

Jong Dae Lee - CEO, Quegen Biotech, South Korea



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Quegen

Biotech is a company focusing on manufacturing beta-glucan for use in a range of healthcare products, from hangover cures to oncology treatments. In this interview, Dr Jong Dae Lee explains the benefits of beta glucan, and how he managed to overcome the challenges in its extraction to make it a commercially viable venture. Dr Lee also discusses his plans to expand the scope of Quegen Biotech's operations into pharmaceuticals.

Dr Lee, could you introduce yourself to our readers and provide an insight into the main operations at Quegen Biotech?

I spent three and a half years on my PhD project at the University of Colorado, Boulder, USA which was based around on-line optimal control of microbial fermentation. Following this, I undertook post-doctoral work at MIT where I studied economic analysis of the fermentation processes. I then returned to Korea and worked at KITECH, the (Korea Institute for Industrial technology) for 23 years. We were provided with a special arrangement where we could work for KITECH while setting up our own company. Thus, I founded Quegen Biotech in 2006 and maintained both roles for ten years. Three years ago, I decided to focus solely on Quegen Biotech's operations.

Quegen Biotech is a company which produces Beta-Glucan by fermenting mushrooms. The beta-glucan that we produce is of high purity and high efficacy. We also make beta-gluten hydrogel, for

which we have the worldwide patent. We have a high emphasis on patents and acquiring these.

Currently we have 32 employees spread across our manufacturing facility and our main sales office. We also have an R&D facility on Jeju Island, where we ferment mandarin peels to produce beta-glucan.

Our manufacturing facility is a 33 billion won (USD 29 million), 10 tonne fermentation facility which was opened in 2007. The company was founded in 2006 and we were able to build the plant ourselves in only one year. We received the financial resources to achieve such a project from the government bank, who recognised the need and potential of such projects.

As a company, we reached a breakeven point in 2016, which is always a key milestone for any biotech company. Now we have the ambition of achieving revenues of USD 78 million by 2022, and plan to launch an IPO on the KOSDAQ next year.

What are the benefits of using beta glucan?

Beta glucan is a sugar with a triple helix structure that has several beneficial properties which mean there will be a huge market for it in the future. For example, it has anti-cancer properties. When beta glucan is in the blood stream, it meets and activates other immune cells, and can kill tumour cells indirectly by activating immune cells. Moreover, during radiation therapies, the consumption will prevent the killing of human immune cells. Beta-glucan also possesses anti-biotic and anti-inflammatory properties. In addition, it has been shown to reduce glucose levels and cholesterol levels when consumed, which is also very good for obesity.

One of the primary uses is as an antioxidant and anti-ageing material. This is why beta glucan can be applied both to cosmetics and pharmaceuticals. There is a variety application that can be applied all over the body from head to toe. From animal tests, we have found synergy effects by co-applying our pure beta-glucan (QBG) with other approved pharmaceuticals treating conditions such as: tuberculosis, severe sepsis, arthritis, ulcerative colitis, diabetes, cholesterol treatment, cognitive improvement, and immune-oncology drugs. In combination it demonstrates better effectiveness and a remarkable reduction in side effects.

Furthermore, our beta-glucan hydrogel, without using any toxic chemicals for cross-linking, is also very useful in the stem cell market, as we can culture stem cells. We can make artificial skins, scaffold for biomaterials, as well as fillers for wrinkles and breast implants. Since it is very porous and injectable to the human body, it can be also applied to wound healing dressing, adhesion

prevention, 3D scaffolds for stem cell, drug delivery systems, and tissue engineering.

Manufacturing beta-glucan is notoriously challenging. How has Quegen overcome these difficulties?

Indeed, manufacturing of beta-glucan is complex, especially if high purity is to be achieved. Consequently, it remains a blue ocean market due to the barriers to entry. There are two ways to produce beta-glucan. Firstly, mushrooms have a layer of beta-glucan in their cell walls. However, this is very hard to extract.

Secondly, in our method, we secrete the beta glucan outside of the cell wall so that we do not have to rupture it. From glucose we ferment mushrooms, which creates the beta glucan. We purify this and create a hydrogel by subjecting it to high energy. Beta glucan can also be dried in the form of a powder. The process to produce beta-glucan takes almost a month in total, adding to the difficulties.

Nevertheless, this is a far more convenient method and is easier for purification. This is why our product has very high efficacy. When comparing our beta glucan with others, extracted from yeast, for example, we have demonstrated that our beta glucan is of higher purity. We used pre-clinical data to verify this. Our process is very simple and has become economical also.

There is a huge market for beta-glucan as it has indirect antibiotic properties. Given that we have the capabilities to manufacture this with high purity, we are expecting a rapid rise in interest and demand.

What are the main products you are manufacturing, and what projects do you have in the pipeline?

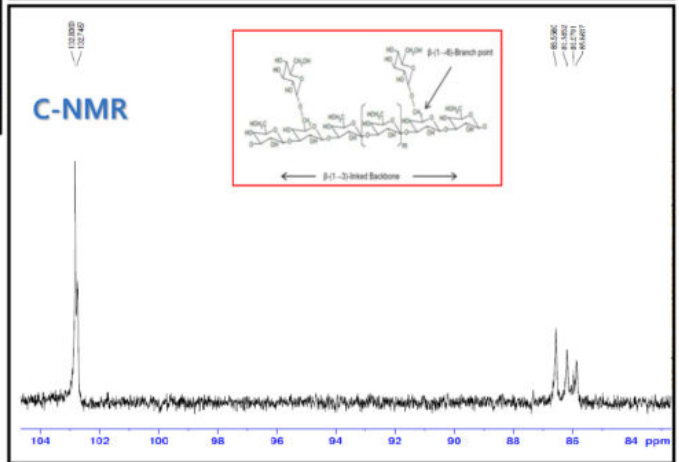
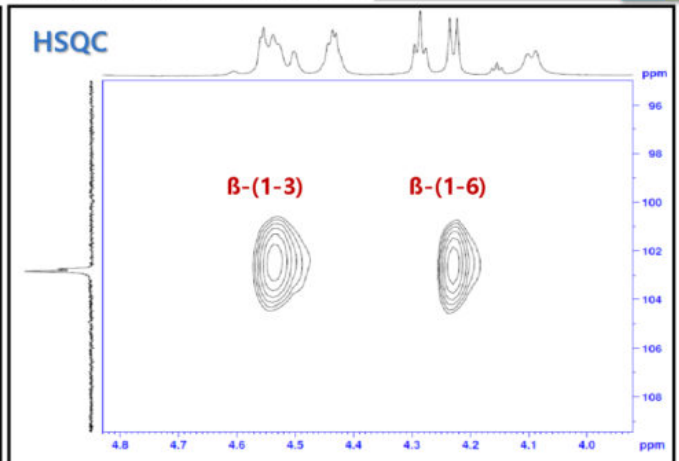
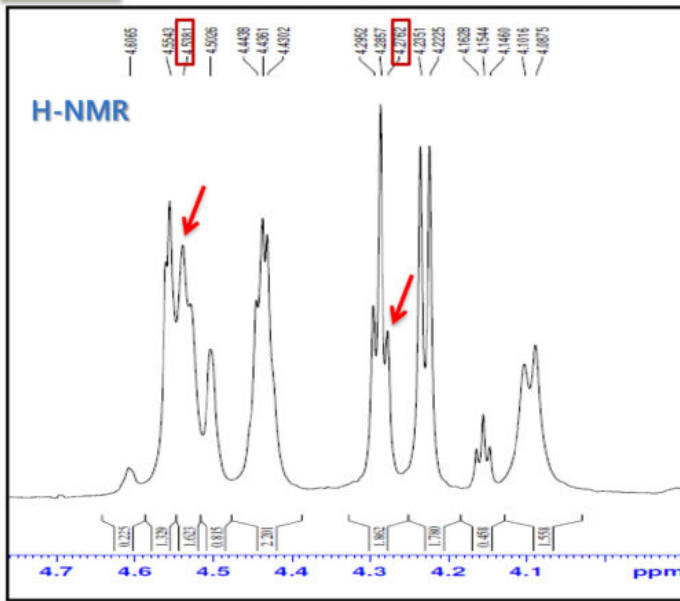
We will focus on manufacturing the beta-glucan and will provide the raw materials for partners focusing on specific areas. In Korea we provide our raw materials to large companies such as LG. We also export to Asian markets: China, Thailand, Japan, and Indonesia. Our export operations are expanding. We are in the process of opening a branch office in the USA. The US FDA has such control over the global direction for regulations, that I want to set up a manufacturing facility there, in the United States. That way we can better target the USA and other Western markets.

We have a wide product pipeline with launches to take place between now and 2023. Currently, our processes only cover cosmetics, but we will be expanding into functional foods very soon. We have also developed a beta-glucan hangover cure. If you drink beta glucan when consuming alcohol, the beta-glucan will increase the ADH activity, and help to decrease the alcohol concentration in the bloodstream. That product will be launched this year.

What are the next major milestones for Quegen?

After launching on the KOSDAQ, we hope to gain the necessary investment to construct a GMP facility, so we can manufacture raw materials within the pharmaceutical sector. We already have a number of collaborations with oncology drug developers interested in beta-glucan. Quegen Biotech is collaborating with PharmABcine to combine beta glucan with Tanibirumab. We are also partnering with Y-Biologics. Y-Biologics have an immune checkpoint inhibitor which we are combining with our pure beta glucan (QBG). We already have good results from animal testing. MSD is running a similar project but using yeast rather than mushroom beta glucan. The beta glucan will improve the efficacy of the drug.

Between the 7th and 9th of January, we attended the Biotech Showcase with JP Morgan biotech conference, where Quegen delivered a presentation. We hope to find partner companies and establish a wider network of partners and investors.

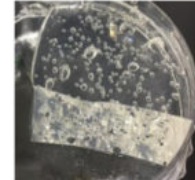


HNMR Major Signal

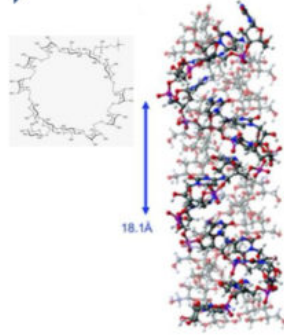
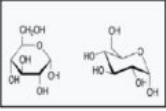
H-1 (1,3-glucan)	4.5381 (218757780)
H-1 (1,6-glucna)	4.2762 (72866954)
Ratio	0.333

USP monograph relative % of 1,6 = (A)/(A+B) * 100 = 25%

Quegen Biotech's betaglucan Hydrogel

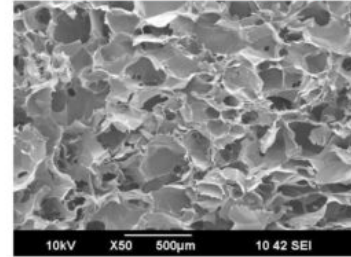


Radiation Fusion Technology



Triple Helix

(10) Patent No.: US 8,592,574 B2
 (45) Date of Patent: Nov. 26, 2013



- **Characteristics**
 - High Purity
 - Natural Form
 - High Efficacy
 - Mass Production
- **Applications**
 - Adjuvant of Cancer Drugs
 - Scar, Burn Treatment
 - Immunity Modulator
 - Skin Regeneration
 - Cholesterol Alleviation

- **Characteristics**
 - No Toxic Chemical Agents
 - Biodegradable & Safe & Durable
 - Composed of Only Glucose
 - Highly Porous
- **Applications**
 - Stem Cell Support
 - Artificial Skin
 - Scaffold for Biomaterial
 - Filler for Wrinkle & Breast Implant
 - Cancer Treatment, DDS

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