From Acid Pickling Sludge to Clay Brick

Member company Category

Bahru Stainless SDN BHD protection of scarce resources; investment in new processes and products in order to deliver a defined sustainability benefit

The Challenge

In Malaysia, acid pickling sludge from an acid neutralization plant is considered hazardous. The most common way of handling this sludge in Malaysia is disposal by landfill. This filling up fast the landfill capacity and involve a high waste disposal cost to the industry. In 2018-2019, an average 5300 tons per annum of the acid pickling sludge is sent to the approved secured landfill site for final disposal.

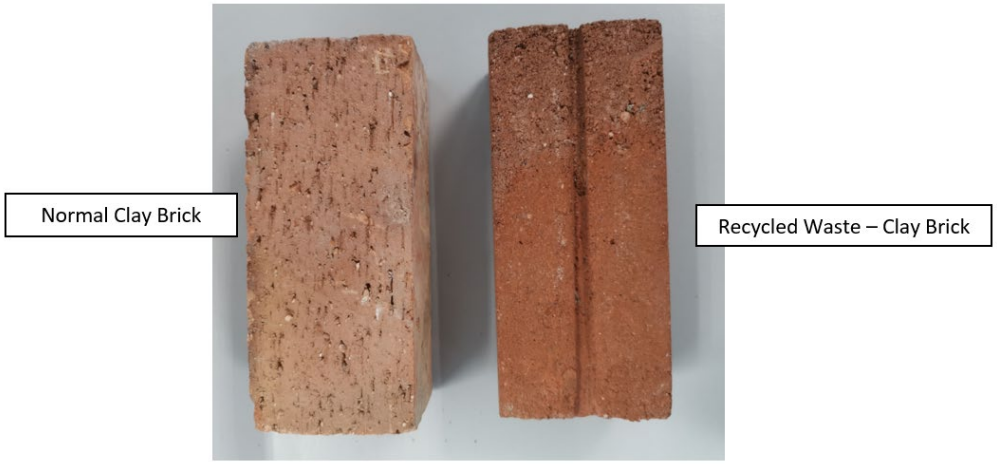
Why?

For environmental improvement, an economic method to treat and efficiently convert this sludge to a value added product is required. Recycling wastes by incorporating them into building materials is a practical solution for eliminating landfill loading up and reducing the land pollution issue.

Needed action

BAHRU STAINLESS has engaged in the research collaboration between a local University and a waste recycler for the sludge recovery project. The waste pickling sludge is used as the sand replacement in the clay brick manufacturing process.

The recycled clay brick is a 100% recycled product comprise with 70% of waste includes pickling sludge from the stainless steel industry (Bahru Stainless), clay sludge from the ceramic industry, coal bottom ash from a power plant, and the balance of 30% is recycled cement.
The conversion of acid pickling sludge into clay bricks enables hazardous waste to be recycled in a sustainable and 'green' manner on an industrial scale. The sludge-to-brick process does not use the conventional kiln operation, its 100% mechanical process, no energy and chemical consumption, This Sludge-to-Brick project fulfills the "Green" Innovation with zero waste generation achievable.



Bahru Stainless picture 1: Recycled Clay Brick versus Common Clay Brick
Through the research work done it shows that the pickling sludge can be used to replace sand by up to 30% and achieved compressive strength more than 25 MPa at 7 days. The recycled clay brick product meets the national requirements and is certified to the national building materials standard under Specification for Masonry Units - Aggregate Concrete Masonry Units requirements.

Action Review

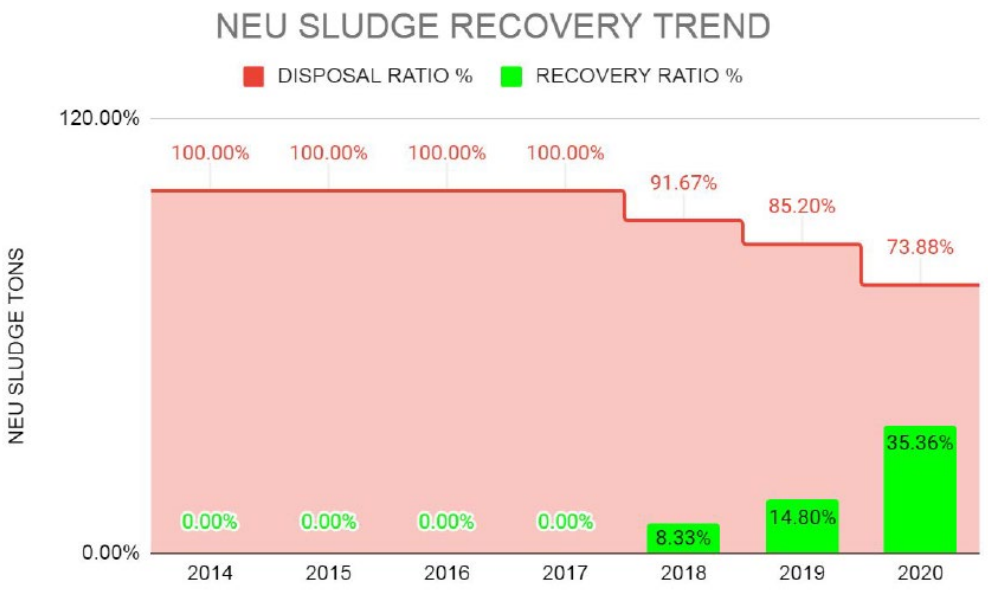
Specific; The pickling sludge is major constituent of 55% the total hazardous waste generation, where it's been sending for landfill at 100% from 2013 to 2017. Since 2018, various trials on the sludge recovery had been carried out but cannot be considered as long term project due to limitation of technology and process specification. In 2020, BAHRU managed to work with a local university and industry partner to realise the potential long term recovery project within 2021-2025.

Measurable; BAHRU was able to increase the recovery rate from 14.8% (2019) to 35% (2020) within the 6 months project period. In addition, the waste handling cost was reduced by 40% per ton of sludge sent for recovery. From August to December 2020, the total BAHRU waste recovery rate achieved 99-100% with the execution of the sludge recovery project. (Graph 1)

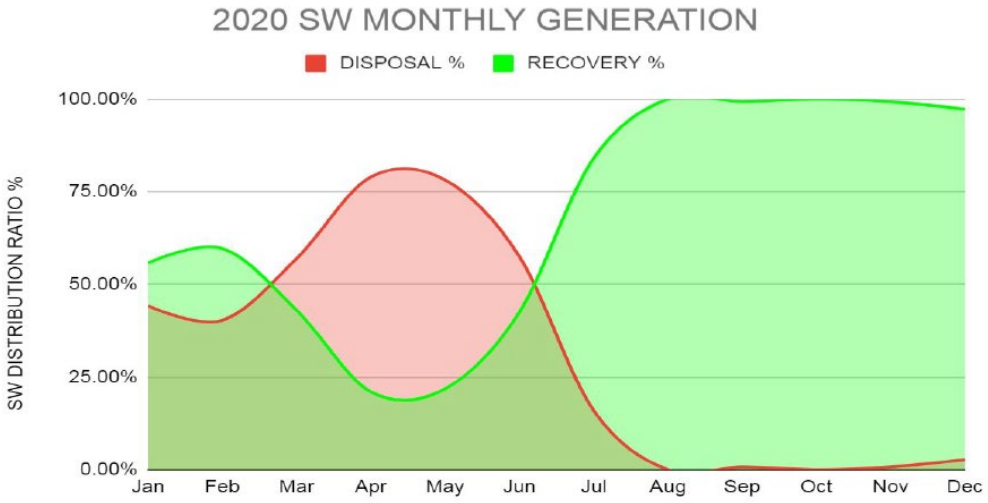
Achievable; The sludge recovery rate is forecast and able to achieve 100% in 2021-2025 with the guarantee of the recovery permit granted by the environmental authority for the sludge recovery to clay brick project.

Realistic; From August to December 2020, the total BAHRU waste recovery rate achieved 99-100% with the execution of the sludge recovery project. (Graph 2)

Time-bound; The clay brick recovery project initiated from mid-July to December 2020. The project continuance with approval was granted for 5 years (2021-2025) by the local environmental authority.



Bahru Stainless graph 1: annual sludge recovery rate versus landfill rate



Bahru Stainless graph 2: 2020 revolution of the total hazardous waste recovery and landfill rate

Target Beneficiaries from the Action

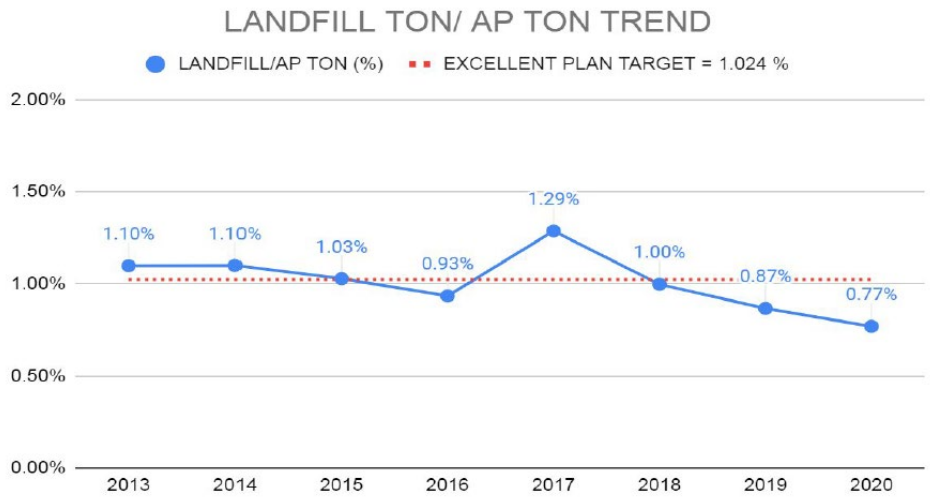
Recycling waste into building material has a direct environmental impact. A new path for resource utilization of the waste pickling sludge is provided, remarkable energy-saving and emission-reduction can be achieved, and the requirements of circular economy and low-carbon economy are met.
Diminishing mineral resources (cement and sand) will be spared for longer term. The open quarry extraction of natural construction material will be reduced and it contributes to the air pollution reduction. Ultimately, landfills will be conserved.

Horizontal Expansion Capability

BAHRU had shared this available sludge recovery into clay brick project with the Acerinox Group companies and this can provide opportunity for the other companies to further study and made reference as the potential recovery projects in the other regions.

Outcome

The annual KPI for the landfill reduction initiatives by Acerinox Group is set.
It is measured at the percentage of sludge landfill ton/ Annealing Ton.
BAHRU having sludge generation at 10.5 kg/Annealing Ton, remarked the highest landfill Ton/Annealing Ton of 1.29 % on 2017 (100 % landfill) and reduce to 0.77 % in 2020 (35 % landfill). (Graph 3)
In term of cost savings, the sludge-to-brick recovery project manages to reduce 40 % of waste management cost per ton of sludge.



Bahru Stainless graph 3: KPI for landfill reduction initiative and result

Recycled Clay Brick Properties	Recycled Clay Brick Advantages
Shape: Uniform, free from warp-age	Environmental friendly
Surface Finish: Smooth	Support green building concept
Strength : 18-22 Mpa	Less usage of mortar and saving in manpower
Water Absorption: 5-10%	Dimension Accuracy
Sound Insulation: Better than red brick	Fire resistant and sound insulation
Efflorescence: Nil	Less penetration of water in brick work
Bonding with mortar: Good High compressive strength	High compressive strength

Estimated Economic Benefit to BAHRU STAINLESS		
For Every 100 ton of Sludge generated	Landfill cost	Recovery cost
	USD 13,888	USD 8,333
	40% Reduction in Waste Management Cost	