

32: Agglomeration – 1980s research in Australia and China

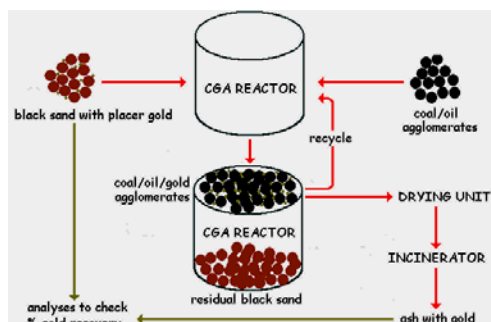


Figure 68. COAL-GOLD AGGLOMERATION  
Flowsheet for placer gold recovery by CGA. (drawing: Robin Grayson)

Agglomeration ‘snowballs’ extremely fine gold with coaly or oily material to produce large particles that can then be recovered easily by floatation.

Coal-gold agglomeration (CGA) makes use of gold being hydrophobic (resists water-wetting) and oleophilic (easily wetted by oils). CGA only works with fine gold, making CGA appropriate for placer tailings with fine gold that would otherwise be lost, and for milled hardrock ore.

CGA began with BP plc in Australia who built a pilot plant processing 1 ton/hour of placer gold concentrate. A patent was awarded to Mark Cadzow, Graham Elkes, Gavin Ewin and David Mainwaring in 1986 (US #4,585,548) and assigned to BP Australia. The team then tried CGA for low-grade hardrock ores with <1 gram/ton of gold, patented in 1990 (US #4,976,781).

In China, Zhao Bing and colleagues found CGA had “many advantages” over cyanide and claimed 88% recovery of gold in amalgamation tailings. In Africa, lab experiments by Kotze and Petersen achieved 85% gold recovery from artificial gold-slurry mixtures [77-82].

A CGA pilot by Envi-Tech Inc under the Canada-Alberta MDA project in 1993/94 indicated gold recovery from agglomeration-adsorption technology may be 95-99% but no results seem to have been published.

Operation

The slurry is piped into a special reactor. Here the hydrophobic-oleophilic properties of gold induce the fine gold to agglomerate into oil-saturated activated carbon particles.

In theory gold particles will agglomerate with oil, but in practice gold grades are so low that there is not enough gold to form oil-gold agglomerates. So for CGA to work it is first necessary to use another hydrophobic material (in this case, comminuted coal dust) to either agglomerate with the gold or to act as a carrier of the gold particles.

The first step is to create coal-oil agglomerates about 5mm in diameter using coal dust bound by kerosene, light gas oil or fuel oil. Agglomerates smaller than 500µ seem to be more effective in recovering gold.

The second step is to add the coal agglomerate to the gold-bearing slurry in the special reactor. The gold particles, due to their oleophilic nature, continue to enter the agglomerate particles until the operator considers the target gold concentration has been reached.

Then the gold enriched oil-saturated activated carbon particles are agitated and the agglomerated gold is mechanically separated.

Finally gold is recovered from the agglomerates by burning them, the coal and oil incinerating to leave gold and ash. The gold is then separated from the ash.

Adoption by placer gold miners

Early success in recovering placer gold with CGA did not lead to its adoption by placer gold miners. Yet it might allow high % gold recovery from ‘difficult’ placers, such as fine gold in laterites (as in much of South America, Africa, Australia and parts of Kazakhstan, Mongolia and China), without the use of mercury or cyanide. Recent work in Turkey shows high % recovery is possible for gold between 53µ and 300µ [83].

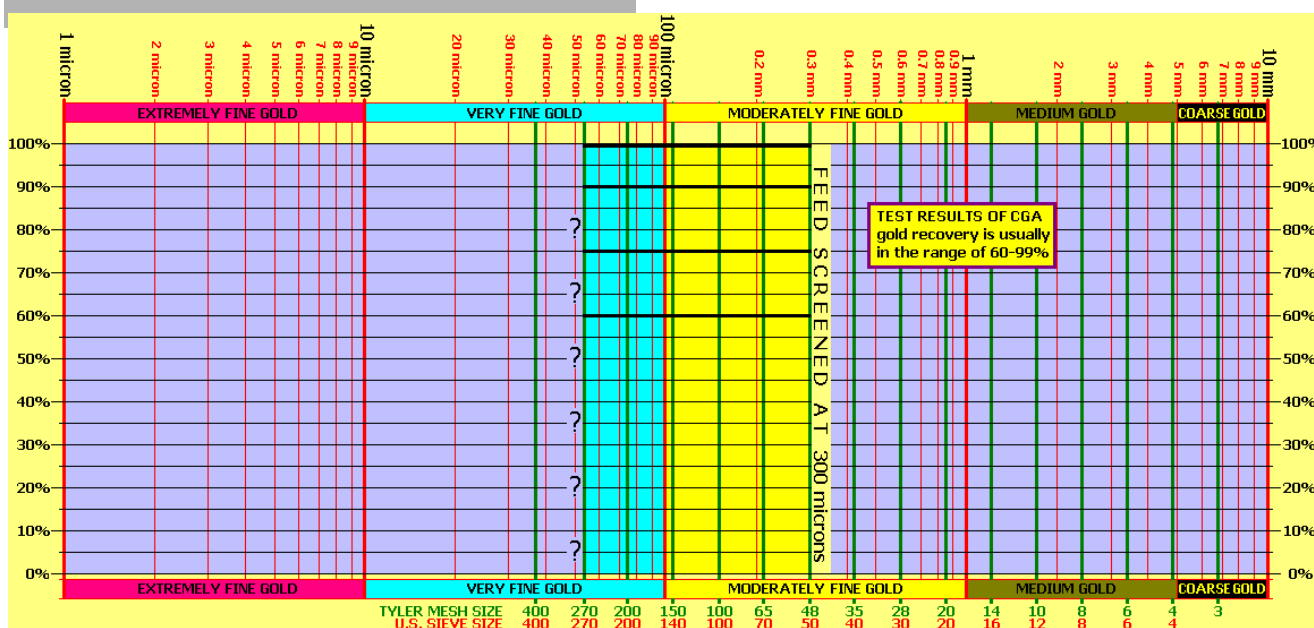


Figure 69. GOLD RECOVERY BY AGGLOMERATION - generalised  
Coal-gold agglomeration (CGA) can recover 90% of gold in the range 53-300µ [83]. (compiler: Robin Grayson)