Contribution to the agronomic characterization of the new METHACOMPOST produced in 2012 on Ametyst plant

Martel Jean-Luc[1] and Allain Monique[1]

(1) SUEZ ENVIRONNEMENT CIRSEE 38, rue du Président Wilson 78230 Le Pecq FR
*Corresponding author: jean-luc.martel@suez-env.com

Abstract
This paper aims at giving a new feedback on the agronomic qualities of the Methacompost produced in 2012 by the Ametyst plant from residual MSW in comparison with the raw digestate produced on the same plant and with MSW compost produced by SITA Grand Ouest on the Gueltas plant. It also compares the 2012 Methacompost to the 2009 one that had been produced with the initial mechanical pre-treatment process line and with an internal bulking agent. The new characterization of the 2012 Methacompost is done through one task of the DIVA collaborative R&D program and in partnership with INRA. Due to some delays attached to the nitrogen bioavailability test realization, only one part of the results can be presented in this paper: agronomic composition of the different studied products and carbon and nitrogen mineralization in soil of the two 2012 composted products. These first results already show a better maturation level of the 2012 Methacompost compared to the 2009 one and to the MSW compost produced on the Gueltas plant.

1/ Introduction

Under the growing regulatory and environmental pressure expressed as well as the EC level (landfill directive and new waste framework directive) as the French government level (Grenelle 1 and Grenelle 2 laws), direct landfilling or incineration of domestic waste are progressively applied to less important tonnages and several important municipalities as the Montpellier urban community have already invested in sophisticated MBT plants owing to divert biodegradable waste from landfill or incinerator. The Montpellier Ametyst plant is the biggest French MBT plant including an AD process applied to the fine organic fraction of MSW and to Biowaste and producing what we have called a final Methacompost. This plant, that has been already described in a previous paper presented at ORBIT 2010 (1), has known some important technical issues from its commissioning in 2008 to early 2012 and has been largely revamped in order to be able to treat the current production of residual MSW and selectively collected biowaste that is about 125,000 TPY. The new and simpler mechanical pre-treatment applied since 2012 to residual MSW is now producing only one organic 0-20 mm fine fraction that is extracted from the initial 0-300 mm raw fraction of residual MSW and is described on figure 1. The new 2012 digestate maturation process that is using an external bulking agent (green waste and wood pallets) instead of the 0-80 mm fraction extracted from pre-treated MSW has been already described in another previous paper presented at ORBIT 2012 (2).

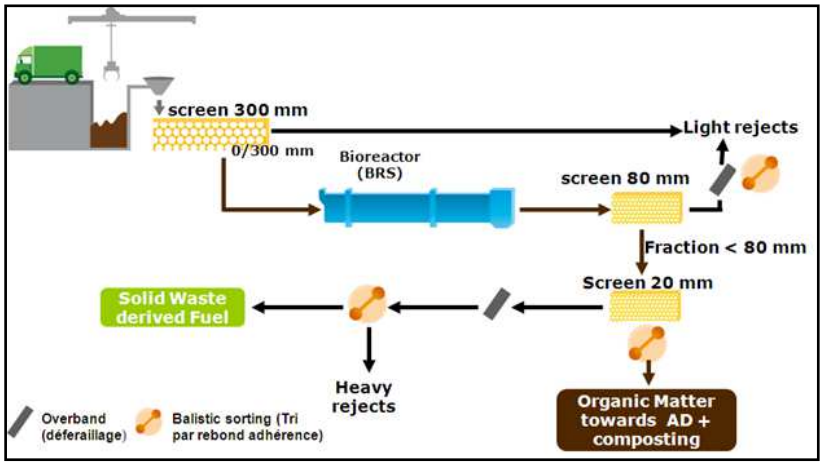

Figure 1. 2012 Mechanical pre-treatment process line applied to MSW on Ametyst plant

The Gueltas MBT plant has been built in 2008 and is operated by SITA Grand Ouest, its capacity of treatment is about 35.000 TPY of residual MSW (30.000 TPY) and industrial biowaste (5.000 TPY). The global process applied to MSW is described on figure 2.

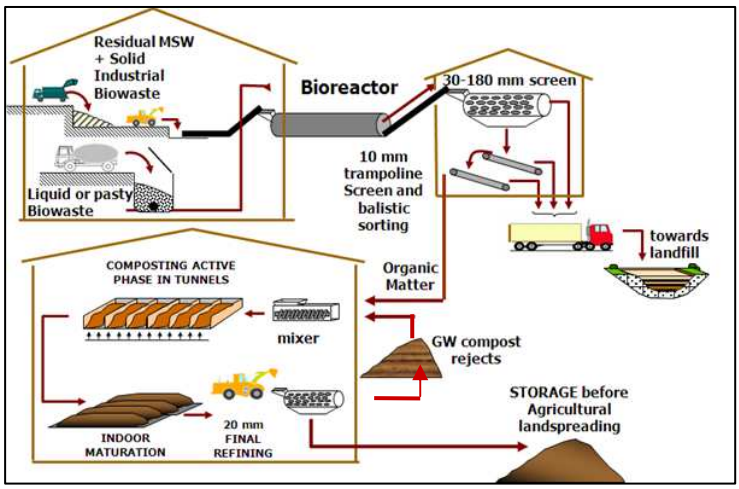

Figure 2. global MBT process applied on the SITA Gueltas plant

2/ Material and Methods

This work is part of the four years (2010-2014) collaborative R&D program DIVA labelled by ANR and that deals with the Characterization and agronomic recovery of main types of digestates produced in France. It gathers 8 public and private contributors and is led by IRSTEA. Suez Environnement is one of the 2 industrial partners and is mainly contributing to the "agronomic characterization" task that is led by INRA. Its main contribution consists in different laboratory and "field" tests owing to precise the agronomic value of different organic products that have been digested and/or composted.

2.1/ studied products

In this paper, only 5 products produced by SITA on Ametyst and Gueltas plant are considered and studied: two 2009 and one 2012 Ametyst Methacompost, one early 2013 Ametyst raw digestate and one 2012 Gueltas MSW compost.

The 2012 Ametyst Methacompost and Gueltas MSW compost have been respectively sampled on 2 and 7 november 2012 on the field test site located at Fabregues (34) and where 2 m3 of each product had been delivered a few days before (field test organised through DIVA program but not described in this paper). The sampling of each product has been done by using the sampling standard EN 12579-2000 and by gathering for each product a final sample of about 30 litres. One part (about 10 liters) of each sample has been directly driven to a local agronomic lab called Celesta-lab for agronomic and environmental analyses (U44051 standard parameters) and for a C and N kinetic mineralisation test done with the protocol defined in the French XPU 44-163 standard.

For the other tests and analyses done in CIRSEE/ INRA Grignon area or in SAS lab, the remaining part of the 2 samples and a third sample of early 2013 Ametyst raw digestate directly sampled on the Montpellier plant have been kept at +4°c Celsius or frozen and kept at minus 18°celsius.

The origin of the 5 studied products and the different processes applied to each one are described on table 1.

Table 1. Different processes applied to the 5 studied products

Studied Products	Plant location	Pre-Treatment	AD stage	Aerated EcoSilo	Matur-ation	Turning number	Final refining mesh
2013 Ametyst raw Digestate	AMETYST (Montpellier)	2/3 days	+/-1 month	NO	NO	NO	NO
2009 Ametyst 0-8mm MethaCompost		3/5 days	1 month	1 month	1 month	2	8 mm
2009 Ametyst 0-10 mm MethaCompost		3/5 days	1 month	1 month	2 months	4	10 mm
2012 AMETYST Methacompost		2/3 days	+/- 1 month	1 month	1 month	4	6 mm
2012 GUELTAS MSW compost	Gueltas	2/3 days of pre-treatment + 4 weeks of tunnel composting			2 months	2	20 mm

2.2/ Germination and phyto-toxicity test

This quick test determines the level of maturity and eventual phyto-toxicity of organic soil improvers incorporated in a commercial growing media and compared to the same pure growing media.
Lepidum sativum (Alenois cress) seeds were used for this test done in the CIRSEE Croissy lab.

2.3/ Rottegrad or self-heating test

This simple german test helps the operators to determine on plant the stabilisation/maturity level of a solid organic product by following during one week the elevation of temperature in the humidified compost (with about 50% water content) placed in a Dewar container of 1,5 litre capacity.

2.4/ Nitrogen Bio-availability test or Chaminade test

This test allows to measure the plant real answer – here a gramin grass species : Lolium perenne or Italy Ray grass - to the Nitrogen fertilising effect of the studied product that is incorporated through different doses to a well known soil inside 500 g capacity containers.
In the 2013 test presented in this paper, only the 2012 Ametyst Methacompost and the 2013 Ametyst raw digestate are considered by using 2 or 3 increasing doses calculated on the bring of total Nitrogen: D1= 100 units/ha, D2= 200 u/ha, D3= 300 u/ha and compared to 2 mineral fertilisation reference treatments (respectively 250 and 500 u/ha) and to one 0 N reference treatment. These 2 products have been tested together with 7 other « DIVA » studied products (1 Methacompost and 3 forms of digestate produced on the BIOD plant and 3 forms of digestate produced on the AGRI 1 plant). It led globallly to 24 different treatments, and to 120 containers (due to 5 repetitions per treatment) disposed in 5 randomised blocks. The grass cultivation began on 4/02/2013, lasted 12 weeks and occurred under one of the INRA Grignon greenhouses with an artificial lighting (+/-12 hours per day) and semi-automatic watering with tap water. Three successive cuttings were applied 4 weeks after sewing (30 days), 8 weeks after sewing (58 days) and 12 weeks after sewing. The same P_2O_5 (70 units/ha) and K_2O (300 units/ha) fertilization rates are applied to all the treatments.

2.5/ C and N mineralization by soil incubation and ISMO

This test has been applied in 2013 to 2 products: the 2012 Ametyst Methacompost and the 2012 Gueltas MSW compost and has been realised by the Celesta-lab. It is described in the XPU 44163 French standard. It allows to calculate the ISMO of each tested product that is the stability index of the organic matter contained in the product.

3/ First Results and Discussion

3.1/ Main physico-chemical characteristics of the 5 studied products

The results of the analyses done on the five products are given on table 2.

Products / Agronomic Parameters	2013 Ametyst 0-20 mm raw digestate	2009 Ametyst 0-8mm Methacompost	2009 Ametyst 0-10mm Methacompost	2012 Ametyst 0-6mm Methacompost	2012 Gueltas 0-20mm Compost
DM (%HM)	31,8	57,9	80	66,2	55,2
OM (%DM)	38,8	68,1	67,6	44,6	61,4
pH	9,0	8,3	8,8	8,5	7,8
C/N	10,4	22,1	23,9	11,7	13,8
NTK (g/kg of DM)	18,7	15,4	14,2	17,9	22,2
$N\text{-}NH4^+$ (g/kg of DM)	7,5	3,5	1,2	0,9	3,8
P_2O_5 (g/kg of DM)	5,4	6,5	6,0	10	9,5
K_2O (g/kg of DM)	7,6	8	8,1	14	11,3
MgO (g/kg of DM)	11,5	6,8	6,7	15,6	10,2
CaO (g/kg of DM)	89	83,5	81,6	150	120

Table 2. agronomic composition of the 5 studied products

We can state that the 2012 Ametyst final Methacompost present rather important differences of composition with the 2009 ones: less organic matter content, lower C/N ratio and higher content in P,K, Mg and Ca. It is due to the new way of operation of the plant observed principally at 3 different levels: mechanical pre-treatment, AD process management and digestate maturation process with a new bulking agent that doesn't bring huge quantities of fresh cellulosic organic matter. We can already conclude that the 2012 Methacompost is better matured and richer in nutrients than the 2009 one. Regarding the comparison with the Gueltas compost, the 2012 Ametyst Methacompost shows again lower organic matter and NNH_4^+ contents and a lower C/N but comparable nutrients content and seems to be better matured too. Main difference between raw digestate and 2012 Methacompost is the much higher NNH4+ content in the first one that makes impossible its use as soil organic improver.

3.2/ C and N mineralization by soil incubation and ISMO

The results of the incubation test led on 2012 Ametyst Methacompost and Gueltas compost are presented on 90 days of follow up on figure 3 for C and figure 4 for N.

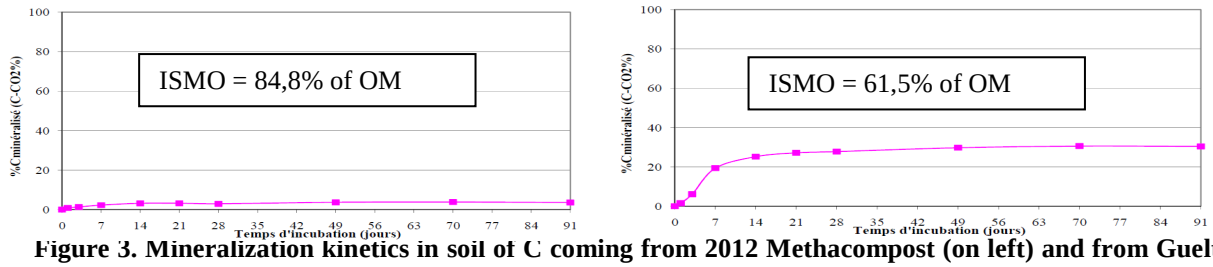

Figure 3. Mineralization kinetics in soil of C coming from 2012 Methacompost (on left) and from Gueltas compost (on right)

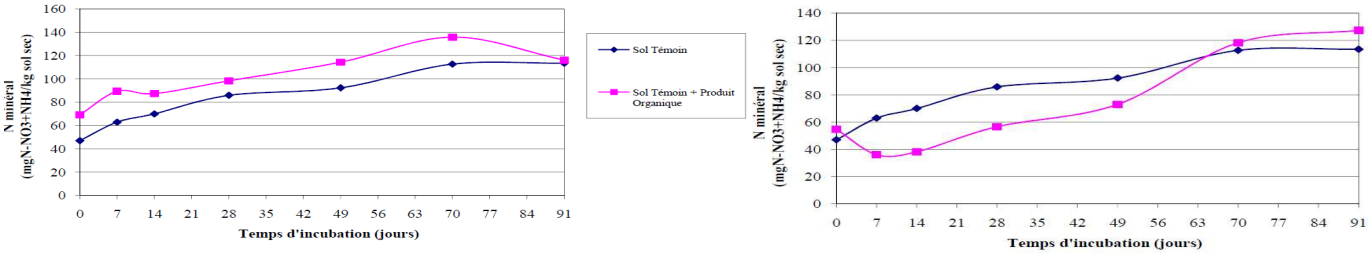

Figure 4. Net mineralization or immobilization of N in soil with (pink) or without (blue) 2012 Methacompost (on left) or Gueltas compost (on right)

These curves and ISMO values confirm the previous analytical results and the very good level of maturation of the 2012 Methacompost :

a/ compared to the 2009 Methacompost that had lost more than 30% of its C during the first 70 days of incubation and immobilised some N that was partially restituted to the soil after 50 days of incubation,

b/ compared to the 2012 Gueltas compost that looks like the 2009 Methacompost one.

4/ First Conclusion and perspectives

The first results of the DIVA study focused in this paper on the new Ametyst Methacompost show its good level of maturation, much better than the 2009 one and better than the Gueltas compost. We have still to wait the results of the bioavailability test (mid 2013) and the ones of the field test (end 2013 and end 2014) put in place in Fabregues last autumn before hard wheat crop in order to be able to confirm all the agronomic qualities of this new product. We can already put forward the "agronomic" synergy between AD and composting of residual MSW: AD helps to compost and mature MSW!

References:

[1] Contribution to the agronomic characterization of Methacompost produced on Montpellier Ametyst plant by jl Martel, D Jolivet, M Allain and O.Greze in ORBIT 2010

[2] Optimisation of the Aerobic maturation process of the MSW digestate on Montpellier Ametyst plant by jl Martel, O Garone, A Sommain and O Greze in ORBIT 2012