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Enzymatic pretreatment of carbonaceous refractory gold ores prior to cyanidation

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Gold ores in which gold particles are trapped within sulfide minerals are called "refractory gold ores," and the ores with carbonaceous shale are classified as "double refractory gold ores (DRGO)." Since $Au(CN)_2^-$ complexes are adsorbed on the carbonaceous matter in the main route of gold extraction, gold recovery loss is 30 to 70% (preg-robbing effect). In addition, DRGO is not suitable for general flotation beneficiation due to poor separation of carbonaceous and sulfide minerals, despite its higher gold grade than ordinary gold ores, making it unsuitable for economic exploitation. However, DRGOs are scattered over five continents, and it is estimated that their gold resources are equivalent to a fraction of the world's total gold production. It is no exaggeration to say that there is now a global need for hydrometallurgy to recover gold from DRGOs without causing air pollution.

The present work reports on a (bio)hydrometallurgy for graphitic gold ores that avoids roasting, which releases toxic gases, and achieves the necessary mineral degradation at ambient temperature and pressure with a low environmental impact, and proposes a new direction that uses the laccase reaction among ligninolytic enzymes, which has never been attempted before, to recover gold from DRGO with different degrees of graphitization. This provides a new guideline for the sequential DRGO treatment process for each ore, through a molecular level study of degraded products by laccase reaction.