○ FY2009 CDM/JI Feasibility Study Report Summary

Title of Feasibility Study (FS)：” CDM feasibility study for aerobic digestion of sewage sludge in Pingdingshan Sewage Treatment Plants, China”

Main Implementing Entity：Pacific Consultants Co.,Ltd.

FS Study Implementation Partner：JCE Co.,Ltd.

・Arrangements of business tables of relevant parties in China
・Assistances of on-site investigations at relevant fields in China
・Follow-up activities of business tables and on-site investigations

１. Description of Project Activity

Sewage sludge is currently sent to landfill site for unmanaged dumping which will cause anaerobic digestion. There could be potential methane emission from this activity and then methane gas is generated and emitted to the atmosphere.

This project is aimed to reduce the methane emission from anaerobic digestion and decay of sewage sludge by avoiding the current unmanaged dumping. Instead, sewage sludge will be applied in an aerobic composting technique. Composting is a process of controlled biological decomposition of organic materials. Sewage sludge will be mixed with culture medium of aerobically growing bacterium (hereinafter referred to as YM aerobes) which decomposes organic materials at ultra-high temperature.

The composting will reduce the negative environmental impact of sewage treatment in terms of anaerobic decay of organic materials in landfill sites and it will make the fertilizer and soil condition values of the composting application in the agricultural fields and landscaping works. In addition, the use of compost will reduce the use of inorganic fertilizer. Methodology to be Applies is AMS-III.F “Avoidance of methane emissions through controlled biological treatment of biomass”.

２. FS Study Contents

(1) FS Study Subjects

This study aims to implement sewage sludge composting activities as a CDM project at a sewage treatment plant in accordance of AMS-III.F. Version 06. For development a CDM-PDD, it is important to prepare sufficient and forehanded monitoring data and relevant evidences as below, thus these are recognized as FS study subjects:

○ Monitoring data related to calculation of emission reductions to be obtained at the demonstrated operation site and the project site;

○ Evidences to demonstrate the additionality of the project activity such as evidences relevant to investment analysis, CDM prior consideration and so on. The benchmark used for the calculation is based on the expected return on investment by the project participants. This benchmark is verified by the interest rate of credit for investment by commercial banks in China.

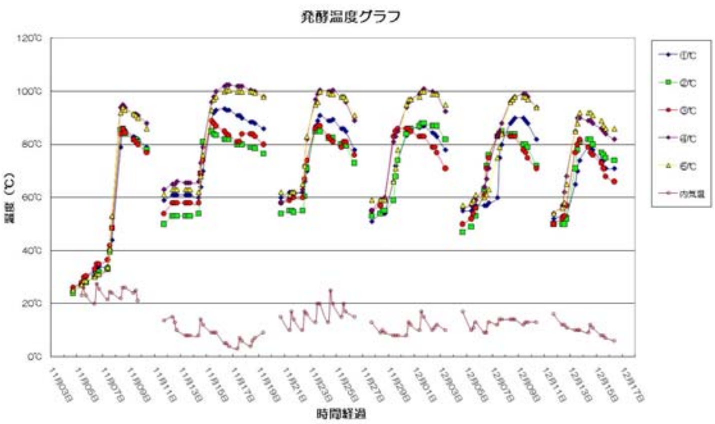
(2) FS Study Contents

On-site investigations

On-site investigations were conducted on 17th-19th November, 2009. Project participants introduced and explained the ultrahigh-temperature aerobic degradation technique by using patent microbes "YM aerobes" as well as actual achievements in Japan at a technical conference held in Nanjing city. The YM aerobes introduction attracted the attention of many convention participants.

Demonstrated operation

Project participants analyzed the monitoring data of demonstrated operation, which is conducted between 4th November and 16th December, 2009, at a sewage treatment plant in Nanjing city. As a result, it is recognized that YM aerobes work on effectively without reference to different circumstances between Japan and China, such as characteristics of sewage sludge, ambient temperature and humidity, available equipments and materials.

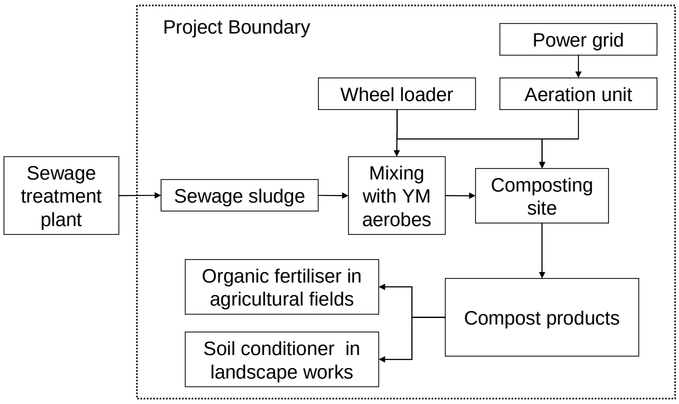


Project site

Pingdingshan-Shi sewage treatment plant is one of the largest sewage treatment plants in China. This project activity will be based in a 250,000 m3/day sewage treatment plant located in Pingdingshan-Shi, Henan Province.

3. Study Outcome for the CDM project realization

(1) Project boundary and baseline emissions



$$BE_y = BE_{CH4,SWDS,y} - (MD_{y,reg} * GWP\_CH_4) + (MEP_{y,ww} * GWP\_CH_4)$$

$BE_{CH4,SWDS,y}$: Yearly methane generation potential of the sewage sludge to be composted by the project activity (tCO_2e)

$MD_{y,reg}$: Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tCH_4)

$MEP_{y,ww}$: Methane emission potential in the year y of the wastewater co-composted. The value of this term is zero if co-composting of wastewater is not included in the project activity (tCH_4)

GWP_CH_4 : Global Warming Potential for CH_4 (value of 21 is used)

$$MEP_{y,ww} = Q_{y,ww,in} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,treatment} * UF_b$$

$Q_{y,ww,in}$: Volume of wastewater entering the co-composting facility in the year y (m^3)

$COD_{y,ww,untreated}$: Chemical oxygen demand of the wastewater entering the co-composting facility in the year y ($tonnes/m^3$)

$B_{o,ww}$: Methane producing capacity for the wastewater (IPCC default value for domestic wastewater of 0.21 $kg\text{-}CH_4/kg\text{-}COD$)

$MCF_{ww,treatment}$: Methane correction factor for the wastewater treatment system in the baseline scenario

UF_b: Model correction factor to account for model uncertainties (0.94)

(2) Project emissions and leakage

$$PE_y = PE_{y,transp} + PE_{y,power} + PE_{y,comp} + PE_{y,runoff} + PE_{y,res\ waste}$$

○ Emissions from incremental transportation

$$PE_{y,transp} = (Q_y/CT_y) * DAF_w * EF_{CO2} + (Q_{y,treatment}/CT_{y,treatment}) * DAF_{treatment} * EF_{CO2}$$

Q_y : Quantity of sewage sludge to be treated aerobically in the year y (tonnes)

CT_y : Average truck capacity for sewage sludge transportation (tonnes/truck)

DAF_w : Average incremental distance for sewage sludge and/or wastewater transportation (km/truck)

EF_{CO2} : CO2 emission factor from fuel use due to transportation ($kgCO_2/km$)

$Q_{y,treatment}$: Quantity of compost produced in year y (tonnes)

$CT_{y,treatment}$: Average truck capacity for compost transportation (tonnes/truck)

$DAF_{treatment}$: Average distance for compost transportation (km/truck)

○ Project emissions from power consumption (electricity/diesel)

Emission factors for grid electricity used shall be calculated as described in AMS I.D. For project activity emissions from fossil fuel consumption the emission factor for the fossil fuel shall be used (tCO_2/tonne).

○ Project emissions during composting process

$$PE_{y,comp} = Q_y * EF_{composting} * GWP\_CH_4$$

$EF_{composting}$: Emission factor for composting of organic waste (t CH_4/ton waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (10 g CH_4/kg waste treated on a dry weight basis and 4 g CH_4/kg waste treated on a wet weight basis).

○ Project emissions from runoff water

$$PE_{y,runoff} = Q_{y,ww,runoff} * COD_{y,ww,runoff} * B_{o,ww} * MCF_{ww,treatment} * UF_b * GWP\_CH_4$$

$Q_{y,ww,runoff}$: Volume of runoff water in the year y (m^3)

$COD_{y,ww,runoff}$: Chemical oxygen demand of the runoff water leaving the composting facility in the year y ($tonnes/m^3$)

UF_b: Model correction factor to account for model uncertainties (1.06)

○ Project emissions from the anaerobic decay of the residual waste/products

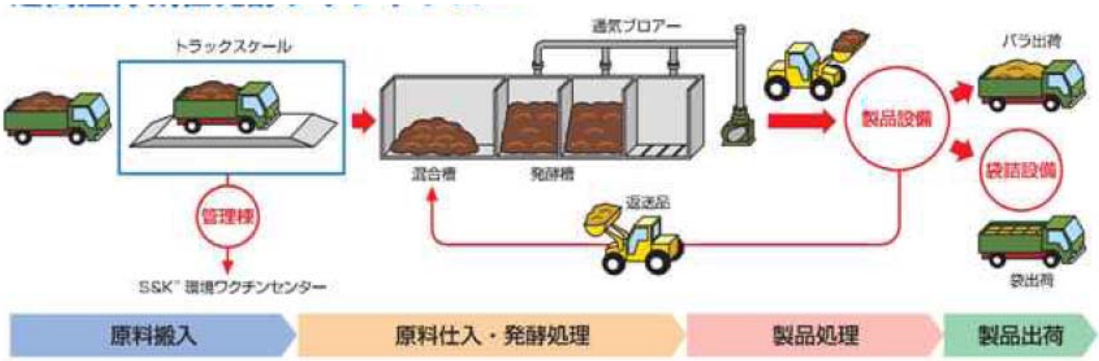
However, the final compost will be evenly applied in agricultural fields or landscaping works. Thus it is unlikely that the final compost will be subject to anaerobic storage or disposal in landfill sited which may cause methane emissions from anaerobic decay of final compost thus the project emissions from this source are considered insignificant for this project scenario.

○ Leakage

There will be no leakage in composting project as all equipments to be used in the project activity are brand new and bought for the purpose of the project activity. No equipment or treatment technology will be transferred from another activity or no existing equipment will be transferred to another activity.

(3) Monitoring Plan

Project participants have an operational and management structure in place to monitor emission reductions from the project activity. Each composting plant will appoint technician team to run the composting plant efficiently. A composting plant manager will be responsible to assign his subordinates to collect and report the monitoring parameters and verify them monthly. All the data will be kept in both hardcopy and softcopy. Data and parameters to be monitored are planned as below. The engineering services department will receive the data from the composting plants and assign a third party consultant or in-house experts to calculate the emission reductions and prepare a monitoring report.



$W_{j,x}$ (tons), DOC_j, k_j Q_y (tons), CT_y (tons/truck), DAF_w (km/truck), $Q_{y,ww,in}$ (m^3), $COD_{y,ww,untreated}$ (tons/m^3)	$EF_{composting}$ (tCH_4/t-waste), $Q_{y,ww,runoff}$ (m^3), $COD_{y,ww,runoff}$ (tons/m^3), Electricity and fossil fuel consumption by composting facilities	$Q_{y,treatment,i}$ (tons), $CT_{y,treatment,i}$ (tons/truck), $DAF_{treatment,i}$ (km/truck)

(4) Estimation of GHG Emission Reductions

The ex-ante estimation of GHG emission reductions is summarized in the table below.

Year	A	B	C
	BE_y (tCO_2e)	PE_y (tCO_2e)	ER_y (tCO_2e)
1	5,142	4,997	145
2	9,985	4,997	4,988
3	14,546	4,997	9,548
4	18,841	4,997	13,844
5	22,886	4,997	17,889
6	26,695	4,997	21,698
7	30,283	4,997	25,286
8	33,662	4,997	28,664
9	36,844	4,997	31,846
10	39,840	4,997	34,843
Total	238,724	49,974	188,750

(5) Duration of Project Activity and Crediting Period

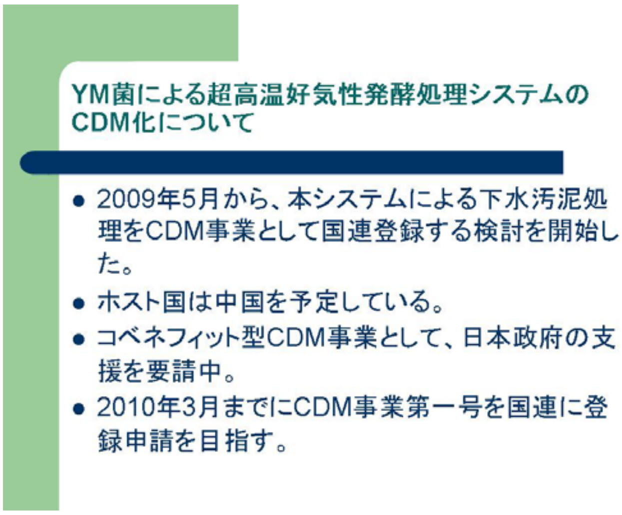
Starting date of the project activity：01/07/2010

The turnkey agreement to develop composting project at Pingdingshan-Shi sewage treatment plant was signed on 01 July 2010 which constitutes the project starting date.

Justification of the CDM prior consideration

Project participants Sanyu, Kubota-gumi and PENYAO have been cooperating on CDM since early 2009. The cooperation with the Japanese Government started on 15 July 2009, where Sanyu and Kubota-gumi proposed to the Japanese Government to work on CDM with PENYAO. This was during the period Japanese mission to China was carried out to identify the need for CDM capacity building and potential for project development.

The evidence to indicate the initiatives to develop a CDM composting project can be clearly seen in a document named “Letter of Intent (LoI)” which was signed on 15 December 2009 between Sanyu, Kubota-gumi and the project developer, PENYAO.



汚泥処理、中国で事業化

久保田組・山有 CDM申請へ

「菌で肥料化」技術を供与

【札幌】北海道の土木建設会社の久保田組（新冠町、國島功社長）と廃棄物処理の山有（鹿児島市、山村正一社長）は中国企業と提携し、中国で微生物を活用した汚泥処理の事業化に乗り出す。自然発酵でセ氏90～100度になる特殊な菌で不純物を処理、汚泥を肥料として再利用する。

汚泥から発生するメタンなどの温暖化ガスを減らせることから、国連のクリーン開発メカニズム（CDM）承認も目指す。久保田組によれば、CDM事業として承認されれば国内のバイオ技術活用例としては初めて。

処理には山有が特許を持つ「YM菌」と呼ばれる特殊な微生物を使う。発酵による温度上昇が他の微生物に比べて大きいため、病原菌や悪臭の元になる化合物などを効率的に処理できる。下水汚泥に混ぜてかき混ぜ、定期的に空気を送り込むと、YM菌が汚泥内の不純物を食べ、45日ほどで肥料になる。

シンガポール市場に上場する中国の環境総合企業、アジアパンヤオグループ（江蘇省、王洪春代表）と提携。8月から上海市の実証プラントで約50トンの下水汚泥の処理実験を始める。山有がYM菌を提供し、久保田組が技術支援する。久保田組は北海道苫小牧市でYM菌を使った汚泥処理工場を運営している。

処理後の肥料を近郊の農場で活用する試験も始め、下水汚泥のリサイクルのモデルを確立する計画。10月まで汚泥の減量効果や臭気などを検証した後、中国で事業を本格化する方針だ。温暖化ガス排出量の削減効果をまとめ、年内をメドに建設コンサルタントのパシフィックコンサルタンツと共同で、国連にCDM事業の承認を申請する。

YM菌による中国での汚泥処理実証実験の流れ

中国の地方自治体

下水汚泥の処理委託

アジアパンヤオグループ

YM菌の技術を提供

久保田組

山有

アジアパンヤオグループが上海市で運営する下水汚泥処理場

YM菌で汚泥を肥料化

農場で肥料として活用

第7回 中小企業都市サミット

Expected operational lifetime of the project activity

10 years

Starting date of fixed crediting period

01/10/2010

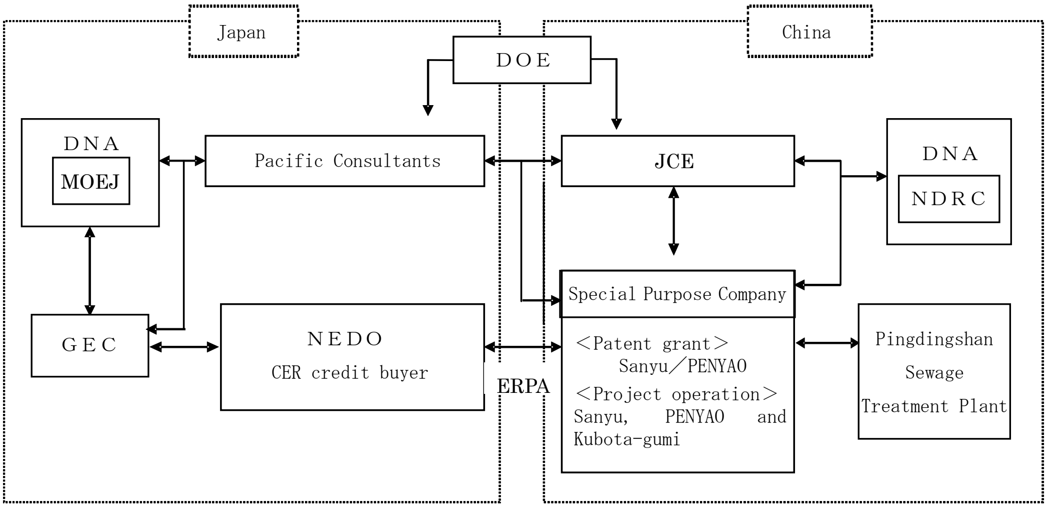
(6) Environmental Impact Analysis

Chinese authorities do not require any environmental impact analysis for sewage sludge composting of the project activity and the environmental impacts are considered insignificant. The project complies with all laws and regulations related to establishment and operation of solid waste and wastewater treatment facilities and composting plants. The project site has been prepared with a suitable drainage facilities for collection and treatment of rainwater and leachate.

(7) Stakeholders' Comments

The project activity is within the existing sewage treatment plant premises. As mentioned in the previous section the environmental impact for the project activity is insignificant and on the other hand it improves the quality of surface stream water and under ground water in the surrounding environment. Furthermore this sewage treatment plant is isolated from inhabitant settlement to avoid any form of discomfort to the local community. Thus the project has minimal involvement from the local stakeholders.

(8) Project Implementation Structure



With CDM support, PENYAO Environment protection Group will be able to use the income from CERs sales to the project in the Pingdingshan sewage treatment plant which is operated and managed by Pingdingshan Wushui Jinghua Gongsi. PENYAO management would not have invested in the project if no revenue from CDM to be contributed to the project.

(9) Financial Plan

The project activity is the "first of its kind" in terms of disposal technology of sewage sludge by using YM aerobes in China. However, there is no public funding involved in this project activity so far. Thus, the special purpose company, which is organized by Sanyu, PENYAO and Kubota-gumi, will have to raise capital on debt finance from banking facility and/or own fund.

(10) Investment Analysis

A benchmark analysis was done to calculate the financial feasibility at different CER price with a financial indicator Internal Return Rate (IRR). The project proponent will only invest in a project with a positive cash flow and an IRR of more than 6% per annum. That value at the time of the PDD completion is 5.94-7.72%, according to the open-to-public website by the People's Bank of China, the China's central bank. However the 6% benchmark will be the company targeted figure for new investments in order to achieve a higher target for the group for the following years. Thus the benchmark of 6% is deemed to be appropriate to be used for this project activity.

Value	Justification
Revenue from the compost	Annual revenue from compost is derived by multiplying the quantity of compost produced and the compost price. 60ton/day * 365day/year * 100yuan/ton = 2,190,000yuan/year The price of compost is calculated based on substitution of the value of inorganic fertiliser. The price of 100yuan/ton was determined by using average price from year 2007-2009.
Saving of sewage sludge disposal cost	The cost of sewage sludge is considered to be zero since the value of sewage sludge is not able to be anticipated in waste trade market. On the other hand the saving of sewage sludge disposal cost for waste receiving business is derived by multiplying the quantity of sewage sludge and the disposal price. 200ton/day * 365day/year * 145yuan/ton = 10,585,000yuan/year
Cost of inoculum YM aerobes	The cost of inoculum YM aerobes is based on the contract price with the supplier Sanyu which is 25yuan/ton. Source of the price is "Composting Accelerant YM aerobes Purchase Agreement" between PENYAO and Sanyu. 200t-sludge/day * 365day/year * 25yuan/t- sludge = 1,825,000yuan/year
Cost of electricity	Cost of electricity was calculated based on the tariff of 0.6yuan/kWh. 2,630kWh/day * 365day/year * 0.6yuan/kWh = 576,000yuan/year
Cost of fuel	Cost of fuel was calculated based on the price of 6yuan/liter. 388liter/day * 365day/year * 6yuan/liter = 850,000yuan/year

The summary of the feasibility study results are tabulated below. The results from the table above indicate that without CDM the project has a 5.4% IRR. To meet the investment criteria of the project proponent, the CER price must be above \$6/tCO_2e. The investment analysis was made for 10 years based on depreciation rates adopted according to PENYAO accounting policies.

CER Price (USD/tCO_2e)	0	6	12
IRR (%)	5.4%	7.7%	9.7%

(11) Demonstration of Additionality

Define alternatives to the project activity

If the composting project is not undertaken as CDM project activity, it could be a realistic alternative. Besides reducing methane emission, the composting project will be able to provide a better use for the abundantly available sewage sludge. The Chinese technology policy recommends proper disposal and the best way to dispose sewage sludge would be composting it in fermenting mound. Even though the project involves some capital investment, it can be easily shown feasible with its CDM contribution in investment analysis.

An alternative that would deliver approximately the same services as the proposed project activity is to dispose into closed landfill sites to collect generated biogas (methane) and flare it. However this is not a likely scenario, as there is no law or regulation to direct sewage treatment plants to capture the gas and flare it from closed solid waste disposal sites. The other option is to generate electricity from biogas to be generated from anaerobic decay of sewage sludge in landfill sites and supply it to the grid. However this will require huge investment in biogas capture, gas scrubber, gas engine and transmission line to inject the power to the local grid. This alternative could be another CDM project if investment analysis shows positive result.

Another alternative is to build up in-situ aeration of landfill sites to avoid methane generation from anaerobic decay of sewage sludge in the baseline. Again this is not a likely scenario as this would require large land area improvement and energy consumption for aeration etc., which would be more feasible to remain unmanaged dumping of organic waste.

The continuation of current situation is to treat sewage sludge in unmanaged open dumping. Most of the sewage treatment plants in China are treating sewage sludge in unmanaged open dumping. In the absence of the CDM project activity, the current situation will continue as this is an effective way of treating the sewage sludge and there are no laws and regulations being opposing anaerobic treatment and emission of methane to the atmosphere.

Barrier analysis

The proposed project activity, aerobic digestion (i.e. composting) of sewage sludge by using YM aerobes, faces a barrier that prevents the implementation of this type of proposed project activity. The barrier due to prevailing current practice, unmanaged open dumping of sewage sludge in solid waste disposal sites, is extensively observed in China.

Besides the project activity is the “first of its kind” in terms of disposal technology of sewage sludge by using YM aerobes in China. Skilled and/or properly trained labour to operate and maintain the technology is not available in China, which leads to an unacceptably high risk of equipment disrepair and malfunctioning or other underperformance. Lack of infrastructure for implementation and logistics for maintenance of the technology and risk of technological failure is significantly greater compared to prevailing current practice.

Thus the project proponent will not be able to implement the project activity unless the aerobic digestion technology of sewage sludge by using YM aerobes is transferred from Sanyu and Kubota-gumi with the support of CDM

Common practice analysis

The common practice in the industry is to send the sewage sludge into solid waste disposal sites for unmanaged open dumping and left to decay naturally. There is no similar composting activity prior to the proposed project activity. The proposed project type has demonstrated to be first-of-its kind mentioned above.

Based on the step by step additionality analysis mentioned above the project is proven to be additional.

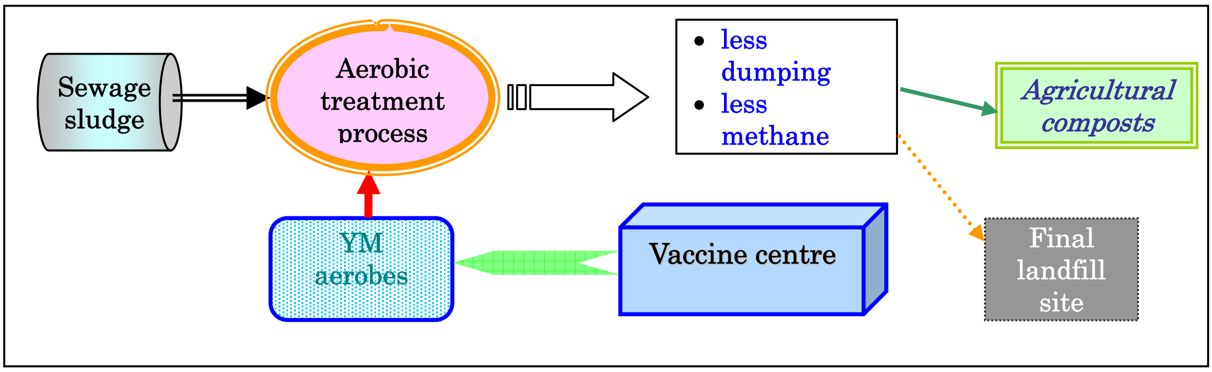
4. Contribution to Sustainable Development in Host Country

Current situation

Sewage sludge is currently sent to landfill site for unmanaged dumping which will cause anaerobic digestion. There could be potential methane emission from this activity and then methane gas is generated and emitted to the atmosphere.

Project activity

This project is aimed to reduce the methane emission from anaerobic digestion and decay of sewage sludge by avoiding the current unmanaged dumping. Instead sewage sludge will be applied in an aerobic composting technique. Composting is a process of controlled biological decomposition of organic materials. Sewage sludge will be mixed with culture medium of aerobically growing bacterium "YM aerobes" which decomposes organic materials at ultra-high temperature.



The composting will reduce the negative environmental impact of sewage sludge treatment in terms of anaerobic decay of organic materials in landfill sites and it will make the fertilizer and soil condition values of the composting application in the agricultural fields and landscaping works. In addition, the use of compost will reduce the use of inorganic fertilizer.

The project is a waste management project that will lead to sustainable development through reduced pollution from sewage sludge as well as reduced methane emissions from anaerobic digestion of sewage sludge. The sewage treatment plants will be encouraged to adopt cleaner technology that facilitates the reuse and regeneration of new materials from waste. The project satisfies the environment sustainability by improving air, soil and water quality and minimizing the waste from sewage treatment plants by reusing and regenerating it into a fertilizer product and soil conditioner.