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The production and application of bioflocculants and their nanoparticles in dairy wastewater treatment

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One of the most pervasive and challenging problems faced by dairy industries is the availability of clean water, reclamation of wastewater and its discharge. This challenge requires modern biotechnological and the fast-growing nanotechnological approaches as robust and newest methods of treating and purifying water at lower cost with less energy in production industries, while at the same time minimizing the use of chemical flocculants and the deleterious health and environmental effects. Bioflocculants, and its silver and magnetic nanoparticles were produced and applied in dairy wastewater treatment. The flocculating activity of all the isolates ranged from 12.14-85.39 % in which *Bacillus subtilis* B2 had the highest flocculating efficiency (85.40%). The best three with high flocculating efficiencies were selected for further studies and production of nanoparticles. They were *Bacillus subtilis* B2 (85.39%), *Fusarium* sp. F6. (81.30%) and *Bacillus licheniformis* B5 (70.88 %). The application of the bioflocculant nanoparticles brought about a reduction in BOD, COD, TSS, TDS, pH, Salinity, Conductivity and turbidity with percentage reduction ranging from 1.11% - 44.17% for BOD, 16.12-71.44% for COD, 7.61-83.70% for TSS, 2.02%-74.94% for TDS, 4.8-6.2 for pH, 2.38%-85.20% for salinity, 15.25%-85.69% for conductivity and for turbidity 2.56%-85.09%. Metal content reduction ranged from 2.91%-71.46% for Fe, 6.15%-95.38% for Cu and 12.57%-97.96% for Zn. Fourier transform infrared spectroscopy revealed the carboxyl (COH) and hydroxyl (OH) group that gave rise to reduced and stable nanoparticle bioflocculants. Scanning electron micrograph showed their crystalline fluffy structures, dendritic nature in different shapes and sizes.

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