

Editorial

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Nanotechnology Based Semen Purification: A Panacea

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With the inception of semen freezing technology, it has become possible to disseminate the superior germplasm through artificial insemination, which really revolutionized the dairy industry. However, production of high quality sperm insemination dose is crucial to the survival of this technology. Cryopreservation of sperm is a damaging phenomenon resulting in about 50% drop in the quality from pre-freeze to post-thaw.¹ One of the pre-dominant contributor to this damage is the presence of dead sperm which act as a source of free radical generation in the semen. The Reactive Oxygen Species (ROS) cause an oxidative injury to the viable sperm, hence removal of such sperm from the semen could lead to improvement in the quality. To this, nanotechnology based semen purification offers an efficient way to eliminate the dead and/or prematurely capacitated spermatozoa from the semen.

Nanotechnology utilizes nanoparticles with size ranging from 1-100 nm. Ubiquitin protein under normal physiological conditions, is added to the dead and defective spermatozoa while their transit down the epididymis through a process that has been termed as protein ubiquitination.² Magnetic nanoparticles are prepared by coating them with either antibodies against ubiquitin or lectin labels such as *Pisum Sativum* Agglutinin (PSA) or Peanut agglutinin (PNA) which can bind to glucosidic residues that become exposed on the outer surface of a sperm with either inherently compromising or prematurely activated acrosome.³ These labeled nanoparticles are mixed with the semen sample and a strong magnet is then applied to concentrate the dead and defective spermatozoa at the bottom, that either bind to lectin coated or antibody coated nanoparticles. In this way dead or defective sperm are removed from the sample and a high quality semen sample is obtained.

The preliminary research on nanobased semen purification has produced some excellent results in boar and bull.⁴ So far no toxic or teratogenic effect of nanoparticles have been reported in dam or new born and a significant increase in conception rates after artificial insemination with nanopurified semen has been documented.⁴ However, this technology awaits further investigation to become a part of semen freezing technology in future. The nanotechnology based semen purification looks simple but has a tremendous potential to improve the quality of semen and can turn an infertile semen into a fertile one through the removal of dead and defective sperm from the semen sample. It is going to create a thrill among andrologists in near future.

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