

Chemoxy International Limited

Leaders in Custom Processing
&
Environmentally Friendly Solvents

ChemSpec, Budapest
June 2014



PRESENTATION TOPIC

Solvent Recovery
Waste valorisation



Chemoxy International Ltd

Background Information



Chemoxy International – Overview



Teesside, UK

Custom Processing

Niche product portfolio

Solvent Recycling

Enhanced Customer value

Key Strengths

- ✓ UK leaders in combined reaction/distillation
- ✓ Growing portfolio of low toxicity proprietary products.
- ✓ Excellent Reputation & Technical Strength
- ✓ Outstanding EH&S Performance.

Key Statistics

- ✓ Sales: £45 (€54, \$75) million
- ✓ Number of employees: 130
- ✓ Number of customers: >100
- ✓ Number of Own Products: 14

Our History



Chemoxy UK Locations



- 8 High resolution fractionation columns
 - Up to 50 theoretical plates
 - 0.75 to 1.75m diameter
 - Vacuum (to 5mmHg)
 - Side stream capabilities
 - Temperatures up to 240°C
- 9 Reaction vessels
 - Carbon/stainless steel (9m³ - 25m³)
 - Glass lined (9m³)
 - Chloride resistant Duplex stainless steel (24m³)
 - Temperatures to 230°C
 - Solids handling facility

Annual output in 2013 – approx. 70kt

Distillation & Separation Technologies

- Columns can be coupled to feed fixed bed and batch reactors
- High resolution distillation
- Flash distillation
- Azeotropic distillation
- Extractive distillation
- Fractional distillation
- Multiple feed points and side-stream take offs



Custom Processing Services

Technologies and Processes

Adsorption
Batch Reactions
Batch-to-Continuous
Distillation
Reactive Distillation
Extractions
Filtration
Fixed-bed reaction
Molecular Sieve
Treatment
Solvent Recovery

Chemistries

Acetal Formation
Acetylation
Aldol Condensation
Alkylation (MeCl/EtCl)
Amination
Boration
Dehydration
Diels-Alder
Epoxidation
Esterification
Etherification
Hydrolysis
Isomerization
Methylation / Methyl capping
Oligomerization
Oxidation
Phase Transfer catalysis
Polymerization (radical)
Quaternization
Transesterification

Typical raw materials handled

Acetic Acid /
Anhydride
Acrylonitrile
Epichlorohydrin
Ethyl Chloride
Hydrogen Peroxide
Methyl Chloride
Phenol
TDi

Solvent Recovery

Waste valorisation



Solvent Recovery Options

- By-product solvent producers face two options:
 - Disposal of solvents via thermal oxidation/landfill

OR

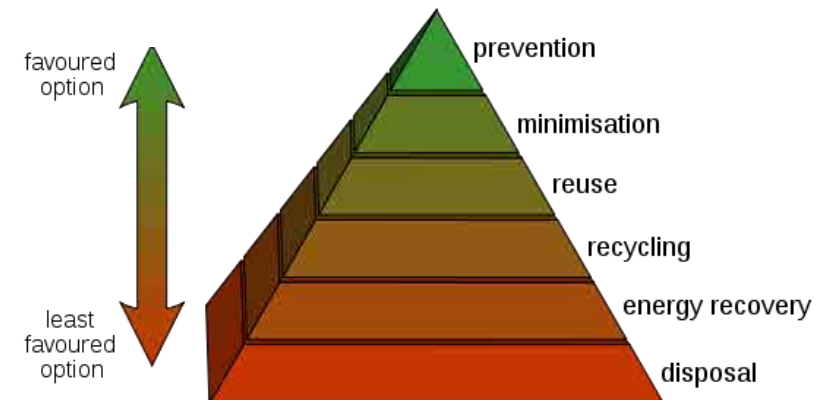
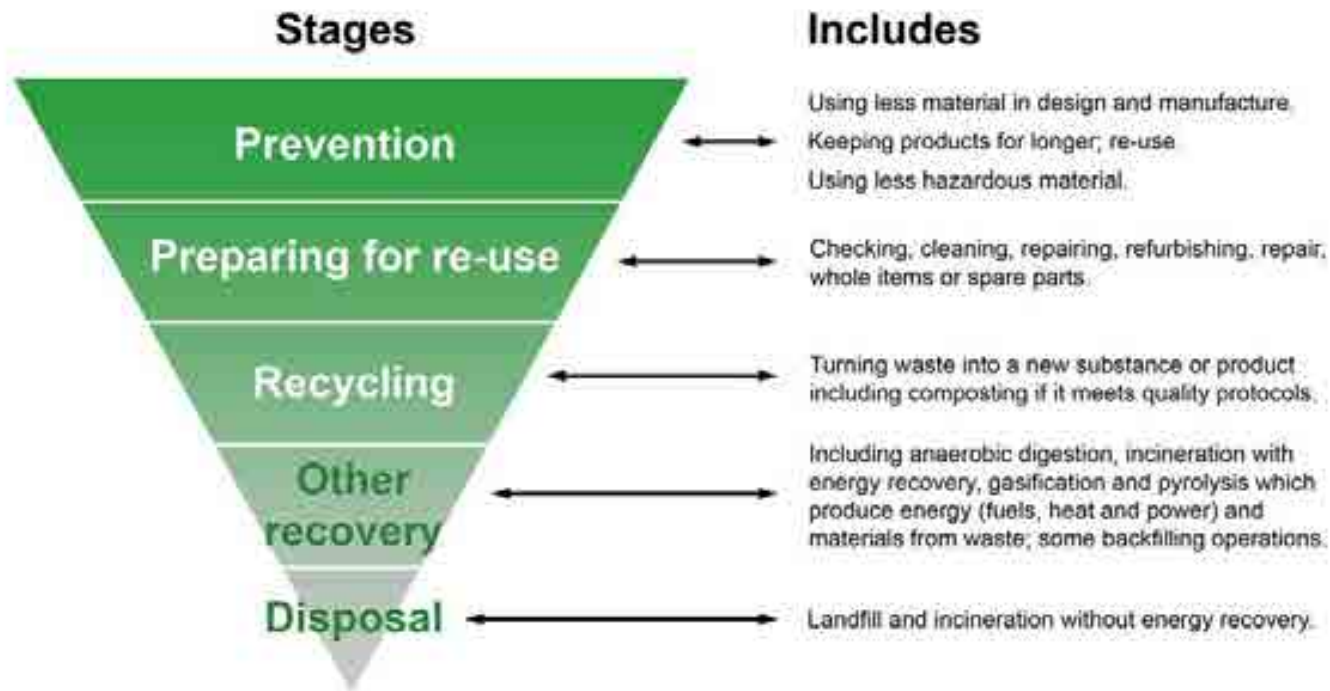
- Recycling
- **Chemoxy** offers the solution:
 - Recycling of by-product streams or solvents used in numerous processes
 - Streams are purified and returned to the customer for reuse

OR

- **Chemoxy** take ownership of the streams by purchasing them from the solvent user/producer

Waste Hierarchy – Schematics

The Waste Hierarchy



REACH & Recovered Solvents

- Interpretation:

- The REACH status of this product has been assessed and the product has been classified as a recovered solvent in accordance with Article 2(7)(d) of REACH
- Requirements of Article 2(7)(d) of REACH states:
 - i. *the substance that results from the recovery process is the same as the substance that has been registered in accordance with Title II; and*
 - ii. *the information required by Articles 31 or 32 relating to the substance that has been registered in accordance with Title II is available to the establishment undertaking the recovery.*

Guidance and reference:

- <http://www.echa.europa.eu/>



Solvents for Recovery

- Acetic acid
- Acetic anhydride
- Acetone
- Butanols
- Cyclohexane
- Ethanol / IDA
- Glycols (MEG, DEG, TEG, MPG, DPG)
- Isoamyl alcohol
- Isopropanol (IPA)
- Methanol
- N-methylpyrrolidone (NMP)
- Phenol
- Tetrahydrofuran (THF)
- Toluene



- Acetonitrile
- Ethyl acetate
- Ethyl hexanol
- Glycerine
- Glycol ethers
- Heptanes
- Hexanes
- Isododecane
- Methyl acetate
- Methyl isobutylketone (MiBK)
- Methyl ethylketone (MEK)
- Monoethanolamine
- Sulpholane
- Xylenes

Waste Sources

- Continuous collaboration with numerous industry leaders in the recovery of solvents and solvent by-products
 - Pharmaceutical manufacturers
 - Industrial solvents users and manufacturers
 - Electronics industry
 - Agrochemical industry
 - Chemicals manufacturers
 - Flavours and Fragrances
- Acquired a wide range of streams and by-products from these industry sectors for recovery/toll recovery
- Majority of customers are repeat customers

Technical Expertise

- Very close working partnerships with our customers
 - from development and improvement of processes
 - to end of projects
- Waste management and disposal expertise
 - Internal waste generated
- Auditable waste management systems
- Continually being approved and audited by the World-leading pharmaceutical companies
- Highly qualified and experienced teams of chemists and chemical engineers
- Computerised process simulation/optimisation (ChemCAD etc)
- Fully equipped laboratories and comprehensive analytical facilities
 - GC, GC-mass spec, HPLC, UV, FTIR and atomic absorption
- In-house project engineering groups - fast track plant modification

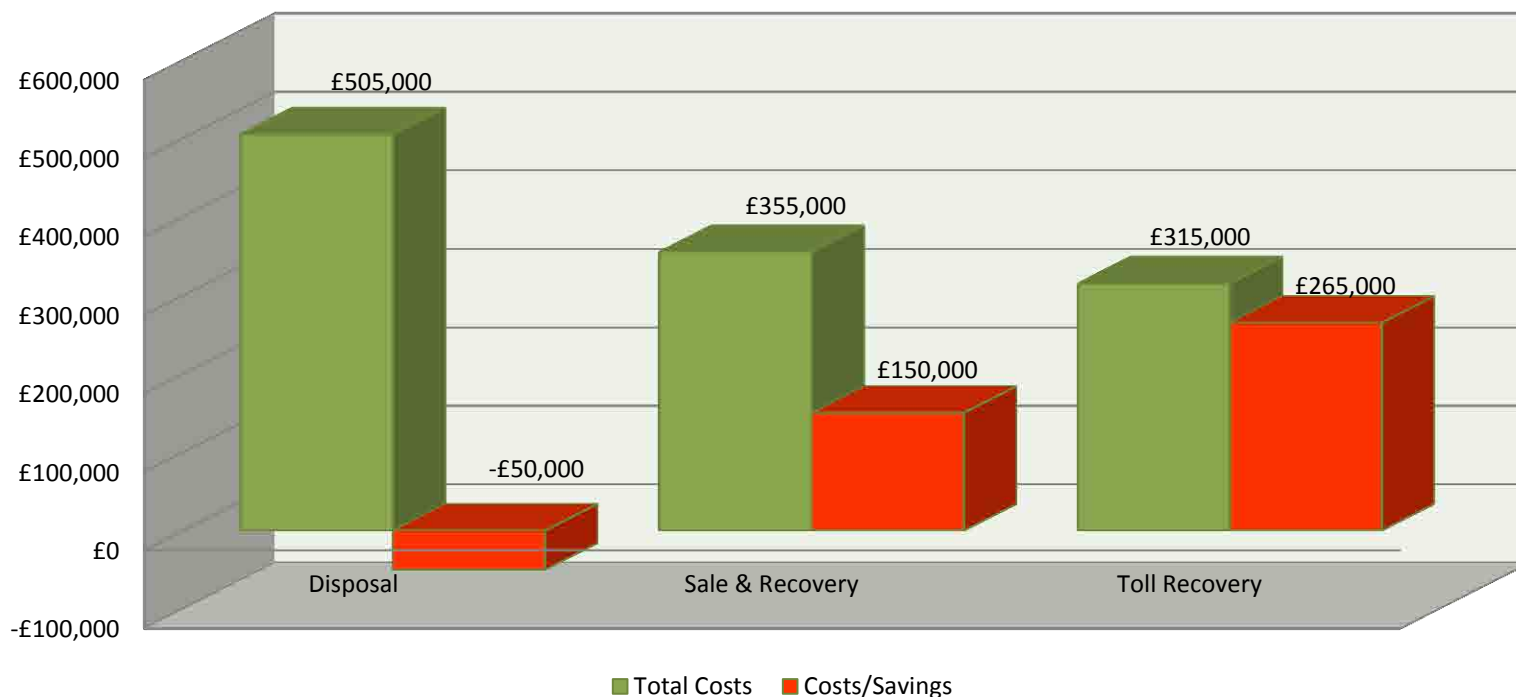
Example calculations – “simple-ish”

- Typical example:
 - Acetone, IPA or toluene
- Composition of waste:
 - 70% solvent
 - 30% others/water
- Options:
 1. Disposal at cost to producer
 2. Sale of waste (may be a lower charge than straight disposal option) and recovery
 3. Toll recovery of waste stream for return and reuse

Summary of Options

Option	Total Costs	Costs/Savings
Disposal	£505,000	-£50,000
Sale & Recovery	£355,000	£150,000
Toll Recovery	£315,000	£265,000

Solvent Recovery Options



Example calculations – “complex blends”

- Blends of difficult or impossible-to-separate solvent mixtures
- Straight separation on distillation column tricky
- Some solvents boil closely together or azeotrope
- **Chemoxy** can utilise our Reactive Distillation Technology
- Either:
 1. Convert one component into another product, then separate mixture
 2. Generate new solvent blend for further sales
- May generate additional value to both producer and **Chemoxy**

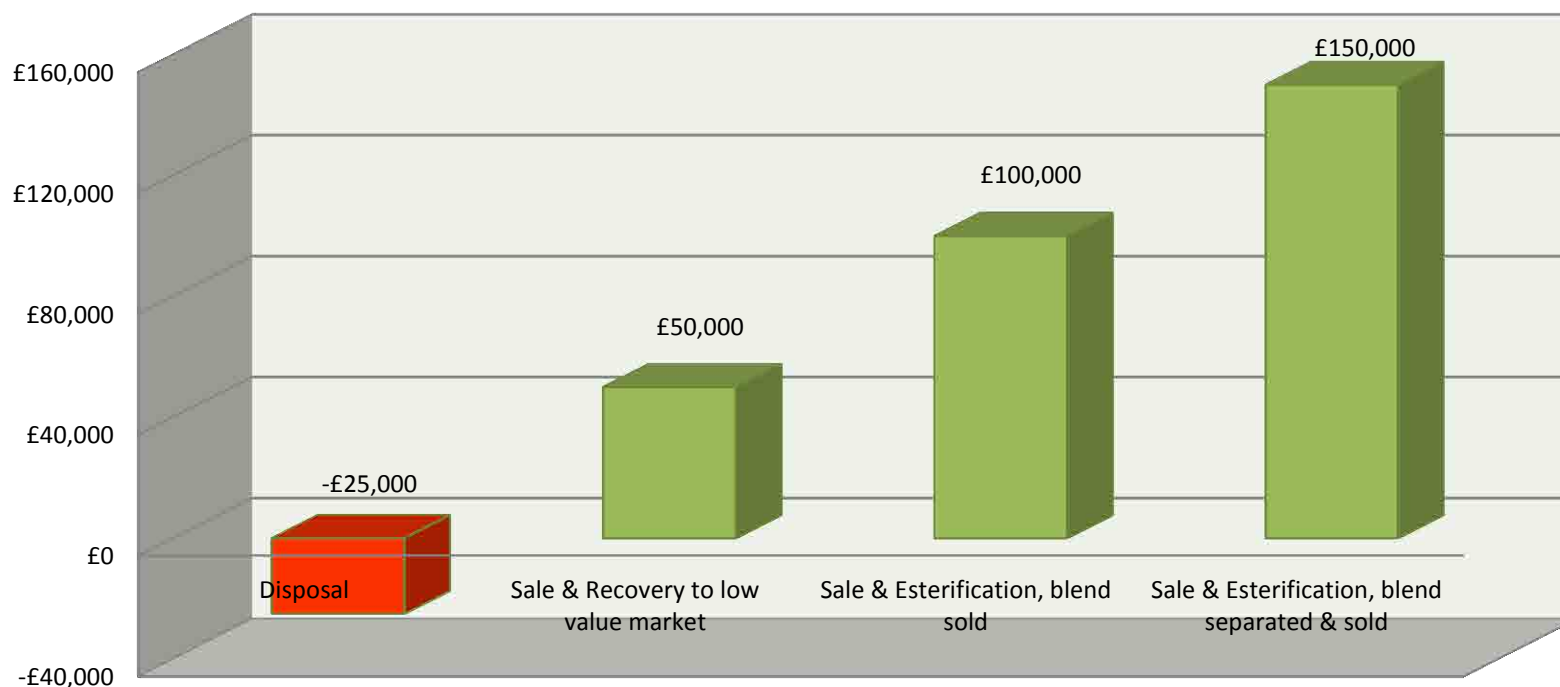
Example calculations – “complex blends”

- Composition of waste:
 - 50% aromatic solvent
 - 30% alcohol
 - 20% others/water – not wanted
- Options:
 1. Producer disposes of blend into fuel (a charge to them)
 2. Producer sells blend to **Chemoxy**
Chemoxy flash distils mixture for low value market (thinners)
 3. Producer sells blend to **Chemoxy**
Chemoxy converts the alcohol to an ester and sells mixture into higher value market
 4. Producer sells blend to **Chemoxy**
Chemoxy converts the alcohol to an ester and separates the aromatic solvent from the ester
Chemoxy sells separate components into even higher value markets if possible (and economics allow)

Summary of Options – complex blends

Solvent Recovery Options - Complex Streams	Savings
Disposal	-£25,000
Sale & Recovery to low value market	£50,000
Sale & Esterification, blend sold	£100,000
Sale & Esterification, blend separated & sold	£150,000

Solvent Recovery Scenarios for Complex Solvent Waste Streams



Summary

- No two projects are the same – each is treated uniquely by our team
- Chemoxy offers capacity, flexibility, technology, know how, solutions to problems, capital avoidance and value for service
- Chemoxy add value to your by-product or waste streams
- Projects are managed using a flexible but comprehensive stage gate system, maximising efficiency but minimising wasted time
- Your confidentiality is assured and your IP protected 100%
- We encourage your technical team to engage us to explore, shape and develop potential projects
- We offer a unique partnership to develop value from your waste streams, and work as an extension of your own resources to create a positive differentiated proposition to reduce waste costs and gain benefits

Thank you

Questions ???

