Applications of *Ochrobactrum oryzae* silver nanoparticles for the removal of heavy metals from sewage sludge

Sinqobile F. Ndulini[1], Mathews S. Mthembu[2]

Department of Biochemistry and Microbiology, University of Zululand, Private Bag X1001, KwaDlangezwa, 3886. South Africa

*Corresponding author: sfanele.ndulini@gmail.com

Phone number: 035 902 6098

1. **Introduction:** The high heavy metals concentrations has limited the use of sludge for agricultural purposes and has also threatened its disposal. Sewage sludge disposal has become the major concern for both public health and environmental safety. A study aiming at remediating sewage sludge for safe disposal and uses by removing heavy metals from sludge was conducted.
2. **Experimental:** *Ochrobactrum oryzae* silver nanoparticles were prepared and used in the removal of heavy metals from the sludge. The microbial nanoparticles were applied on sludge at room temperature and samples were collected at 24 hours' intervals and analyzed for concentrations of zinc, lead, nickel and iron using spectrophotometric methods.
3. **Results and discussion:** The removals were found to be 100% for nickel, 68% for iron, 52% for zinc, and the lowest was 38% for lead. The obtained findings were in line with the sludge disposal and use standards set by the South Africa's Department of Water and Sanitation. Reyad *et al* 2017, has reported that *O. oryzae* has an ability to degrade atrazine which is an endocrine disruptor and human carcinogen, this shows the successful use of microbes in bioremediation [1]. Microorganisms accumulates and detoxify heavy metals through their reductase enzymes which reduce metals salts into metal nanoparticles with narrow size distribution and less polydispersity [2]
4. **Conclusion:** The applications of *Ochrobactrum oryzae* fused with silver nanoparticles proved effective and to be efficient in the removal of heavy metals from sludge, and the technique may be used an environmental friendly and cost effective tool in bioremediation of sewage sludge for proper disposal and management as well as usage by improving public health and reducing environmental pollution.
5. **References:**

[1]. Reyad, A. M. M., Redwan, T.E.E., Ibrahim, W. M. and Essa, A.M.M. (2017) 'Occurrence of Atrazine Biodegrading Bacterium ', *Egyptian Journal of Boytany*, 57(2), pp. 303–316.

[2]. Singh, P., Kim, Y., Zhang, D. and Yang, D. (2016) 'Biological Synthesis of Nanoparticles from Plants and Microorganisms', *Trends in Biotechnology*. Elsevier Ltd, 34(7), pp. 588–599.

Key words: Sewage sludge, heavy metals, microbial silver nanoparticles, *Ochrobactrum oryzae*