MPS
MINING & PROCESS SOLUTIONS

GLYCINE LEACHING PROCESS

Innovative Thinking & Technology

www.mpsinnovation.com.au

The Glycine Leaching Process is an environmentally benign hydrometallurgical process that will leach base and precious metal oxide, mixed oxide and sulphide ores.

Glycine is the simplest and cheapest amino acid, and is available in bulk in different grades. **It is an environmentally safe and stable reagent** and is biodegradable and easily metabolized in most living organisms.

It is selective on which metals it leaches and does not leach common gangue minerals.

Leaching characteristics of metals under consideration at pH values between 9 and 12 with Sodium Glycinate as solvent

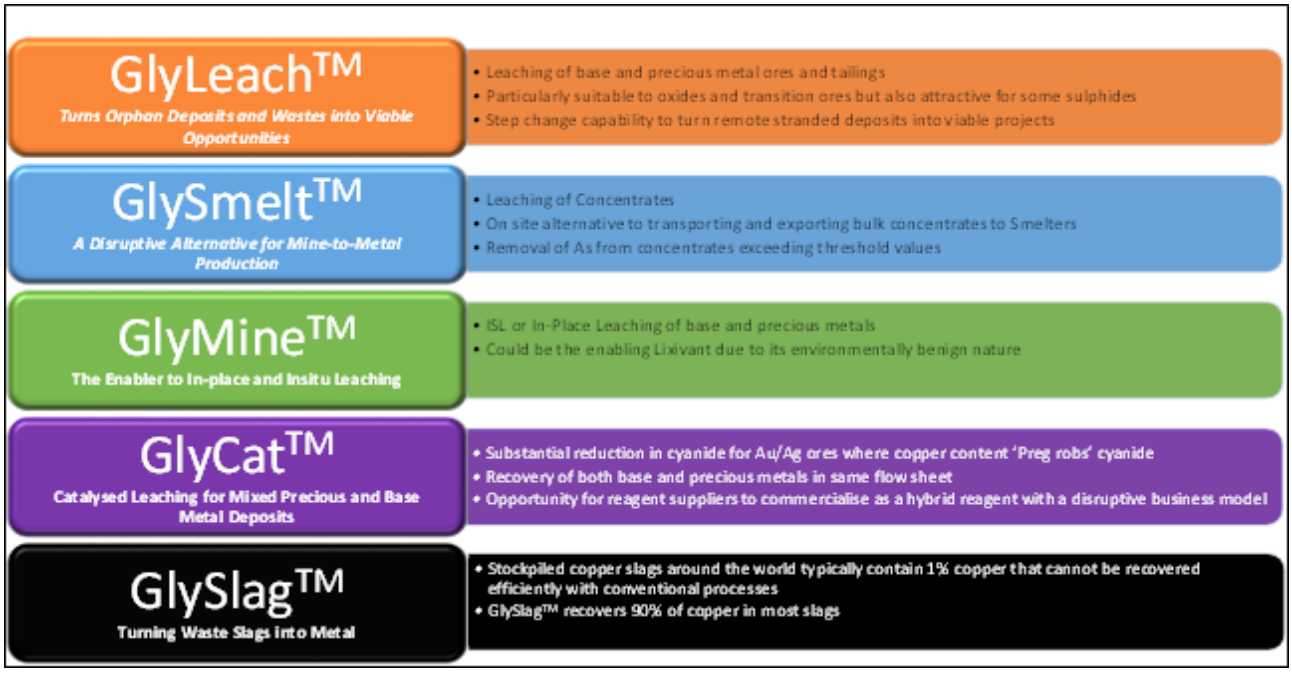
25 **Mn** Manganese 54.9	26 **Fe** Iron 55.9	27 **Co** Colbalt 58.9	28 **Ni** Nickel 58.7	29 **Cu** Copper 63.5	30 **Zn** Zinc 65.4	31 **Ga** Gallium 69.7	32 **Ge** Germanium 72.6	33 **As** Arsenic 74.9	34 **Se** Selenium 79.0
	44 **Ru** Ruthenium 101.0	45 **Rh** Rhodium 102.9	46 **Pd** Palladium 106.4	47 **Ag** Silver 107.9	48 **Cd** Cadmium 112.4	49 **In** Indium 114.8	50 **Sn** Tin 118.7	51 **Sb** Antimony 121.8	52 **Te** Tellurium 127.6
	76 **Os** Osmium 190.2	77 **Ir** Iridium 192.2	78 **Pt** Platinum 195.1	79 **Au** Gold 197.0	80 **Hg** Mercury 200.6	81 **Tl** Thallium 204.4	82 **Pb** Lead 207.2	83 **Bi** Bismuth 209.0	

Glycine Solubility Unknown	**Known Glycine Insoluble**	**Known Glycine Leachable**	**Known Glycine Leachable Limited Test work**	**Unknown Subject to Experiment**	**Known Amphoteric Anions**

It is easily recovered and recycled. Flow sheet test work and modelling to date has shown that less than 5% Glycine loss can be expected. This means low reagent consumption costs for the major leaching reagent.

It is a simple process than can be used with “off the shelf” items of equipment.

Several applications of the technology are being developed.



GlyLeach™ - Turning orphan deposits and wastes into viable opportunities

GlyLeach™ is the application of Glycine to leach fresh base and precious metal ore sources. These include the use of Glycine as a Lixivant in Dump/Heap Leaching, Continuous Vat Leaching, Traditional Vat Leaching, and Agitated Leaching flow sheets.

GlySmelt™ - A Solution for Mine-to-Metal Production

GlySmelt™ is the application of Glycine as a method to leach concentrates, specifically 'dirty concentrates" and is a potentially disruptive technology to change the current paradigm from a mine-to-concentrate value chain to a mine-to-metal model. It also offers opportunity to improve on suboptimal gold and copper recovery for existing plants that use flotation. Gold recoveries to copper concentrate are often sacrificed to make a threshold smelter grade copper concentrate.

GlySlag™ – Turning waste slag into viable opportunities

GlySlag™ is the application of Glycine to leach residual metals contained in slags, a by-product of the smelting process. Typically, these slags are stockpiled and in the case of copper slags can contain upwards of 1% copper in a form that does not respond well to traditional processing.

GlyMine™ – The enabler to in place and insitu leaching

GlyMine™ is the application of Glycine as a Lixivant in applications where leaching of valuable metals can be carried out by circulating the lixiviant through bore holes into a permeable or semi-permeable rock mass (in situ) or directly on broken ore (in place) with minimal handling and size reduction. Glycine is attractive over other known Lixivants due to its low toxicity and biodegradable nature.

GlyCat™- Catalysed leach for mixed base and precious metals

GlyCat™ is the application of Glycine with cyanide to mixed base metal and precious metal ores. The presence of copper minerals in with gold is known to lead to many challenges during the cyanidation of gold ores, such as high consumption of cyanide with low gold extraction and undesirable impacts on gold recovery during the downstream processes. GlyCat™ is a process to enhance the dissolution

of gold and copper in gold/copper ores where glycine is used as a catalyst with cyanide in a cyanide starved leaching environment.

OUR TECHNOLOGY IS BACKED BY A LEADING RESEARCH GROUP

Mining & Process Solutions (MPS), through its collaboration and commercialisation agreement with Curtin University, has the backing and support of a leading minerals research group continuing to undertake fundamental research into Glycine leaching.

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