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RECP Experiences in M/s. Atul Limited (Aromatic Division), Gujarat, India

Achievements at a Glance

Gujarat Cleaner Production Centre (GCPC) is working with M/s. Atul Ltd (Aromatic Division) in Gujarat. The total investment is USD 7355834.72 (One time) and saving was USD 1514681.4(Yearly) with total revenue generation from waste up to USD 920236.113 (yearly). The RECP involves the improvement targeting resource efficiency, process improvement, energy efficiency and reduced environment impacts, by employing appropriate technologies, both environment and economic gain as achieved.

Overview

M/s. Atul Limited (Aromatics Division) is the largest manufacturer of p-Cresol in the world located at Ankleshwar, Gujarat. Aromatics Division is also the largest producer of p-Anisic Aldehyde and p-Anisyl Alcohol in the world and also the leading manufacturer of Manganese Sulphate and Sodium Sulphite.

Initially the company was having Effluent Treatment Plant (ETP) with activated sludge process. To upgrade the ETP, second stage biological activated sludge process system was introduced. Further up-gradation was done by replacement of surface aerators by 484 in numbers. OTT make submerged diffusers in the first stage activated sludge process of treatment for better degradation efficiency. The effluents generated from various manufacturing plants were coming to ETP by gravity through underground drains. As a first step of the improvement, the characterization of different effluent streams was done based Chemical Oxygen demand (COD) & Total dissolved solid (TDS) value.

The segregation of high and low TDS effluent streams were done through over head pipe lines with installation of measurement devices. Flow of each and every stream coming from different plants was measured by a magnetic flow meter. Based on the analysis of various stages of operation, it was found that efficiency of bio-logical oxidation is being affected due to high TDS streams getting mixed in the common incoming line and giving shock load to ETP disturbing ETP performance. It was found and concluded that the high TDS effluent was hindering biological treatment of waste with lower degradation efficiency in ETP. Hence, a proposal was put up to the Top Management for installation of a Multiple Effect Evaporator (MEE) for treating high TDS effluent streams separately to enhance the efficiency of bio-logical oxidation in ETP and improve the quality of liquid discharge to FETP (Final Effluent treatment Plant).

1. MEE plant of Atul Ltd (AR Div) **2. Waste Recovery Plant of ATUL (AR)** **3. Reverse Osmosis (RO) Plant**

The DCS controlled based Quadruple Multi-Effect Evaporation (MEE) plant having capacity 250 M3/day was installed successfully for handling high TDS liquid effluents. The plant was designed and installed in a professional way. Condensate coming out from MEE operation is mostly recycled back in the process and partly sent to ETP. Solid coming out from MEE plant was of yellow colour powder containing mixed salts and 5 to 6 % moisture which was considered to be a solid waste and not saleable in the market because it was containing mixed salts. It had been disposed off at common secured landfill site.

It was found that the total operating expenses of MEE plant was high. This was a very expensive proposition for the business and not a sustainable solution in long run. Therefore, various options were explored for value creation from this Solid Waste generated.

Benefits

1. Creation of 'Wealth from Waste'

Transforming the solid waste coming out from MEE operation into a saleable product i.e. 99% anhydrous Sodium Sulphate powder (Na_2SO_4) as a long term strategy, Green technology was introduced. A Global platform technical meeting had been conducted , participating Eminent technocrats from the country and world. Techco-economical feasible solution of converting the waste for making 99% pure anhydrous Sodium Sulphate was concluded. A DCS automated 'Waste Recovery Plant' had been installed for converting waste into Sodium Sulphate. Company has recovered large amount Sodium sulphate powder. Introduction of new eco-friendly technology has helped us to increase the productivity of p-Cresol and others downstream products in a sustainable way.

2. Introduction of reverse osmosis (RO) technology to recycle the entire treated waste water in the process and conserve natural resource in order to attain zero liquid discharge (zld)

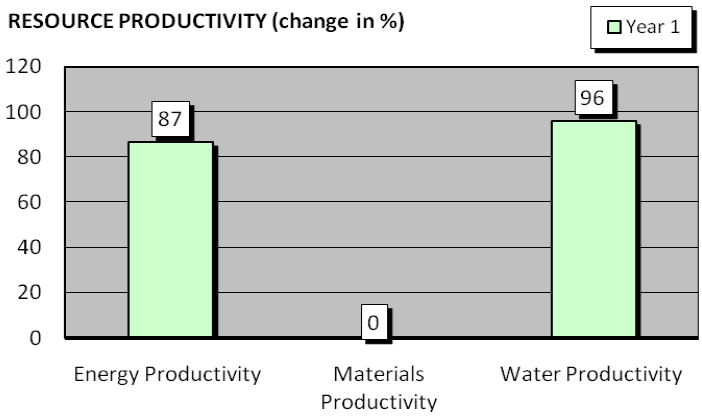
The DCS based RO plant of 700 m^3/day capacity has been Installed. Treated Waste Water coming from ETP tertiary treatment is again pre-treated to remove hardness, oil/grease etc. The Pre-treated water is then passed though a Dual Media Filter (DMF) followed by Ultra Filtration system (UF). After UF, water is fed through RO system in multi stages and clear water having very low TDS"(ie, upto 25 ppm) is recovered as permeate for recycling in the process.

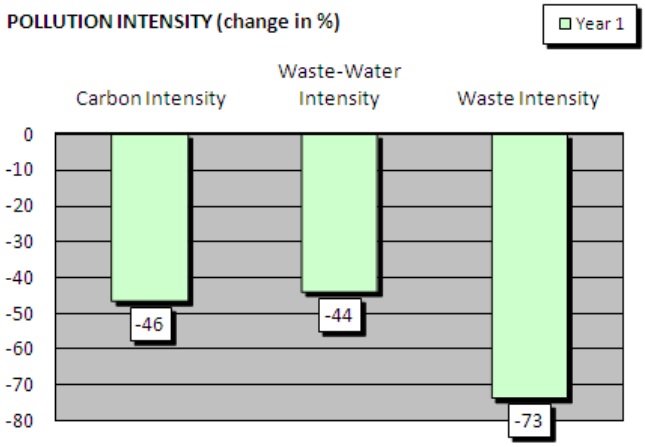
The RO plant has been successfully commissioned resulting in complete stoppage of Waste Water discharge in the common pipe line and achieving Zero Liquid discharge (ZLD) objective. The reject water having high TDS is sent to a multi-effect evaporator system for removal of solids through Centrifuge. The solid coming out from reject stream is non-toxic & non-hazardous and used in secured land fill. It is not only a technological success but also classic example of Conservation of Natural Resource (water) for a sustainable solution.

ABSOLUTE RECP INDICATORS					
Indicator	**Unit**	**Baseline (B) (Before RECP intervention)**	**Year 1 A (After RECP implementation)**	**Change (C) C=100*(A-B)/B** [%]	**Difference Between A and B**
Resource use					
Energy Use	[kWh/yr]	24,550,963.00	30,106,592.00	22.63	5,555,629.00
Materials Use	[ton/yr]			0.00	0.00
Water Use	[m3/yr]	433,366.00	505,894.00	16.74	72,528.00
Pollution					
Carbon dioxide	[ton CO_2-eq/yr]	205,246.05	251,691.11	22.63	46,445.06
Waste-Water	[m3/yr]	129,299.00	166,277.00	28.60	36,978.00
Waste	[ton/yr]	7,525.00	4,575.00	-39.20	-2,950.00
Product Output					
Product Output: P	[ton/yr]	25,468.00	58,312.12	128.96	32,844.12

RECP Experiences

RECP Profile





Resource Efficient and Cleaner Production (RECP)

Resource Efficient and Cleaner Production (RECP) entails the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment.

RECP addresses three sustainability dimensions individually and synergistically:

- *Production efficiency*
  > Through improved productive use of natural resources by enterprises

- *Environmental management*
  > Through minimization of the impact on nature by enterprises

Human development
> Through reduction of risks to people and communities from enterprises and supporting their development

Success Areas

- Creation of 'Wealth from Waste' through high revenue generated from waste.
- Transforming solid waste into a saleable product, Anhydrous Sodium Sulphate powder (Na_2SO_4).
- Reduction and recycling for treated waste water.
- Conservation of Natural Resource (ie. water) for a sustainable solution.

- Improvement on overall environment management system (EMS).
- Implementation of 'Clean and Green Technology'.
- Reduction in TDS load and COD with greater efficiency of ETP.
- Achieved Zero liquid discharge concept and recycle the entire water into process as well as utility.

Table 2: Options implemented

Principal Options Implemented	Benefits			
	Economic		Resource Use	Pollution generated
	Investment [USD]	Cost Saving [USD/yr]	Reductions in energy use, water use and/or materials use (per annum)	Reductions in waste water, air emissions and/or waste generation (per annum)
For putting up a 250 m^3/day MEE for handling only high TDS effluent	USD 998940.518	USD 0	22.63% deduction in energy requirement.	Carbon intensity decreased by 46%
For putting Waste Recovery Plant for converting impure Sodium Sulphate into 99% pure Na2SO4 through Technology innovation.	USD 3632510.97	USD 1210836.99	Purity of Sodium Sulphate is 99% which is saleble product for the industry	Recovery of waste in to saleble product
For putting up RO & MEE for recycling of Teated waste water in Process and conserve natural resource and achieve.	USD 1589223.55	USD 303844.407	Water productivity increased upto 96 %	Increase in water productivity up to 90 %
Installation of another 330 m^3/day stand-by MEE for sustainability of above.	USD 1135159.68	USD 0	Energy productivity increased upto 87 %	Reduction in energy consumption

Approach taken

The overall objective of the programme is to facilitate promotion of Resource Efficient and Cleaner Production without entailing excessive cost in Chemical industry so as to strengthen environmental management and pollution control in the industry. Cleaner production methodology was taking as an approach for this project which includes List Process Steps, Identify Wasteful Processes, Process Flowchart, Material and Energy Balance, Identify Cause of Waste, Technical-Financial- Environmental Feasibility, Implementation of Cleaner Production Solution etc.

Business case

Resource Efficient and Cleaner Production means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and where that is not practicable, to reduce emissions and the impact on the environment as a whole.

Testimony Box
Gujarat Cleaner Production Centre (GCPC), Gujarat, India
The Gujarat Cleaner Production Centre (GCPC) has been established by Industries & Mines Department, Govt. of Gujarat under Gujarat Industrial Development Corporation (GIDC) in the year 1998 with technical guidance of UNIDO and since then the centre is actively engaged in the promotion of Cleaner Production (CP)/Clean Technology (CT) through its various activities such as orientation/awareness programmes, CP and CT Assessment Projects etc. Contributions of GCPC over the years towards promotion of Cleaner Production in the state of Gujarat to improve the productivity and the environmental problems faced by SMEs have been significant. GCPC had also played active role in framing Industrial Policy 2003, 2004, 2009 and 2015, also supported in developing many financial assistance schemes pertaining to CP/CT. GCPC is also member of RECP of UNIDO and Climate Technology Centre and Network (CTCN), a working arm of UNFCCC. GCPC have so far conducted more than **200 Orientation Programmes** in different colleges, organizations and industries associations. The centre has successfully completed more than **100 CP Demonstration Projects** in various sectors like Textile, Dairy, Pulp & Paper, Chemical, Petrochemical, Pharmaceutical, Fish Processing, Ceramic etc.
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English Abstract (where applicable)