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Research Article

SYNTHESIS, OF NANOPARTICLE AND NANOFIBER FROM A UNIQUE SOURCE, *RAILLIETINA TETRAGONA* (CHICKEN CESTODE)

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ABSTRACT

In nanotechnology, nanoparticles, nanomembranes, nanofibers, nanorods, are frequently used in almost every walk of life, ranging from, industrial, biological, pharmacological and biomedical fields. Metals, and heavy metals, are commonly used for the synthesis of nanoparticles, which are frequently used in many biological and medical applications. Though they are extensively used, they have deleterious effects upon human body. In this regard, a number of plant based nanoparticles and other nano products, are being synthesized. Apart from plant materials, there are instances, where in microorganism, such as bacteria, fungi yeast is also used to synthesize nano products. These are very much ecofriendly and also less expensive to metal nanoparticles. It is quite evident that nanoparticles, synthesized from a natural source are more appealing as they are both ecofriendly and inexpensive. Based upon these conclusions, it was hypothesized that nanoparticles and nanofiber can also be produced from natural and some sort of a novel source *i.e.*, an intestinal parasite, which is often considered as a waste, or as an intruder or infestation of human/chicken intestines. This discarded piece of parasitic life may be an appropriate and cheaper alternative source for the production of nano products. In the present study for the first time, it was attempted to synthesize nanoparticles and nanofiber using an intestinal parasite *Raillietina tetragona* as a potential source. These particles may be referred to as para/bio nano particles, as they originate from a parasite, or from a living animal source, *R. tetragona* is a common, cestode, found in chicken intestines. The parasite measuring approximately 15cm in length, was carefully removed from the intestine of chicken was suitably stored at room temperature, and later processed for the synthesis of nanoparticle and nanofiber. Nanoparticles were synthesized using the method of acid hydrolysis and nanofiber was prepared using electro spinning technique. The nanofiber which was synthesized, was hydrophilic in nature, and measured about 6cm x 3cm in size. This study, strongly suggests that wealth can be reaped out of waste. These processed para nano materials are cost effective, ecofriendly and hence may be suggested to be used frequently in biological and medical applications.

Keywords: Nanoparticle, Nanofiber, *Raillietina tetragona*, Electro spinning, Chicken cestode.

INTRODUCTION

Nanoscience and nanotechnology has certainly revolutionized biological and medical sciences in a big way. Nanoparticle, nanomembranes, nanofibers, nanorods, find applications in almost every walk of life, ranging from, industrial, biological , pharmacological and biomedical fields (Wang & Wang, 2014). The unique versatility, of nanoparticles, is attributed to their, size and dimensions. (100nm) and materials, exhibit certain unique physical properties, when they are downsized to nano proportions, in contrast to heavier materials, which show constant physical properties (Abdel Goad *et al*., 2020). The main driving force, for the development of nanotechnology, stems, from the understanding of biological processes as they are often happening at a nanoscale (Kipp, 2004) and living cells are typically 10µm in size and their components are much smaller in size. Metals and heavy metals are commonly used for the synthesis of nanoparticles, which are frequently used in many biological and medical applications. Though they are extensively used, they have their own drawbacks as there are evidences where in nanoparticles, made from metals, have deleterious effects upon human body (Agarwal *et al*., 2013). To avoid the risk of using metal nanoparticles, scientists are constantly

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exploring, different materials, which can be both ecofriendly and also cost effective. In this regard, a number of plant based nanoparticles, have been synthesized and this method of developing plant based nanoparticles, is considered to be green chemistry approach (Parveen *et al*., 2016). Apart from plant materials, being used as nanoparticles, there are evidences, where in microorganism, such as bacteria, fungi yeast are also used to synthesize nano products (Li *et al*., 2011).Cellulose and bacterial cellulose(BC) seem to be used for synthesis of ecofriendly, nano based products, which seem to gain more popularity in recent times (Jose *et al*., 2020; Ma *et al*., 2020).It is quite evident from these studies, that nanoparticles, synthesized from natural sources are more appealing as they are ecofriendly, biocompatible and also least expensive. Based upon these evidences, we hypothesize that nanoparticles and nanofiber can also be produced from natural or some sort of a unusual source *i.e.*, an intestinal parasite. The present study is an attempt to develop nanoparticles and nanofiber from much cheaper source or to be precise, from waste material *i.e* from an intestinal parasite (chicken cestode).

MATERIALS AND METHOD

For the purpose the experimentation, chicken intestines, were collected from the source. The intestines, infested with parasitic infection, were thoroughly washed, and then dissected for parasitic infection, chicken cestode, identified as *Raillietina tetragona*, was identified, which was white in color and was carefully collected in to the petridish. The worm measured approximately 15 cm in length was collected and dried overnight in an incubator at a temperature of 37 degree Celsius. The parasite was thoroughly dried and pounded into a fine powder using a motor and pestle, and was further processed for nanoparticles and nanofiber.

Preparation of nanoparticles

Cestode nanoparticles were produced from the purified cestode by repeated acid hydrolysis. Cestode powder was soaked in 3M HCl for acid hydrolysis and incubated for 90 min at 90°C in a thermostat water bath. The sample was centrifuged at 6000 rpm for 10 min and the pellets were collected. The acid hydrolysis step was repeated thrice and the final pellet was suspended in distilled water to dilute the acid concentration. The suspension was dialyzed against distilled water until it reaches pH 6 (Figure 1).

Preparation of nanofibre

Cestode powder of 2% was dissolved in 80 %(w/v) of acetic acid. To the mixture 1 ml of 10% PVA (Poly vinyl alcohol) polymer was added as additive to obtain thick fibre consistency. The mixture was electro spinned in 18kv potential using electro spinning apparatus, and tip to plate distance of 15 cm at a flow rate of 0.5 ml/hour (Figure 2).

RESULTS AND DISCUSSION

In the present study, we have successfully synthesized nanoparticles and a hydrophilic nanofiber, using a rather unusual source, chicken intestinal cestode (*R. tetragona*). As hypothesized, this seems to be accost effective, biocompatible, nano material. In recent times, plethoras of different materials are being constantly tested, for effective drug delivery system, in cancer therapy and many other pathological applications. As mentioned earlier, metals and other non-metal ions, though can be effectively molded in to various nanostructures, they don't seem to be best suited for medical and biological applications, attributing to their deleterious effects upon human body. Nanoparticle based drug delivery systems, are the most sort after treatment options, for many pathological conditions, in particularly in cancer treatment, because of their ability to directly to the

Figure 1. Nanoparticle.

Figure 2. Nanofiber.

desired cells (Hammel *et al*., 2004) and also to target precisely the tumor cells amongst the healthy ones (Hammel *et al*., 2004).Nanofibers are more frequently used in tissue engineering, bone remodeling and skin regeneration. Apart from these, they are also being efficiently used in drug delivery systems, (Hammel *et al*., 2004; Verreck *et al*., 2003). In conclusion it may be said, that, it is often advisable and advantageous to use nano structures, which are derived from natural components, for biological and medical applications, as they are more ecofriendly, cost effective and more importantly biocompatible. Therefore in the present study we have successfully derived or molded nanoparticles and nanofiber from a more natural or unusual source, a cestode.

CONCLUSION

This experiment, distinctly illustrates, the dogma, that there can never be any material described as waste in nature, and also strongly re asserts the law of thermodynamics, as energy cannot be created or destroyed, but can only be converted from one form to another, similarly mass cannot be destroyed , but can only be converted from one form to another.

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