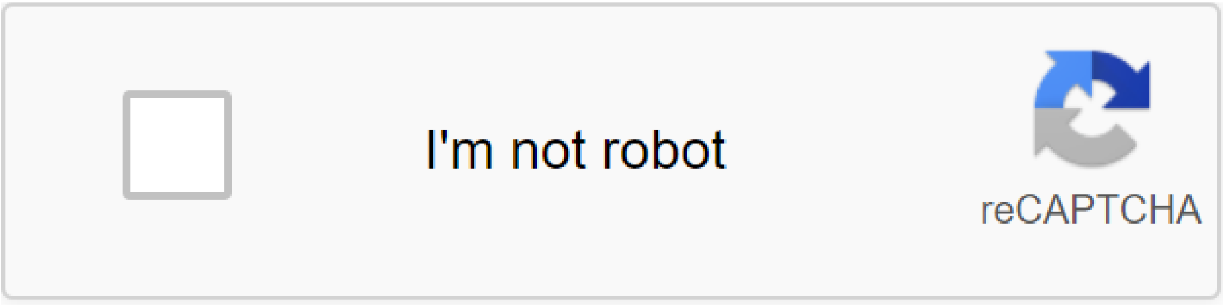
Heap leaching of gold pdf



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The leaching of a pile of gold is an industrial mining process used to extract precious metals, copper, uranium and other compounds from ore using a series of chemical reactions that absorb specific minerals and re-separate them after separating them from other earth materials. Like the mining on the spot, the extraction of the leach heap differs in that it places the ore on the liner, then adds chemicals through the drip systems to the ore, while at the mining site there are not enough of these liners and pulls a pregnant solution to produce minerals. Heap leach is widely used in modern large-scale mining operations because it produces desired concentrates at a lower price than conventional processing methods such as flotation, agitation and leaching vats. In addition, landfill leaching is an integral part of most copper mining operations and determines the quality of the material produced along with other factors, some of the listed sources of this article may not be reliable. Please help this article by looking for better, more reliable sources. Unreliable quotes can be challenged or deleted. (October 2019) (Learn how and when to remove this template message) Due to the profitability that landfill leaching has on the mining process, i.e. it can make a significant contribution to the economic viability of the mining process, it is advantageous to include leaching results in the overall economic assessment of the project. This process has an ancient origin; One of the classic methods of copper production (iron sulfate) was a heap of iron pyrite and collection of leaching from the heap, which was then cooked with iron to produce iron (II) sulfate. The process on the left: ore fines without agglomeration. Right: Ore fines after agglomeration - Improving trickle-down as a result of agglomeration. The mined ore is usually crushed into small pieces and bulked up on an impenetrable plastic or clay lined leaching pad where it can be irrigated with a leaching solution to dissolve valuable metals. While sprinklers are sometimes used for irrigation, more often operations use drip irrigation to minimize evaporation, provide a more even distribution of leaching solution, and avoid damage to exposed mineral. The solution then seeps through the pile and leaches both the target and other minerals. This process, called leaching cycle, usually takes from one or two months for simple oxide oxides (such as most golden floors) to two years for nickel lateral des. The leaching solution containing dissolved minerals is then collected, processed into the plant's process to eradicate the target mineral, and in some cases precipitates other minerals and is processed into after adjusting the levels of reagents. The final recovery of the target mineral can range from 30% of mine-contained landfill leaching of sulphide copper ore to more than 90% for the ores that are easiest to leach, some oxide gold ore. Ore. key questions that need to be addressed in the heap leaching process: can investments in ore crushing be justified by the potential increase in recovery and the pace of recovery? How should acid concentration be changed over time to create a solution that can be economically treated? How does the shape of the heap affect the recovery and solution class? In any coincidence, what type of recovery can be expected before the quality of the leaching solution falls below the critical limit? What kind of recovery (quantitative dimension) can be expected? In recent years, the addition of agglomeration drum has improved the process of leaching the heap, allowing you to leach more efficiently. A rotating drum aglometor, such as a tire operated by Sepro Agglomeration Drum, works by taking shredded ore penalties and agglomerating them into more homogeneous particles. This makes it much easier to leach the solution to seep through the pile, making its way through the channels between the particles. Adding an agglomeration drum also has the added benefit of being able to pre-mix the leaching solution with ore penalties to achieve a more concentrated, homogeneous mixture and allow leaching to start before the heap. Despite significant progress in the development of heap leaching over the past few years through the use of new materials and improved analytical tools, industrial experience shows that expanding the design process beyond the liner and into the rock piles itself has significant advantages. The characteristics of the physical and hydraulic (hydrodynamic) properties of ore for leaching focuses on the direct measurement of the key properties of ore, namely: Relationship between heap height and ore density (density profile) Relationship between bulk density and seepage ability (conductivity profile) Relationship between bulk density, porosity and its components (micro and macro) Relationship between moisture content and seepage (conductivity curve) Relationship between the above-mentioned parameters and ore preparation practices (mining ore) , crushing, agglomeration, treatment and placement method) Theoretical and numerical analysis, and operational data show that these fundamental mechanisms are controlled by scale, dimension and heterogeneity, all of which negatively affect the scalability of metallurgical and hydrodynamic properties from laboratory to field. The dismissal of these mechanisms can lead to a number of practical and financial problems that will resonate throughout the life of the heap, affecting the financial impact of the operation. Through procedures that go beyond commonly used metallurgical testing and the integration of data gleaned through 3D monitoring in real time, a more complete representative characteristic from the heap of the environment received. This improvement in understanding leads to a much higher degree of accuracy in terms of creating a truly representative sample of the environment in the heap. By sticking to the characteristics identified above, a more comprehensive look can be taken into account on the leaching conditions of the heap, allowing the industry to move away from the actual approach of the black box to the physical and chemically inclusive model of the industrial reactor. Precious metals Shredded ore is irrigated with a solution of diluted alkaline cyanide. The solution, containing dissolved precious metals in a pregnant solution, continues to seep through the crushed ore until it reaches the liner at the bottom of the pile, where it flows into the storage pond (pregnant solution). After separating precious metals from the pregnant solution, the solution of diluted cyanide (now called infertile solution) is usually reused in the process of leaching the heap or sometimes sent to an industrial water tank, where residual cyanide is processed and residual metals are removed. In areas with very high rainfall, such as the tropics, in some cases there is excess water that is then discharged into the environment after treatment, which creates possible water contamination if the treatment is not carried out properly. (quote is necessary) The production of a single gold ring using this method, can generate 20 tons of waste. [7] During the extraction phase, the gold ions form complex ions with the cyanide: Au + (s) + 2 CN − (aq) ⟶ Au (CN) 2 − (aq) {\displaystyle {\ce {{Au+ (s)}+ 2CN^- (aq) -> Au(CN)2^- (aq)}}} Recuperation of the gold is readily achieved with a redox-reaction: 2 Au (CN) 2 − (aq) + Zn (s) ⟶ Zn (CN) 4 2 − (aq) + 2 Au (s) {\displaystyle {\ce {{2Au(CN)2^{-}(aq)}+Zn(s)->{Zn(CN)4^{2}-(aq)}+2Au(s)}}} The most common methods to remove the gold from solution are either using activated carbon to selectively absorb it, or the Merrill-Crowe process where zinc powder is added to cause a precipitation of gold and zinc. A fine product can be either dore (gold-silver bars) or zinc-gold sludge, which is then refined elsewhere. The copper ore method is similar to the cyanide method above, except for the sulphuric acid used to dissolve copper from its ores. The acid is processed from the solvent extraction chain (see electro-victory extraction solvent, SX/EW) and reused on the leaching site. A by-product is iron (II) sulfate, yarosite, which is produced as a byproduct of pyrite leaching and sometimes even the same sulphuric acid that is needed for the process. Both oxide and sulphide deses can be leached, although leaching cycles are very different, and sulfide leaching requires a bacterial or bio-leaching component. In 2011 leaching, both leaching and leaching in place, produced 3.4 million metric tons of copper, representing 22 percent of world production. The biggest heap leaching operations are found in Chile, Peru and the southwestern United States. Although leaching heaps is a low cost process, it usually has a recovery rate of 60-70%. This is usually the most profitable with low-grade ores. Higher-grade soras usually go through more complex milling processes, where a higher degree of recovery justifies the additional costs. The process chosen depends on the properties of the ore. The final product is cathode copper. Nickel Ore This acid heap leaching method, as in the copper method is that it uses sulphuric acid instead of a solution of cyanide to dissolve the targeted minerals from crushed ore. The amount of sulphuric acid required is much higher than for copper ores, up to 1000 kg of acid per tonne of ore, but 500 kg more often. The method was originally patented by Australian miner BHP Billiton and is currently commercialized by Cerro Matoso S.A. in Colombia, a subsidiary of BHP Billiton; Valley in Brazil; and European Nickel PLC for mining in Turkey, the Talvivaara mine in Finland, the Balkans and the Philippines. There are currently no commercial nickel leaching operations on a commercial scale, but There is a sulphide HL in Finland. Restoring nickel from leaching solutions is much more complex than copper and requires different stages of iron and magnesium removal, and the process produces both the leaching of ore residues (ripios) and chemical precipitation from plant recovery (mainly the residues of iron oxide, magnesium sulfate and calcium sulfate) in roughly equal proportions. Thus, a unique feature of the leaching of the nickel heap is the need for tailings. The end product may be nickel precipitation hydroxide (NHP) or mixed-sedimented hydroxide metal (MHP), which are then subject to conventional smelting for the production of metallic nickel. Uranium ore Diagram leaching heaps for uranium (USA NRC) Is similar to leaching a pile of copper oxide, also using diluted sulfuric acid. Rio Tinto commercializes this technology in Namibia and Australia; Areva, Niger with two mines and Namibia; and a number of other companies are exploring its feasibility. The final product is yellow and requires significant further processing for the production of fuel class feed. The device While most mining companies have moved from the previously adopted sprinkler method to the seepage of the slow-dripping chemicals of choice, including cyanide or sulphuric acid closer to the actual ore bed, the heaps of leaching pads haven't changed too much over the years. There are four other major categories of pads: regular, landfill leaching, valley fills, and/turn off pads. Typically, each pad has only one geomembred liner for each with a minimum thickness of 1.5 mm, usually thicker. Conventional pads are the simplest in design are used mainly for flat or gentle areas of areas hold thinner layers of shredded ore. Landfill leaching pads hold more ore and can usually handle less flat terrain. The valley fills the pads located at the bottom of the valley or levels that can hold everyone in it. In/off pads include putting significantly larger loads on the pads and removing and restarting it after each cycle. Many of these mines that previously had a digging depth of about 15 meters are digging deeper than ever before to extract materials, about 50 meters, sometimes larger, meaning that in order to place all the land is being pushed out, the pads will have to hold higher weights from the more crushed ore contained in a smaller area (Lupo 2010). With this increase in build-up there is the potential to reduce yields or the quality of ore, as well as potential either weaknesses in the lining or high pressure accumulation area. This accumulation still has the potential to cause punctures in the liner. According to 2004 data, tissue cushions that could reduce potential punctures and leaking are still being discussed because of their propensity to increase risk if too much weight on too large a surface has been placed on cushioning (Thiel and Smith 2004). In addition, some liners, depending on their composition, may react with salts in the soil, as well as acid from chemical leaching to affect the success of the liner. This can be amplified over time. (quote is necessary) Environmental problems The efficiency of heaps of leaching mining works well for large volumes of low-grade ores, as reduced metallurgical processing (comcompination) ore is required in order to extract an equivalent amount of minerals compared to milling. Significantly reduced processing costs are offset by a decrease in yields, usually by about 60-70%. The total environmental impact caused by heap leaching is often lower than more traditional methods. (quote is needed) It also requires less energy consumption to use this method, which many consider an environmental alternative. State regulation in the United States, the General Mining Act of 1872 gave the right to study and mine in the public domain; the original law does not require recovery from mining (Woody et al. 2011). Federal land reclamation requirements depended on state requirements until the federal Land Policy and Management Act of 1976. Currently, mining on federal lands must have a government-approved mining and reclamation plan before mining begins. Reclamation bonds are needed. Mining on the federal, or private land depends on the requirements of the Clean Air Act and the Clean Water Act. One solution proposed to address the problems of reclamation is the privatization of land to be mined (Woody et al. 2011). Some of the sources of this article may not be reliable. Please help this article by looking for better, more Sources. Unreliable quotes can be challenged or deleted. (October 2019) (Learn how and when to remove this message template) Cultural and social problems With the growing movement of environmentalists has also come to an increasing understanding of social justice, and the mining industry has shown similar trends recently. Societies close to potential mining sites are at increased risk of injustice because their environment is affected by changes made to mined land, whether public or private, which can eventually lead to problems in social structure, identity and physical health (Franks 2009). Many argued that by passing minepower through the locals, this dissent could be mitigated, since both interest groups would share both equal voice and understanding for future purposes. However, it is often difficult to reconcile corporate mining interests with local social interests, and money is often a decisive factor in the success of any disagreement. If communities can feel that they have a genuine understanding and power in matters relating to their local environment and society, they are more likely to tolerate and promote the positive benefits that come with mining, as well as more effectively encourage alternative heap methods of leaching mining using their deep knowledge of local geography (Franks 2009). Some of the sources of this article may not be reliable. Please help this article by looking for better, more reliable sources. Unreliable quotes can be challenged or deleted. (October 2019) (Learn how and when to remove this message template) Examples of also Gold cyanidation Gold Mining In-situ Leaching Tailings Mineral Processing Yellowcake Environmental Justice Links - Petersen, J., Dixon, D. G. (2002). Thermophilic heap of halkopirit concentrate leach. Mineral Engineering, 15 (11), 777-785. Buffard, Sylvie K. and David G. Dixon. Study of hydrodynamics processes leaching heap. 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