

## COMPARATIVE ASSESSMENT OF ACUTE TOXICITY OF SILVER NANOPARTICLES AND RAJATHA BHASMA ON BRINE SHRIMP

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Nanoparticles provide a promising prospective in future medical applications, especially in fighting against microbial diseases while mitigating the development of acquired resistance in bacteria. Several studies have investigated the potential of using silver nanoparticles to treat infectious diseases, cancers and wounds, although silver may cause toxicities. The ancient Rasa Shastra (Indian Alchemy) and Ayurveda inherit a unique set of herbo-mineral-metallic drugs (Rasa Aushadha), which consist of fine particles believed to be in the nanoscale (e.g. Bhasma). Rajatha Bhasma (RB), made out of fine silver particles, is used to treat neurological, respiratory, digestive, skin and infectious diseases in Ayurveda medicine. However, to date, only a handful of studies have investigated the potential toxicities of these herbo-mineral-metallic drugs used in Ayurveda. The objective of this study was to investigate the acute toxicity of RB in comparison with modern silver nanoparticles (SNP) using brine shrimp lethality bioassay (BSLB). One preparation of RB (RB1) was made by the researchers following the recommended authentic procedures. Two other RB products in the market were purchased (RB2 and RB3). SNP were prepared using the Turkevich method. In order to conduct the BSLB, artificial seawater was prepared in the laboratory. Nauplii of brine shrimp (24 h old) were exposed to different concentrations of RB and SNP (674.00  $\mu\text{g ml}^{-1}$ , 337.00  $\mu\text{g ml}^{-1}$ , 167.00  $\mu\text{g ml}^{-1}$ , 83.50  $\mu\text{g ml}^{-1}$ , 41.75  $\mu\text{g ml}^{-1}$ , 20.88  $\mu\text{g ml}^{-1}$ , 10.44  $\mu\text{g ml}^{-1}$ , 5.21  $\mu\text{g ml}^{-1}$ , 2.60  $\mu\text{g ml}^{-1}$ , 1.30  $\mu\text{g ml}^{-1}$  and 0.65  $\mu\text{g ml}^{-1}$ ) in triplicates in 12 well cell culture plates. De-ionized water was used as the control. After 24 h, the number of dead nauplii was counted, and the percentage of deaths was calculated. The lethal concentration required to kill 50% of the population ( $\text{LC}_{50}$ ) was calculated using the software Minitab 14. SNP, RB1, RB2 and RB3, in respective order, had  $\text{LC}_{50}$  values of 32.75 ( $\pm 8.50$ )  $\mu\text{g ml}^{-1}$ , 326.17 ( $\pm 94.40$ )  $\mu\text{g ml}^{-1}$ , 340.03 ( $\pm 158.50$ )  $\mu\text{g ml}^{-1}$  and 149.52 ( $\pm 85.85$ )  $\mu\text{g ml}^{-1}$ . The study reveals that the RB preparations were relatively non-toxic compared to SNPs at the concentrations used. However, acute and chronic toxicities associated with RB treatments need to be further assessed in higher animal models.

**Keywords:** Acute toxicity, Brine shrimp lethality, *Rajata bhasma*, Silver, Silver nanoparticles