
secondary aerated lagoon area (Mr. Ryan Benavidez)

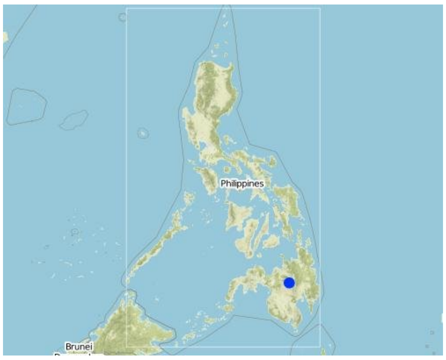
Sugar Mill Wastewater Re-use for Irrigation (Philippines)

DESCRIPTION

Re-using of wastewater to support agricultural crop production, as well as, to help in environmental protection

With increasing water demand and with the changing climate, water availability or water security is critical for the agriculture sector as this resource is a fundamental prerequisite in crop production. Various solutions are tapped and one of it is harnessing the potential of wastewater to be used for irrigation. In the Philippines, one of the companies that utilize their treated wastewater is the BUSCO SUGAR MILLING CO., INC. located in Brgy. Butong, Quezon, Bukidnon. This treated wastewater is currently being re-used as irrigation water for the BUSCO Cane Farms areas, adjacent to the Mill Site covering 493 hectares and also to their leased adjacent 323-ha agricultural land. Primarily, water as an industrial by-product is evident in both raw and refined sugar milling process. Volume of wastewater can be generated in the following sources or stations of sugar production: mill and cane handling station, process and/or boiling house, refinery house, and boiler house. In BUSCO, this wastewater all goes to their common wastewater treatment plant with a capacity of 100,000 volumetric meter and uses primary and secondary treatment. The treatment started with the screening of influent (waste water) which passes through a motor driven conveyor type system to separate the solid waste such as bagasse, bagacillo, silt/mud, sand, and trash canes. After the screening, it now proceeds to the oil/grease separation at the separator tank. Oil and grease that usually floats were removed via manual skimming. The next treatment process is called neutralization wherein the acidic influent (phof 4.0–5.0) will be added with chemicals (i.e. Lime and/or caustic soda) to neutralize and maintain the pH at 6.0–8.0. The neutralized wastewater is then impounded in a digester tank to undergo the process of digestion. Enzymes or bacteria are being introduced to enhanced biodegradation. Aeration is also applied to minimize suspended solids and scum formation. After this, wastewater is transferred to the lagoon for primary aeration process. Lagoons are belted with air diffuser membrane to produced fine bubbles and efficiently dissolved oxygen. Waste water was aerated and polluting substance decomposed. Further, the wastewater and the activated sludge are again mixed and aerated in the secondary and tertiary aeration where the polluting substances are further decomposed by oxidation and are absorbed. Finally, it will store in the final settling pond which will then be utilized for irrigation. The treated wastewater in BUSCO has a Biological Oxygen Demand (BOD) value of 50mg/L which is within the prescribed standard BOD parameters of wastewater quality to be used for crop irrigation (< 150mg/L). Irrigation is done through the hand move spray irrigation system. It uses aluminum pipes backed by centrifugal pumps and spray nozzles. Aside from supporting the sugarcane water requirement particularly during dry months, the treated wastewater/effluent contains nutrients (Nitrogen- 2.5mg/L; Phosphorus- 3.8 mg/L; Potassium- 3.8 mg/L) which reduce fertilizer requirements of the sugarcane farm.

LOCATION



Location: Butong, Quezon, Bukidnon, Philippines

No. of Technology sites analysed: single site

Geo-reference of selected sites

- 125.0726, 7.80763

Spread of the Technology: evenly spread over an area (approx. 1-10 km2)

Date of implementation: 10-50 years ago

Type of introduction

- ✓ through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- through projects/ external interventions


Final settling pond (Mr. Ryan Benavidez)


Sugarcane farm area where treated wastewater is irrigated (Mr. Ryan Benavidez)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose
- ☐ improve production
- ☑ reduce, prevent, restore land degradation
- ☑ conserve ecosystem
- ☑ protect a watershed/ downstream areas – in combination with other Technologies
- ☐ preserve/ improve biodiversity
- ☐ reduce risk of disasters
- ☐ adapt to climate change/ extremes and its impacts
- ☐ mitigate climate change and its impacts
- ☐ create beneficial economic impact
- ☐ create beneficial social impact

Land use


Cropland - Annual cropping
Main crops (cash and food crops): sugarcane

Water supply
- ☐ rainfed
- ☑ mixed rainfed-irrigated
- ☐ full irrigation

Number of growing seasons per year: 2
Land use before implementation of the Technology: n.a.
Livestock density: n.a.

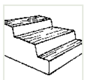
Purpose related to land degradation
- ☐ prevent land degradation
- ☑ reduce land degradation
- ☐ restore/ rehabilitate severely degraded land
- ☐ adapt to land degradation
- ☐ not applicable

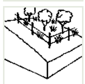
Degradation addressed


water degradation - Hp: decline of surface water quality

SLM group
- waste management/ waste water management

SLM measures

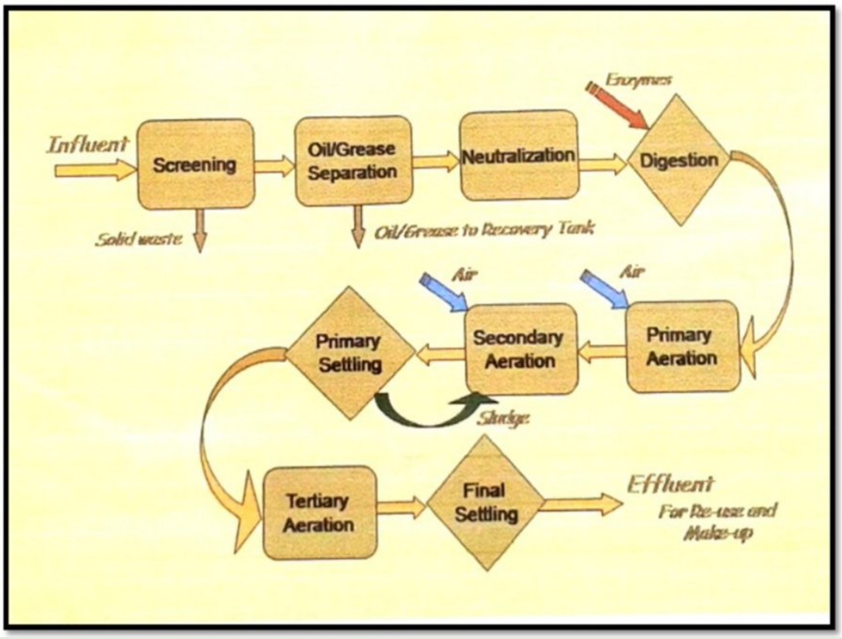

structural measures - S8: Sanitation/ waste water structures


management measures - M6: Waste management (recycling, re-use or reduce)

TECHNICAL DRAWING

Technical specifications
Wastewater treatment flow diagram of BUSCO. The treatment started with the screening of influent (waste water) which passes through a motor driven conveyor type system to separate the solid waste such as bagasse, bagacillo, silt/mud, sand, and trash canes. After the screening, it now proceeds to the oil/grease separation at the separator tank. Oil and grease that usually floats were removed via manual skimming. The next treatment process is called neutralization wherein the acidic influent (phof 4.0–5.0) will be added with chemicals (i.e. Lime and/or caustic soda) to neutralize and maintain the pH at 6.0–8.0. The neutralized wastewater is then impounded in a digester tank to undergo

the process of digestion. Enzymes or bacteria are being introduced to enhanced biodegradation. Aeration is also applied to minimize suspended solids and scum formation. After this, wastewater is transferred to the lagoon for primary aeration process. Lagoons are belted with air diffuser membrane to produced fine bubbles and efficiently dissolved oxygen. Waste water was aerated and polluting substance decomposed. Further, the wastewater and the activated sludge are again mixed and aerated in the secondary and tertiary aeration where the polluting substances are further decomposed by oxidation and are absorbed. Finally, it will store in the final settling pond which will then be utilized for irrigation. The treated wastewater in BUSCO has a Biological Oxygen Demand (BOD) value of 50mg/L which is within the prescribed standard BOD parameters of wastewater quality to be used for crop irrigation (< 150mg/L).



Author: BUSCO Sugar Milling Co.

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs
- Costs are calculated: per Technology unit
- Currency used for cost calculation: **n.a.**
- Exchange rate (to USD): 1 USD = n.a.
- Average wage cost of hired labour per day: n.a.

Most important factors affecting the costs
n.a.

Establishment activities
1. Establishment of Waste Water Treatment Facilities (Structural)

information not available.

Maintenance activities
n.a. information not available. The Company bore 100% of the cost.

NATURAL ENVIRONMENT

Average annual rainfall
- < 250 mm
- 251-500 mm
- 501-750 mm
- 751-1,000 mm
- 1,001-1,500 mm
- 1,501-2,000 mm
- ✓ 2,001-3,000 mm
- 3,001-4,000 mm
- > 4,000 mm

Agro-climatic zone
- ✓ humid
- sub-humid
- semi-arid
- arid

Specifications on climate
n.a.

Slope
- ✓ flat (0-2%)
- ✓ gentle (3-5%)
- moderate (6-10%)
- rolling (11-15%)
- hilly (16-30%)
- steep (31-60%)
- very steep (>60%)

Landforms
- ✓ plateau/plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

Altitude
- 0-100 m a.s.l.
- 101-500 m a.s.l.
- ✓ 501-1,000 m a.s.l.
- 1,001-1,500 m a.s.l.
- 1,501-2,000 m a.s.l.
- 2,001-2,500 m a.s.l.
- 2,501-3,000 m a.s.l.
- 3,001-4,000 m a.s.l.
- > 4,000 m a.s.l.

Technology is applied in
- convex situations
- concave situations
- ✓ not relevant

Soil depth
- very shallow (0-20 cm)
- shallow (21-50 cm)
- moderately deep (51-80 cm)
- deep (81-120 cm)
- very deep (> 120 cm)

Soil texture (topsoil)
- coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

Topsoil organic matter content
- high (>3%)
- medium (1-3%)
- low (<1%)

Groundwater table
- on surface
- < 5 m
- 5-50 m
- > 50 m

Availability of surface water
- excess
- ✓ good
- medium
- poor/ none

Water quality (untreated)
- ✓ good drinking water
- poor drinking water (treatment required)
- for agricultural use only (irrigation)

Is salinity a problem?
- Yes
- ✓ No

Occurrence of flooding
- Yes

- unusable
- ✓ No

Species diversity
- ✓ high
- medium
- low

Habitat diversity
- ✓ high
- medium
- low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- subsistence (self-supply)
- mixed (subsistence/ commercial
- ✓ commercial/ market

Off-farm income
- less than 10% of all income
- 10-50% of all income
- > 50% of all income

Relative level of wealth
- very poor
- poor
- average
- rich
- very rich

Level of mechanization
- manual work
- animal traction
- ✓ mechanized/ motorized

Sedentary or nomadic
- ✓ Sedentary
- Semi-nomadic
- Nomadic

Individuals or groups
- individual/ household
- ✓ groups/ community
- cooperative
- ✓ employee (company, government)

Gender
- ✓ women
- ✓ men

Age
- children
- youth
- ✓ middle-aged
- ✓ elderly

Area used per household
- < 0.5 ha
- 0.5-1 ha
- 1-2 ha
- 2-5 ha
- 5-15 ha
- 15-50 ha
- 50-100 ha
- 100-500 ha
- ✓ 500-1,000 ha
- 1,000-10,000 ha
- > 10,000 ha

Scale
- small-scale
- medium-scale
- large-scale

Land ownership
- state
- ✓ company
- communal/ village
- group
- individual, not titled
- ✓ individual, titled

Land use rights
- open access (unorganized)
- communal (organized)
- ✓ leased
- ✓ individual

Water use rights
- ✓ open access (unorganized)
- communal (organized)
- leased
- individual

Access to services and infrastructure

health	poor			✓	good
education	poor			✓	good
technical assistance	poor			✓	good
employment (e.g. off-farm)	poor			✓	good
markets	poor			✓	good
energy	poor			✓	good
roads and transport	poor			✓	good
drinking water and sanitation	poor			✓	good
financial services	poor			✓	good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

Crop production	decreased						✓		increased
irrigation water availability	decreased							✓	increased
expenses on agricultural inputs	increased					✓			decreased

Socio-cultural impacts

Ecological impacts

water quantity	decreased							✓	increased
nutrient cycling/ recharge	decreased					✓			increased
drought impacts	increased							✓	decreased

Off-site impacts

groundwater/ river pollution	increased							✓	reduced

Benefits compared with establishment costs

Benefits compared with maintenance costs

CLIMATE CHANGE

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- [x] single cases/ experimental
- [ ] 1-10%
- [ ] 10-50%
- [ ] more than 50%

- [ ] 0-10%
- [ ] 10-50%
- [ ] 50-90%
- [x] 90-100%

Has the Technology been modified recently to adapt to changing conditions?
- [ ] Yes
- [x] No

To which changing conditions?
- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths
- Contribute in the elimination or reduction of water pollution in the near-by water bodies. Complying to the environmental standards. Water availability particularly during dry months. (land user's view)
- • Source of irrigation during water shortage on dry months • Additional source of nutrients thus decreasing the dependency on chemical fertilizers • Eliminate/Reduce wastewater discharge on water bodies thus reduction of water pollution • Complying to the environmental standards • Savings on wastewater discharge fee of the industrial company (compiler's or other key resource person's view)

Weaknesses/ disadvantages/ risks → *how to overcome*
- Investment cost. → *Optimizing the operation of the treatment facility; possible utilization of other wastes like sludge, mill ash, and mudpress into soil conditioner or fertilizer* (compiler's or other key resource person's view)
- none (land user's view)

REFERENCES

Compiler

Philippine Overview of Conservation Approaches and Technologies - philcatsecretariat@gmail.com

Resource persons

Feliciano Perater, Jr. - land user
Gloria Betonio (agri10cdo@gmail.com) - SLM specialist
Jemar Raquid (bswmclientcenter@yahoo.com) - None
Dianne Michelle Adel (bswmclientcenter@yahoo.com) - None
Ryan Benavidez (bswmclientcenter@yahoo.com) - None

Full description in the WOCAT database

https://qcat.wocat.net/en/wocat/technologies/view/technologies_1914/

Linked SLM data

n.a.

Documentation was faciliated by
Institution
- Bureau of Soils and Water Management

Project
- Decision Support for Mainstreaming and Scaling out Sustainable Land Management

Key references

Links to relevant information which is available online

not available: None