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MICROBIAL UTILIZATION OF WASTE FOR NANOPARTICLES PRODUCTION

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Abstract

The synthesis of silver nanoparticles (SNPs) extensively studied by using chemical and physical methods. Here, the biological methods were used and give benefits in research field in the aspect of very low cost (from waste to wealth) and safe time as well. The study aims to isolate and exploit the microbial power in the production of industrially important by-products in nano-size with high economic value, to extract highly valuable materials from hazardous waste, to quantify nanoparticle size, and characterization of SNPs by X-Ray Diffraction (XRD) analysis. Disposal X-ray films were used as substrate because it consumes about 1000 tons of total silver chemically produced worldwide annually. This silver is being wasted when these films are used and disposed. Different bacterial isolates were obtained from various sources. Silver was extracted as nanoparticles by microbial power degradation from disposal X-ray film as the sole carbon source for ten days incubation period in darkness. The protein content was done and all the samples were analyzed using XRD, to characterize of silver (Ag) nanoparticles size in the form of silver nitrite. Bacterial isolates CL4C showed the average size of SNPs about 19.53 nm, GL7 showed average size about 52.35 nm and JF Outer 2A (PDA) showed 13.52 nm. All bacterial isolates partially identified using Gram's reaction and the results obtained exhibited that belonging to *Bacillus sp*. There are few reports on SNP synthesis by bacteria. In this paper, we report the synthesis of SNPs by *Bacillus* isolate. This is also the first report on production of SNPs from disposal X-ray film as the sole carbon source using bacterial power in darkness. According to (Table 1), the protein content of all the most potent bacterial isolates were higher than the control. The protein content exhibited the highest in case of JF Outer 2A PDA isolate than other samples.

Table 1: Screening of the most potent isolates for protein content obtained from disposal x-ray film at 37°C.

NO.	Isolate Symbol	Protein Content (mg/ml)
		Mean ± SD
1	Control	0.0 ± 0.000
2	CL4C	0.651 ± 0.002
3	GL7	0.673 ± 0.009
4	JF OUTER (2A PDA)	0.871 ± 0.003

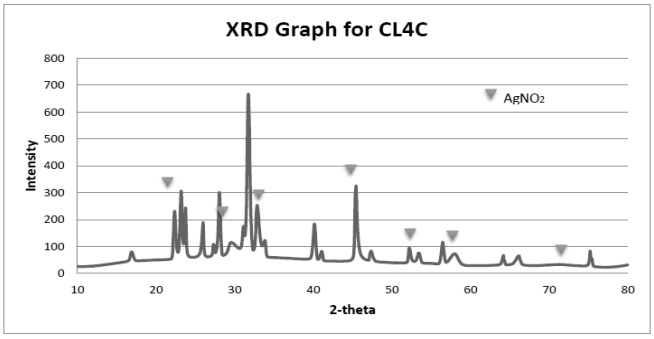

Figure 1: Shows the silver nitrite XRD peaks for CL4C isolate

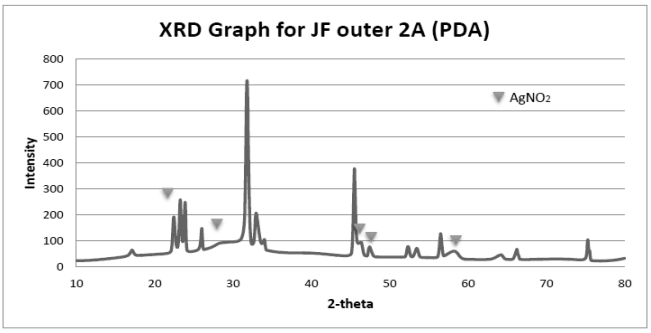

Figure 2: Shows the silver nitrite XRD peaks for JF Outer 2A (PDA) isolate

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References

Jeevan, P., Ramya, K., Rena, A. E., (2011). Extracellular biosynthesis of silver nanoparticles by culture supernatant of *Pseudomonas aeruginosa*. *Indian Journal of Biotechnology*. Vol 11 pp 72-76.

Kannan N., Subbalaxmi, S., (2011). Green synthesis of silver nanoparticles using *Bacillus subtillus* IA751 and its antimicrobial activity. *Research Journal of Nanoscience and Nanotechnology* 1 (2): 87-94, 2011.

Mukunthan, K. S., Elumalai, E. K., Trupti Pate, N., Ramachandra Murty, V., Catharanthus roseus: a natural source for the synthesis of silver nanoparticles, Asian Pacific Journal of Tropical Biomedicine (2011) 270-274.

Mukunthan, K. S., Elumalai, E. K., Trupti, N. P., Ramachandra Murty, V. Catharanthus roseus: a natural source for the synthesis of silver nanoparticles. *Asian Pacific Journal of Tropical Biomedicine* 2011; 270-274.

Natarajan, K., S. Selvaraj, S., Murty, V. R., (2010). Microbial production of silver nanoparticles. *Digest Journal of Nanomaterials and Biostructures*. Vol. 5, No 1, March 2010, p. 135 - 140.

Oyanedel-Craver, V. A., and Smith, J. A., *Sustainable colloidal-silverimpregnated ceramic filter for point-of-use water treatment.* Environ. Sci. Technol., 2008. **42**: p. 927-933.

Thirumurgan, A., Tomy, N. A., Jai Ganesh, R., Gobikrishnan, S. Biological reduction of silver nanoparticles using plant leaf extracts and its effect an increased antimicrobial activity against clinically isolated organism. *De. Phar. Chem* 2010; 2: 279-284.

Udayasoorian, C., Kumar, K. V., Jayabalakrishnan, R. M., (2011). Extracellular synthesis of silver nanoparticles using leaf extract of *Cassia auriculata*. *Digest Journal of Nanomaterials and Biostructures*. Vol. 6, No 1, January-March 2011, p. 279-283.