

Chemical Tech

Bio-Pd/Fe Core–Shell Granules for Sustainable Dye Degradation

Technology Domain: Chemistry

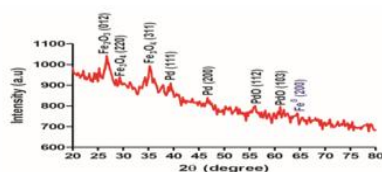
Patent Application Number: 202241065854

Status (Patent/TRL): Granted Patent / TRL 4

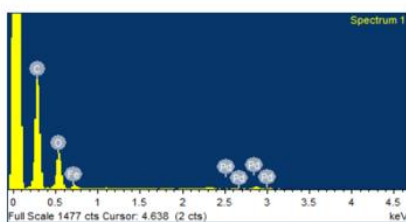
Technology Summary:

This invention provides an innovative and environmentally friendly method for treating industrial effluents, particularly those containing challenging Azo dyes. The key technical solution is the synthesis of bimetallic bio-Pd/Fe core-shell aerobic granules within a sequential batch reactor. This involves a phased process: maturing aerobic microbial granules, then sequentially increasing sodium tetra-chloro palladate concentration to form bio-Pd nanoparticles, and finally adding FeCl_3 to deposit bio-Fe, creating the unique Pd/Fe core-shell structure on the microbial granule surface.

The key inventive feature lies in this in-situ, phase-wise formation of Pd/Fe nanoparticles on microbial granules, offering a convenient and highly effective biological approach to dye degradation. As a result, the bio-Pd/Fe granules successfully demonstrate efficient degradation of Azo dyes, including methyl orange, with high removal percentages (e.g., 98.1% for methyl orange). The use of this invention extends beyond the textile industry to various effluent treatment plants, providing an improved, sustainable, and efficient bioremediation method for persistent organic pollutants.



OUTPUT: Observed Pd(0) peaks at 20: 39.6° and 46.6°; nZVI peak at: 64.8° (JCPDS no. 006-0696), Fe_2O_3 peak at 26.6°; Fe_3O_4 peaks at 29.4° and 35.4°; PdO peaks at 55.8° and 61.2° (JCPDS no. 46-1043)



Element	Weight%	Atomic%
C K	52.17	66.90
O K	30.00	28.88
Fe L	12.51	3.45
Pd L	5.32	0.77
Totals	100.00	

OUTPUT: EDAX analysis of Bio-Pd/Fe nanoparticles confirmed the presence of Pd and Fe elements with wt % of 5.32 and 12.51 respectively.