



Homogeneous Catalyst Recovery



OVERVIEW

1. Industry Sectors
2. Using Homogeneous catalysts
3. Treatment routes
4. Mastermelt Group Capabilities
5. Mastermelt Approach
6. Management of Risk
7. Next Steps





INDUSTRY SECTORS

PHARMA & NUTRACEUTICAL



- Spend on medicines is set to increase 20% to USD 1.8 trillion by 2026 driven by demand in North America, Europe and RoW
- Fast growing niches around oncology and particularly kinase inhibitors where Palladium homocats are essential in manufacturing
- 73 kinase inhibitor-based APIs approved by FDA from 2001- 2021
- Other therapies starting to utilise more homocats such as anti- inflammatory and diabetes

Goal is to provide a proactive approach to maximise recovery of precious metals from complex homogenous catalyst through expert R&D and technical solutions.



INDUSTRY SECTORS

AGRO & FINE CHEMICAL



- Agrochemicals market is expected to hit \$308.4 billion in 2025
- Precious metal Homcats specialised in areas such as succinate dehydrogenase inhibitors (SDHIs) and synthetic pheromones
- More advanced formulations will enable greater sustainable farming with step changes in resistance management and regulatory compliance

Goal is to provide a proactive approach to maximise recovery of precious metals from complex homogenous catalyst through expert R&D and technical solutions.



USING HOMOGENEOUS CATALYSTS

1

Opens up a number of reaction pathways from cross coupling to amination.

2

Trends evolving from "simple" catalysts such as Pd acetate to more complex catalysts

3

The precious metal will be present in the solvent mother liquor or byproduct stream after separation of the active

4

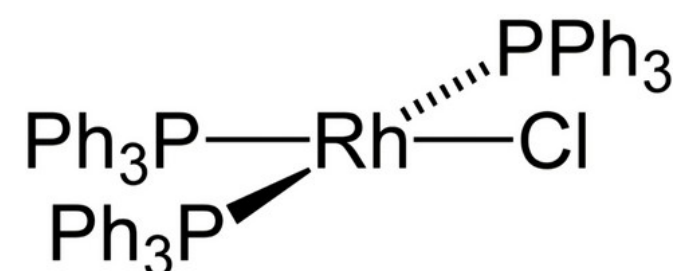
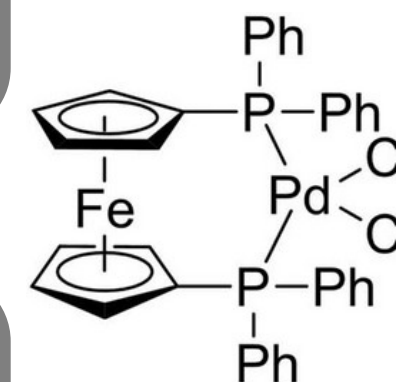
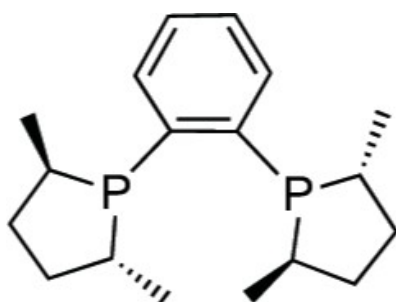
These solvent streams will have low concentration precious metal in a typically hazardous mixtures of organic solvents.

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Maximising recovery of the precious metal can make a major positive impact to manufacturing costs and carbon footprint.

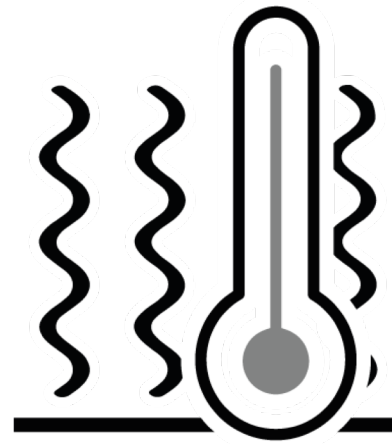
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Mastermelt has the expertise to separate and recycle the precious metal in a safe and efficient way.





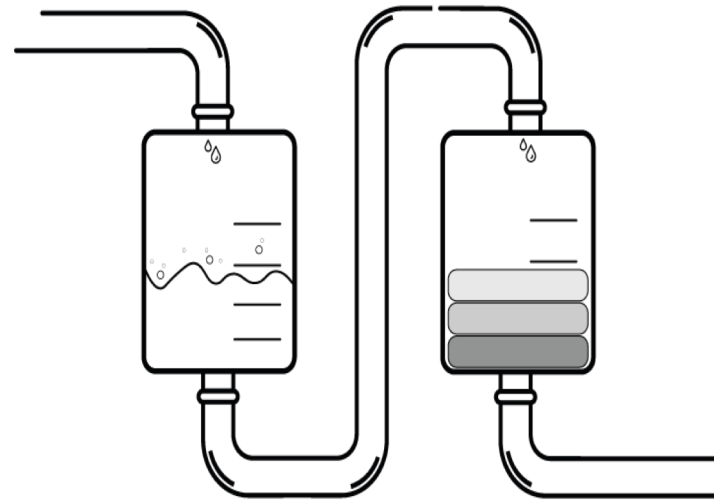
TREATMENT ROUTES



DIRECT TREATMENT

Usually for longer chain organics or where a distillation step has been used in the process.

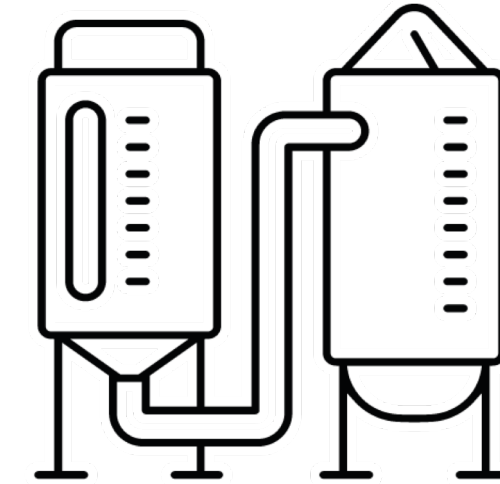
The solvent stream can be treated directly through Advanced thermal treatment at a Mastermelt site.



SCAVENGER TREATMENT

The solvent stream is reacted with a MM scavenger which selectively binds to the precious metal.

Mastermelt can supply the scavenger and equipment for this route or treat offsite.



DISTILLATION

The solvent stream is concentrated using advanced distillation techniques.

Mastermelt design the process then can offer treatment at a number of local partners in Europe

MASTERMELT CAPABILITIES



38 years' experience in precious metal processing

Proprietary processes to treat homogeneous catalysts at ppm level

References include multiple top 20 APIs from both Innovators and CMOs sites

Multi-technologies to treat complex waste streams: Metal Scavenging, Advanced Distillation, Advanced Thermal Treatment

Local sites: UK, Germany, Singapore, US

Volumes of Catalyst Processed:

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20 MT Rhodium homcat

-

115 MT Palladium homcat

-

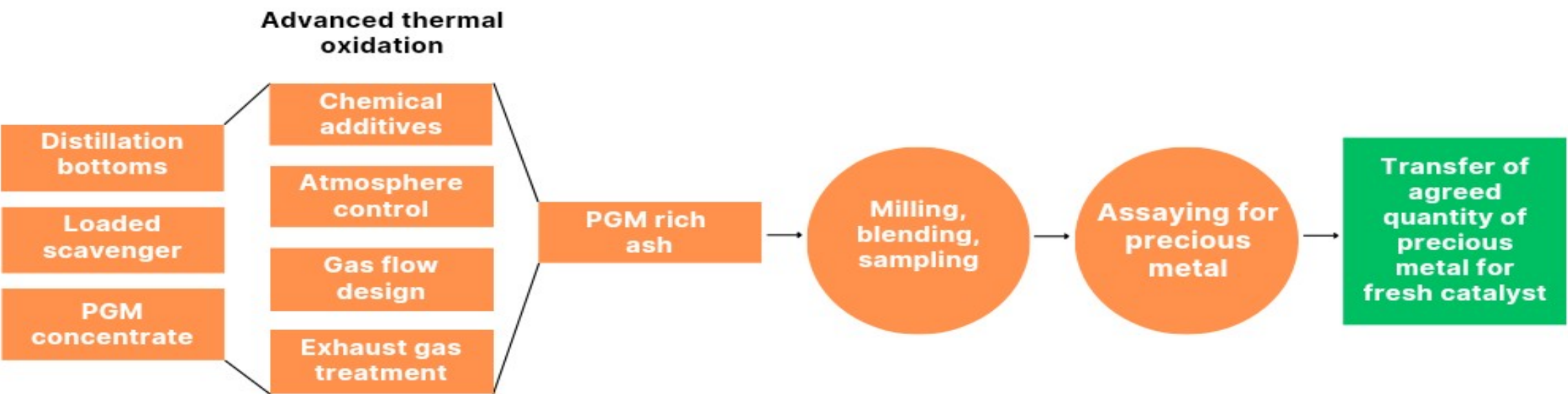
>1500 MT thermally treatment

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MASTERMELT APPROACH

The importance to accurately sample following pre-treatment processing cannot be underestimated



Mastermelt's experience in Advanced Thermal Treatment, Milling, Blending and Sampling produces a homogeneous sample representative of the bulk material.

Assaying of the material is expertly analysed by our experienced laboratory team at Mastermelt Technical Centre.




MANAGEMENT OF RISK

Full IP Protection	Material Segregation & Data Integrity	Optimising Recoveries During Processing	Metal Management
Non-disclosure agreement including non-analysis provisions on formula ✓	Full bar-coded material tracking ✓	Measurement of material characteristics before processing ✓	Price fluctuation uncertainty Cash Flow shortfalls Refining outturn timing
Certificate of Destruction issued ✓		Development of a tailored processing route with scale up ✓	- Metal pledges, hedging, cash advances may be arranged with Mastermelt's partner Mitsubishi Corp* ✓
Independent witness available for witnessed destruction ✓	Automated weighing with no manual entry ✓	Multiple materials can be trialed to give confidence ✓	

*Subject to eligibility criteria

NEXT STEPS

- 
- Enter into NDA discussions (if required)
 - Receive waste stream samples for characterisation
 - Provide indicative refining terms based on advised content and volumes
 - Recommendation for local independent witness
 - Share additional documentation as required
 - Available to answer any questions technical or commercial
 - Open to site visit and audit of your local Mastermelt plant