

68: tincture of iodine leaching – 2000s research in Japan

Iodine leaching had been widely used to recover gold in the late 1800s and early 1900s, then dwindled with the rise in popularity of cyanide leaching and mercury amalgamation and the high cost of iodine. Advances prior to 2000 are dealt with in Section 4.

In the last 25 years much has been claimed about 'secret' lixiviant formulations, and methods of precipitating gold from streams and seawater – most is quackery.

In contrast, the tincture method of iodine leaching is fully explained, repeatable and verifiable, as invented in 2006 Hiroyasu Murakami and Y. Nakao of the National Institute of Advanced Industrial Science and Technology (AIST) of Japan: 'A trial of extracting gold from stream sediment and high Au/Ag ore using halogen-containing organic system' [40].

To dissolve the gold, a halogen-containing organic system (HOS) is used, composed of iodine I₂, sodium iodide NaI and ethanol C₂H₅OH, a mixture closely akin to 'tincture of iodine'. Tincture of iodine is usually 10% elemental iodine in ethanol, and a component of emergency survival kits to disinfect wounds and to sanitize surface water for drinking.

To precipitate the gold from solution, ascorbic acid C₆H₈O₆ is added – a chemical familiar as vitamin C.

Iodine being expensive, it is important to regenerate the tincture of iodine. Hydrogen peroxide H₂O₂ is added to oxidise the iodide I⁻ back to iodine I₂. The regenerated tincture of iodine can once again dissolve gold.

The Japanese researchers recovered 79.9% gold from a stream sediment sample, and 84% gold from a hardrock sample in the Kitakami mountains of northern Japan.

Operation

Tincture of iodine is obtained from a lab supplier.

If placer ore, the pay gravel is finely screened, the coarse fraction being subjected to conventional gravitational separation, the fine fraction being subjected to leaching. If hardrock, the ore is milled very finely before being subjected to leaching

1st stage – leaching gold into solution

The fine ore is added to a little water in a tank and kept agitated by stirring. Tincture of iodine is stirred in, and is dark brown due to the presence of I₃⁻ ions. These are an effective oxidant and in the presence of I⁻ ions reacts to form the stable gold-iodine complex:



Lab experiments show an hour is sufficient for the tincture of iodine to leach most of the gold – faster than cyanide can. Then dissolution declines and full leaching of gold from a saturated gold solution might take six hours.

2nd stage – recovering gold from solution

To recover the dissolved gold from the pregnant solution, ascorbic acid is added to reduce the iodine:



This reaction results in a deficiency in I₃⁻ causing the tincture to lose its dark brown colour and become a poor solvent. It is now possible to precipitate gold. Deposition starts when the tank is diluted by about 70% water by volume. The gold appears as colloidal gold and next as fine-grained particles. The gold is removed by filtration.

Adoption by placer gold miners

It seems possible that tincture of iodine may become popular among recreational and artisanal gold miners for fine gold recovery.

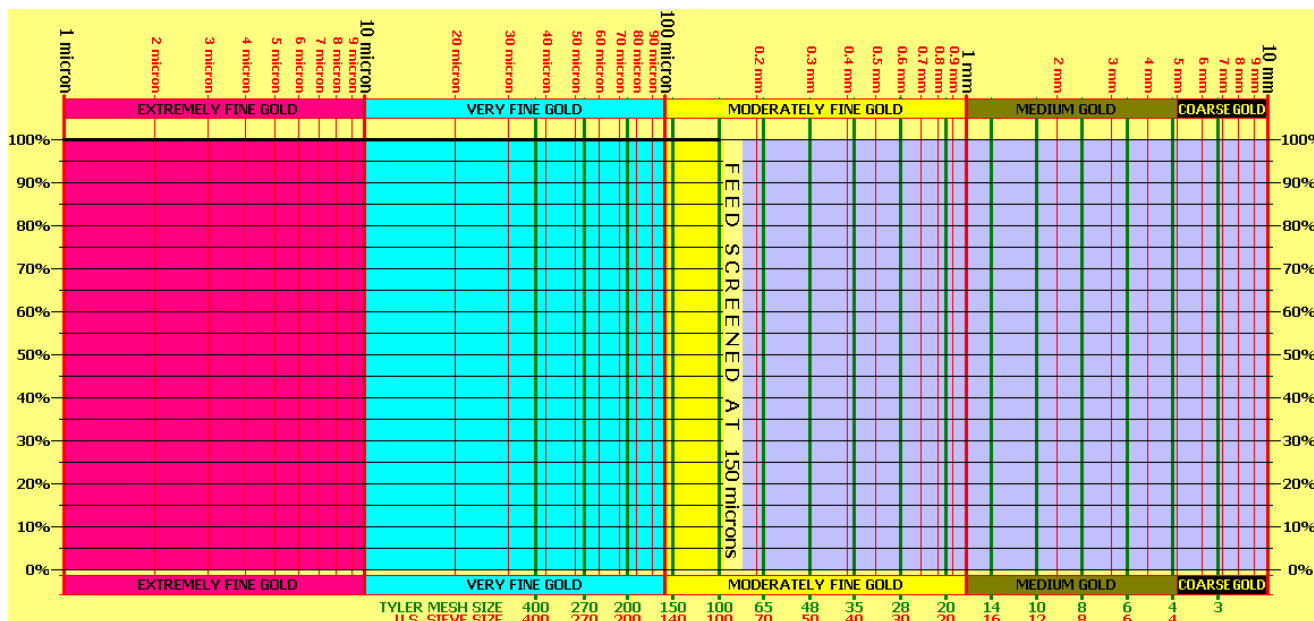


Figure 141. GOLD RECOVERY BY TINCTURE OF IODINE LEACHING
 Recovery of placer gold by tincture of iodine and vitamin C in tests by Hiroyasu Murakami and Y. Nakao [40]. (compiler: Robin Grayson)