

Managing Saline Waste Associated with Waste Incineration and Thermal Combustion (WITC) Residues

Pact Renewables Capability Overview



**IMPACTUS.
TREAT TO MINIMISE FOOTPRINT.
PRODUCT RECOVERY FROM SALINE WASTE.**

Pact Renewables Pty Ltd (Pact) is a technology firm focused on providing advisory services regarding SALINE WASTEWATER reduction solutions using its innovative proven technologies. Pact has conducted numerous SALINE WASTEWATER treatment investigations, ranging from scoping studies to laboratory testing and field piloting/demonstration. This in turn has helped industries around the globe to assess, identify options and implement sustainable solutions to minimise impacts of SALINE WASTEWATER on their operations and the environment, whilst producing commercial value products from saline effluent to offset treatment costs.

OUR EXPERTISE IN THE FIELD

- > Saline water/wastewater characterisation
- > High efficiency solid/liquid separation
- > Integrated solids washing and thickening methodologies
- > Proven saline water treatment technologies
- > Advanced mineral composites for encapsulation of hazardous waste for safe land disposal
- > Saline wastewater carbonation technology for generation of carbon credit
- > Techno-economic and life cycle assessments
- > Design of piloting/demo facilities and support with field trials
- > Development and optimisation of technology applicability envelope for multiple-site application

Learn more about our SALINE WASTE management solutions contact us: info@pactrenewables.com



*World Economic Forum
January 2023, Davos*

WASTE INCINERATION AND THERMAL COMBUSTION (WITC) RESIDUALS REQUIRING SALT REMOVAL BEFORE BENEFICIAL USE OR SAFE DISPOSAL

Saline waste, often marked by elevated concentration of chloride ion, are reported from a range of WITC residues including fly ash generated by coal power plants and stored in impoundments, fly ash generated by municipal solid waste and energy-from-waste (EfW) incineration operations, as well as salt residues reported from kiln dust of cement and lime manufacturing operations.

Elevated concentration of salts (whether in solid, liquid or slurry form) in WITC residues has long been considered detrimental to reuse/recycle or safe landfilling of salt-impacted residues. It is also increasingly being identified as an operational and environmental challenge to emerging opportunities for encapsulated beneficial use (i.e., in cement and concrete products), unencapsulated beneficial use (such as fill, structural support or thermal insulation) of WITC residues and as well as a feedstock for manufacture of carbonated concrete and speciality cements. The key issue faced by energy generation and construction industries is what to do with often large volumes of saline wastewater generated from washing of WITC residues in the face of climate change impacts that increasingly necessitate treatment of mildly saline effluents for water production, particularly in water-stressed regions.



TECHNOLOGIES BEHIND OUR SALINITY SOLUTIONS

SALPRO: an enabling technology for selective or sequential recovery of commercial-grade mineral products from inorganic saline streams by a combination of chemical reaction, evaporation and separation process steps, using conventional mineral processing equipment. The technology was selected in 2006 by the U.S. Bureau of Reclamation as then the highest ranking zero liquid discharge (ZLD) technology solution for saline waste in terms of technical and operational feasibility, environmental acceptability, and economic grounds. Salpro is a piloted, licensed and commercially deployed technology; it offers substantial scalability and flexibility in design and operation for achieving ZLD outcomes by converting the bulk of impactful saline waste streams into low-footprint minerals and treated water for downstream use.

MBC: mineral-based composites formulated from benign and plentiful industrial minerals for use in management of diverse, hard to abate, waste streams (including residual bittren) by a combination of encapsulation (via aggregation/granulation) and solidification of hazardous material prior to safe land disposal in landfills. MBC technology has earned Dr. Aharon Arakel and Pact Renewables the "Top Innovator" status, announced at World Economic Forum 2023, held at Davos, Switzerland.



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(continued)

DETAILED DESCRIPTION OF OUR SERVICES

Site visit for saline wastewater characterisation

We offer characterisation of saline wastewater in coal fines storage ponds and fly ash impoundments as a one-off service. This will require a site visit and precise sampling of representative samples to avoid contamination using validated methods. Drawing from our decades-long industry experience we have assembled robust sampling protocols, laboratory analytical methods, monitoring and data reporting procedures, that collectively form a core component of Pact's QA/QC system. Further, we employ a proprietary predictive brine model that enables a better understanding of the impacts of changing diurnal and seasonal temperatures and mixing conditions on the make-up of saline wastewaters and hence the design of Salpro based treatment systems. This model has been rigorously calibrated and validated using numerous saline water samples collected from diverse hydrological basins and industrial operations around the globe, thus nearly covering all possible inorganic saline water types and waste streams generated by industrial activities.

Advice on integrated solid/liquid separation and solids washing

We also offer expert advice on integrated solid/liquid separation and solids washing methods following limited bench-scale trials on samples provided by clients, using our proprietary high-efficiency solid/liquid separation (HES) and solids washing (CCW) technologies. HES enables fast separation of light weight solids from liquids at high flow rates in a thickened slurry form. As our HES modules have no moving parts and extremely easy to clean, they are ideally suited for separation of lightweight WITC residues (i.e., fly ash, cenospheres) from saline effluents. The thickened slurry is then subjected to freshwater washing using CCW - our enabling washing technology with minimal wash cycles and demonstrably reduced freshwater usage. The washed solids subsequently can be dried in appropriate drying vessels to generate low-chlorinity WITC residues for reuse/recycle or safe landfilling. The CCW based fly ash washing options have gone through significant improvements and an optimised version was recently deployed at a major EfW fly ash management facility.

Contact for technical/project enquiries:

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Bench-scale saline waste treatment trials

We undertake laboratory-based saline wastewater treatment trials, using samples either provided to us or formulated thereof by us, which may include precursor solid/liquid separation and solids washing trials. Such trials are limited to selected samples and primarily for the purpose of process and products validation prior to project undertaking. The trial results are applied to design of one or more saline waste treatment options, using Salpro and MBC technologies, for integrated recovery of mineral products and water from ash pond waters or the leachates of WITC residues subjected to washing, with the ultimate goal of achieving zero waste discharge (ZWD) outcome.

Techno-economic feasibility and life cycle assessments

These assignments are based on a two-way engagement process with our clients to ensure their requirements and project information are fully understood and communicated before commencement. The feasibility assessment of our technology-based solutions involves three main components, namely (1) information collection and screening, (2) description of proposed treatment system options and conceptual design, based on provided wash water quality and estimated flow rates or wash water quality generated through laboratory trials by Pact using client's WITC samples and (3) cost-benefit analysis of the proposed treatment system options and comparisons using lifecycle assessments. Such assessments are generally

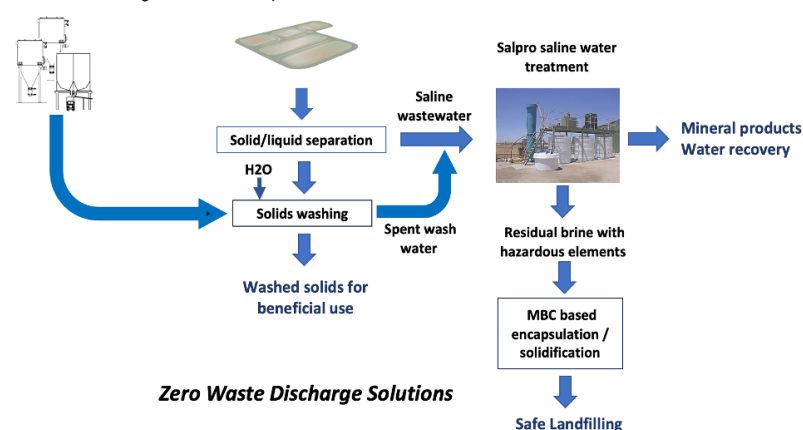
undertaken at a pre-feasibility/scoping study level and commonly include steps of defining benchmark values, saline wastewater and hazardous waste removal/disposal requirements, carbon footprint reduction options, treatment system options, preparation of preliminary specifications for product streams, and reporting of preliminary techno-economic and lifecycle cost evaluation findings.

Development and optimisation of technology applicability envelope (TAE)

Drawing from our proven technology platform and skill sets we offer all above-mentioned services in a single package under amicable contractual arrangements to entities seeking saline waste solution in the form of a technology applicability envelope for their site/project specific requirements. The TAEs we develop are systematically optimised to ensure compatibility with local, state, and national regulatory guidelines, and minimise potential liabilities for our clients. The assignment may also include options of supplying a plant design package for field piloting/demonstration of the selected saline wastewater solution, as well as developing a toolkit to facilitate various tasks in managing saline wastewater by the client at its own workflow. The ownership of generated IP, data and information on products and their markets/offtakers, remain with the client.

Fly ash from coal power plants; fly ash from MSW and EfW incineration processes; kiln dust from cement and lime manufacturing

Coal fly ash and coal washing fines in saline impoundments



CLIENT EXAMPLES

BHP Billiton (South Africa), Hallett Group (Australia), Murray Darling Basin Commission (Australia), Occidental Petroleum (USA), Origin Energy (Australia), Petroleum Development Oman (Middle East), Placer Dome (Australia), Ragn-Sells (Sweden), Santos (Australia), Takata Corporation (Japan), U.S. Environment Protection Agency, WaterReuse Association (USA).



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