Title:	Geoalkalibacter halelectricus SAP-1 sp. nov. possessing extracellular electron transfer and mineral-reducing capabilities from a haloalkaline environment
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Abstract:	The extracellular electron transfer (EET)-capable electroactive microorganisms (EAMs) play crucial roles in mineral cycling and interspecies electron transfer in different environments and are used as biocatalysts in microbial electrochemical technologies. Studying EAMs from extreme environments is desired to advance the electromicrobiology discipline, understanding their unique metabolic traits with implications to extreme microbiology, and develop specific bioelectrochemical applications. Here, we present a novel haloalkaliphilic bacterium named Geoalkalibacter halelectricus SAP-1, isolated from a microbial electroactive biofilm enriched from the haloalkaline lake sediments. It is a rod-shaped Gram-negative heterotrophic anaerobe that uses various carbon and energy sources and respires on soluble and insoluble terminal electron acceptors. Besides 16S-rRNA and whole-genome sequence-based phylogeny, the GGDC values of 21.7%, ANI of 78.5%, and 2.77% genomic DNA GC content difference with the closest validly named species Geoalkalibacter ferrihydriticus (DSM 17813T) confirmed its novelty. When grown with the solid-state electrode as the only electron acceptor, it produced 460 ± 23 μA/cm2 bioelectrocatalytic current, thereby confirming its electroactivity. Further electrochemical analysis revealed the presence of membrane redox components with a high formal potential, putatively involved in the direct mode of EET. These are distinct from EET components reported for any known electroactive microorganisms, including well-studied Geobacter spp., Shewanella spp., and Desulfuromonas acetexigens. The capabilities of G. halelectricus SAP-1 to respire on soluble and insoluble electron acceptors including fumarate, SO42−, Fe3+, and Mn4+ suggests its role in cycling these elements in haloalkaline environments.
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