nanoparticle

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Infinity Turbine LLC

Silver Nanoparticle Production by Hydrodynamic Cavitation

This webpage QR code

Structured Data

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Company Name: Infinity Turbine LLC
Product: Spinning Disc Reactor to Produce Nanoparticles.
Working Fluid: Water.
Machine: Hydrodynamic cavitation SDR
Industry: Nanoparticle.
Applications: Producing nanoparticles.

PDF Version of the webpage (first pages)

Silver Nanoparticle Production $14 per gram from botanical sources

Spinning Disc Reactor for Nanoparticle Production to make $24 million per year

For the full review, please download our pdf: 20190425-infinity-supercritical-sdr-nanoparticle-review (see link below).

Spinning Disc Reactors, or SDRs, are a very new type of processing unit that has had new applications discovered every year.

A big field of interest as of lately has been process intensification which is a design approach that focuses on smaller, cleaner, safer, and more energy efficient processes. One design that has received considerable attention as of late has been the spinning disc reactor (SDR). Its basic design includes one or more liquid streams being flowed onto a quickly rotating disc.

The centrifugal acceleration from the rotation creates a very thin liquid film which significantly heightens the mass transfer and micro-mixing ability of the liquid streams. It also is a continuous feed reactor which can be applied to many processes that have relied on large volume and high residence time designs like batch or continuously stirred tank reactors (CSTR).

While the SDR can be used for many different processes, it excels greatly in a specific few. These include processes that rely on precipitation and uniformly mixed reactants. These traits allow for SDRs to be used in the bottom-up production of nanoparticles, where particles are created through nucleations and subsequently crystal growth. This is where batch reactors and CSTRs aren't as easily applied due to their high volumes and lack of sufficient mixing ability. "Top-down" processing where bulk material is ground down into nanoparticles is typically avoided when trying to achieve nanoparticles of a certain size and narrow size distribution due to the lack of control over the process.

In 2010, the global market for quantum dots was low, sitting at $67 million [27]. It was projected to have an amazing 59.3% compound annual growth rate, which was mostly realized and by 2016 it has become a $610 million global market (with the estimated CAGR it was predicted to reach $670 million by 2015) [28]. The current growth rate is estimated at 41.3% now for 2016 to 2021, predicting the global market to reach $3.4 billion by 2021 [28].

Both silver and titanium dioxide nanoparticles have a realized and open market to enter with predicted growth and new applications coming out consistently. The cost to produce the materials is rather low and the production ability seems high enough, especially with silver, that a company could actively pursue using an SDR to produce the nanoparticles with success. Since the proof of concept and idea is already detailed, there would be a low cost of entry into these markets as well. The revenue from such could be used to support R and D into quantum dots or pharmaceutical nanoparticles.

Strategy: (prices updated on 5 January 2021)

Silver Nano Particles Production at $14.25/gram Sell Price ($285/20/ml):

[Note: these are 2017 figures. For 2021 double the figures below.] If silver nanoparticles of 99% purity or higher can be produced anywhere in the range of 10 nm – 40 nm, they can be sold at a wholesale price of $3+ a gram ($6/gram in 2021). To undercut the market to allow for entry I assumed a price of $2 a gram ($4/gram in 2021). This comes out to be about $24 million a year in revenue for 2017 ($48 million in 2021). As seen in Table 15, this comes out to about $12 million a year in profit for 2017 ($24 million a year for 2021). Referencing Section 2.21, a producer with the production rate would have a 1.56 percent market share of the global market.

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Green Synthesis of Silver Nanoparticles Using Astragalus

Green Synthesis of Silver Nanoparticles Using Astragalus tribuloides Delile. Root Extract: Characterization, Antioxidant, Antibacterial, and Anti-Inflammatory Activities.

Abstract: Today, the green synthesis of metal nanoparticles is a promising strategy in material science and nanotechnology. In this research, silver nanoparticles (AgNPs) were synthesized through the high-efficient, cost-effective green and facile process, using the Astragalus tribuloides Delile. root extract as a bioreduction and capping agent at room temperature. UV-Vis spectroscopy was applied for the investigation of the reaction proceedings. To characterize the greenly synthesized AgNPs, Fourier-transform infrared spectroscopy (FTIR), Xray diffraction spectroscopy (XRD), and transmission electron microscopy (TEM) analyses were utilized. In addition, the total phenolics and flavonoids contents, antioxidant, antibacterial, and anti-inflammatory activities of the greenly synthesized AgNPs and the A. tribuloides root extract were evaluated. The results indicated that the AgNPs had spherical morphology and crystalline structure. The total phenolics and flavonoids contents of the greenly synthesized AgNPs were lower than those for the A. tribuloides root extract. The resultant AgNPs exhibited the appropriate antioxidant activity (64 percent) as compared to that for the A. tribuloides root extract (47 percent). The antibacterial test approved the higher bactericidal activity of the resulting AgNPs on the Gram-positive and Gram negative bacteria in comparison to the A. tribuloides root extract. Considering the anti-inflammatory activity, the greenly synthesized AgNPs showed a stranger effect than the A. tribuloides root extract (82 versus 69 percent at 500 micro g/mL). Generally, the AgNPs that were fabricated by using the A. tribuloides root extract had appropriate antioxidant, antibacterial, and anti-inflammatory activities and, therefore, can be considered as a promising candidate for various biomedical applications.

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Spinning Disc Reactor Prototype for Sale: $100,000

Includes: industrial cart with swivel casters, experimental cavitation discs, spare parts. Also includes a centrifuge to experiment with separating liquids. Domestic USA crate and freight anywhere lower 48 USA $2,500.

Features and Design of Experimental Cart System:

Power: 110V 60hz plug. AC to DC variable speed drive. DC motor drive for SDR assembly.

Dimensions: Unit measures 24 inches wide x 48 inches length x 54 inches height. Fits through any USA standard door, hallway, and elevator.

Construction: Powder coated caster beams (bolt together beams) and laser cut clear acrylic table top, back and lower shelf. Caster beams are easily reconfigured using 3/8 bolts/fasteners. Beams have 3/8 inch bores for fasteners, and 3 inch diameter cut-outs for easy access to fasteners, or providing access to wiring or other internal beam contents.

Mobility: Heavy duty industrial 5 inch swivel and lock casters.

SDR Assembly: SDR modular blocks and bolt together with quick release toggle, which allows rapid reconfiguration of internal shaft mounted SDR discs. Multiple cavitation format discs are included. Magnetic coupling for sealed rotating assembly. Multiple input and exit ports on blocks allow multiple configurations. Glass sight viewports for camera and lighting. Sensor ports for pressure, temperature, or other sensors. Vertical solid state liquid heating vessel. When run in cavitation mode, you will hear a gravel-like sound which indicates cavitation of water. In addition, there will be an absence of light present when using a flash light or laser through viewport when water cavitation is in full process. This is not a botanical processor, but rather an experimental system to show cavitation. The most asked question is the ability for continuous flow cavitation, and that cavitation provides the process to extract oil from botanicals. This system allows you to experiment with these issues. This is a low pressure system using patented modular blocks. Seals are designed to contain liquid only (not a pressurized system). System designed for water and oil only. While oil does not cavitate, oil-to-oil extraction is possible and happens quickly with this method of rotating discs. There are several studies which suggest that oil-to-oil extraction is viable and has extraction rates much better than some ethanol extraction processes, but this is something you would have to verify. System can easily be configured for extraction, but that process would be your responsibility.

High Technology Applications: This same SDR (Spinning Disc Reactor) technology can also be used to produce silver nanoparticles and other hi-tech (liquid battery and component) manufacturing. This technology may be a huge impact for manufacturing for companies like Quantum Scape and Ambri liquid metal technology. This system may also be adapted for recycling lithium batteries.

Can You Build This System On Your Own ? Yes, of course you can. But expect about a 12 month trial-and-error process. We use our own patented modular block system, which allows for rapid prototyping and integration from testing to market. What you are buying is time. The time savings alone will easily pay for the system very shortly. In addition, we already have 5 years of botanical extraction experience under our belts, which includes CO2 and water phase change cavitation science experience since 2004.

Sale Conditions: System sold as-is, no warranty,and no guaranty on extraction rates as a experimental system. System is sold with no support. Support may be available as a paid option (depending on application).

Demonstration: If you would like to pay for a demonstration of water cavitation, we are able to arrange a showing in

Hydrodynamic Cavitation Processing Systems:

Concurrent with the Modular Blocks and Extraction Systems, I developed a Spinning Disc Reactor for process intensification. Termed the Sonic Extractor, this device uses spinning discs to hydrodynamically cavitate water. It turns out that you can also cavitation CO2 (quite easily) which allows us to use a spinning disc to phase change CO2 from a liquid to gas, and act as a pump. This methodology is perfect for Silver Nanoparticle production, and other continuous push-button manufacturing.

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