienfeld, E., Knight, D. P., Vollrath, F., & Engström, W. (2005). Spider Silk Proteins – Mechanical Property and Gene Sequence. *Zoological Science, 22*(3), 273–281. https://doi.org/10.2108/zsj.22.273

[4] https://en.wikipedia.org/w/index.php?search=Super +Bacteria&title=Special:Search&go=Go&ns0=1