

Artificial, Nanomedicine for Comprehensive Treatment of Several Diseases

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Our group at S. N. Bose National Centre has developed a safe and cost effective nanomedicine that promises accurate treatment of a number of diseases. The medicine combines nanoparticles extracted from manganese salt with citrus extract, like from lemon. Both the ingredients are non-toxic, rather essential for the wellbeing of our body. Specifically manganese is a trace element, which our body needs in small amount for the normal functioning of our brain, nervous system and enzymes. It is thus considered an essential nutrient and can be found in seed, and whole grains as well as smaller amount in legumes, beans, nuts, leafy green vegetables & tea. On the other hand citrate salts from citrus extract (which contains potassium and sodium) belong to a class of drugs to make our urine less acidic. This effect helps the kidneys to get rid of uric acid, thereby helping to prevent gout, kidney stones and other metabolic problems (acidosis) caused by kidney diseases.

A crucial combination of manganese and citrate employing tricks of nanotechnology produces the nanomedicine in our laboratory. The artificially made nanomedicine is found to be important to maintain “redox” balance in our body’s tissues- these are types of reactions in cells that add or remove oxygen, and are essential for many processes such as generating energy in cells. The redox reactions can also create harmful products to our cells called reactive oxygen species (ROS) which can instantly oxidize lipids (fat), proteins and nucleic acids accelerating our aging process. However, it has to be noted that our immune cells naturally produce ROS or generate oxidative stress to kill virus/bacteria and infected cells in our body. Thus controlled-increase of ROS

or oxidative stress aids our immune cells to perform their natural functions more efficiently.

The developed nanomedicine is shown to have intelligence to decrease and/or increase oxidative stress (ROS) in our body depending on the situation and cures several diseases. Our findings have been published in international journals. In October last year a comprehensive review entitled “Role of Nanomedicine in Redox Mediated Healing at Molecular Level” of all the development has been published (DOI: <https://doi.org/10.1515/bmc-2019-0019>). The concept got immediate attention of international experts in the field and referred as “a new front in redox medicine, the emerging field of ROS-based nanomedicine, involving nanomaterials with ROS-regulating properties, holds promise for optimized therapeutic efficacies” in a recent Nature journal (DOI <https://doi.org/10.1038/s41580-020-0230-3>) in March in this year. The efficacy of the developed nanomedicine in balancing oxidative stress (ROS) in mice is tested recently. In a controlled experiment, we have injected lead (Pb) ions to the mice to create higher oxidative stress (ROS) and liver damage. The liver disease due to lead toxicity is very common in humans due to increase in pollution and use of Pb-containing cosmetic paints including lipsticks. In the experiment we found the nanomedicine reduces oxidative stress of the mammal due to lead-exposure and also helps to remove the toxic ions from the liver (popularly known as chelation therapy in medicine) reversing the damage of the organ. Recently ChemMedChem (Volume15, Issue5 March 5, 2020 Pages 391-391 DOI <https://doi.org/10.1002/cmdc.202000098>), which is one of leading journals for drug discovery from Wiley publication house has highlighted our work in the front cover (as shown in the artwork).

Enhancement of oxidative stress by the nanomedicine in animal tissue is also commendable and finds application in curing diseases including neonatal jaundice. In recent past we have shown that the added oxidative stress upon



administration of the nanomedicine can break down bilirubin (the toxic molecule causing jaundice) providing a cure for hyperbilirubinemia (jaundice). In a trial (<https://doi.org/10.2217/nnm.15.83>) on mice we found the nanomedicine safe and its swift, precisely bringing down bilirubin level within two and half hours. This ability of controlled enhancement of oxidative stress (ROS) in mammals paves new potential for the application of the nanomedicine in controlling virus infection including COVID-19. Recently, local administration of hydrogen peroxide, which is in a class of ROS, is recommended to be a way of surviving COVID-19 (<https://www.livetradingnews.com/surviving-the-coronavirus-disease-how-hydrogen-peroxide-works-172241.html>). The excess ROS was achieved by applying the hydrogen peroxide chemical in respiratory track through a nebulizer is advised in order to inactivate COVID-19 by breaking down the viral structure. As direct application of hydrogen peroxide create several complications including direct oxidation of normal body cells, replacement of the chemical by our nanomedicine would be beneficial. Our animal trial for the “redox” healing of several diseases is completed. We are now looking for sponsors so that we can start clinical trials on humans.