Specific Verification Protocol
ETV01/2015

Aerobic Biodegradation of Third generation Mater Bi under marine condition
By NOVAMONT Spa

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1. INTRODUCTION

Environmental technology verification (ETV) is an independent assessment of the performance of a technology or a product for a specified application, under defined conditions and quality assurance

1.1 Name of technology

Bio-based plastics (Mater Bi of Third generation) that are biodegradable under marine conditions.

1.2 Name and contact of Proposer

Novamont S.p.A., via Fauser 8, I-28100, Novara Italia
Contact person: Francesco Degli Innocenti
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1.3 Name of verification body and responsible for verification

The verification is performed by Certiquality S.r.L. Via G. Giardino 4, 20123 Milano
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The appointed verification expert is: Piero Franz ;
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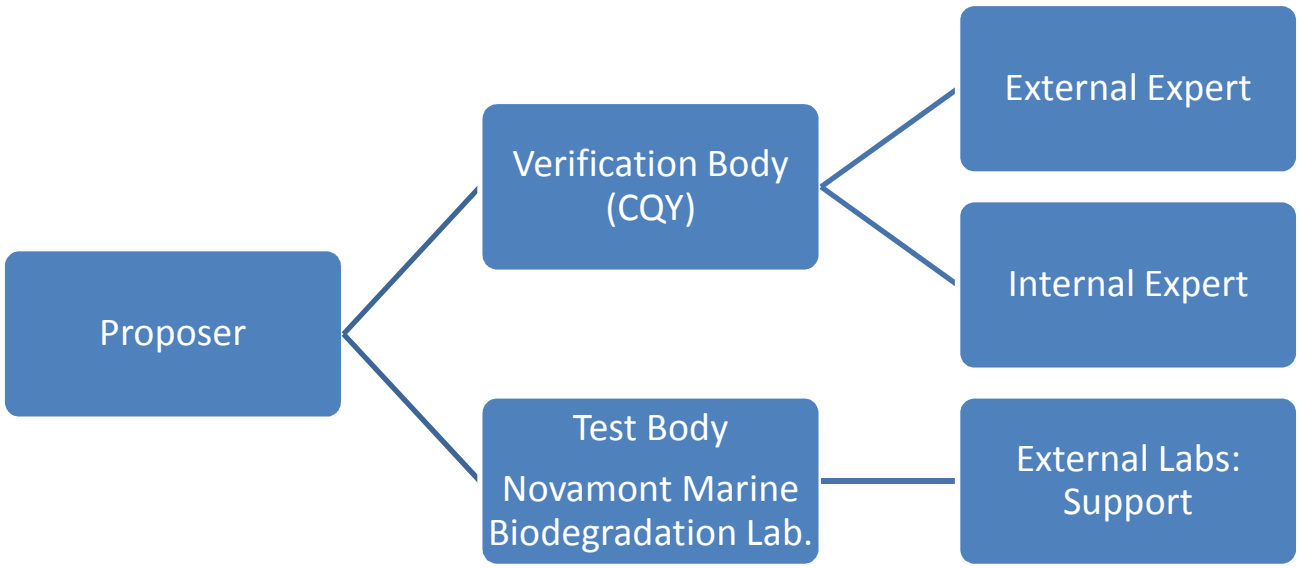
1.4 Organization of verification, experts, verification process

As mentioned above the verification will be managed by Certiquality according to the flow chart of the organizations involved in the process:

Figure 1: Organizations involved in the EU ETV pilot:



The Certiquality expert will be supported by an external qualified person on laboratory quality.
Lab quality expert: dr. Marina Mari
Certiquality auditor/expert: dr. Piero Franz
Since the technology is on the market the laboratory tests have already been carried out by the Novamont Marine biodegradation laboratory located in Novara, via Fauser 8.
Therefore the verification process will follow the steps listed below with the relevant documentations:

Table 1: Main phases of the verification process:

Step	*Responsible*	*Document*
Preparation	*Verification Body*	*Quick Scan* *Contract with Proposer* *Specific Verification Protocol*
Testing	*Test Body*	*Test Plan* *Test Report*
Verification	*Verification Body*	*Verification Report* *Statement of Verification*

Quality Assurance is managed by the internal quality procedures audited by an external Qualification Body (IIP, Istituto Italiano Plastici) according to the ISO 17025 standard and finally reviewed by the Verification Body (Certiquality).
The statement of verification will be issued by Certiquality after completion of the verification process.

2. DESCRIPTION OF TECHNOLOGY AND APPLICATION

2.1 Summary description of the technology

The manufacturing of this innovative material consists of a combination (generally by means of intimate mixing) of the native corn starch with copolyesters and other natural and renewable raw materials. Possible plastic scraps from manufacturing process are recycled in the extrusion process directly.
The proposed technology tries to combine the mechanical and barrier properties of plastics with the biodegradability of cellulosic materials. This will fit a larger spectrum of requirements coming from the market.
Plastic litter in our oceans is a growing concern. Uncontrolled disposal of waste (e.g. litter) is a serious social problem that must be solved by increasing environmental and civic education, and people's environmental awareness. That said, it is of interest to know the marine biodegradability of plastics, in case of uncontrolled release.

2.2 Scope and borders of application

Alternatives covering all the possible applications where marine biodegradability is a relevant characteristic do not exist.
Plastics that are biodegradable in liquid conditions are: poly(vinyl alcohol) (PVA) and Polyhydroxyalcanoates (PHA). However, PVA is soluble in water and this limits its suitability only to very specific applications. PHAs are bacteria-synthesized polymers that are known to be easily biodegradable in all environment, but whose massive commercial exploitation is still, after 40 years from the original development by ICI (UK), to be fully developed.

All the other plastic materials currently present in the market are not biodegradable or their marine biodegradability is unknown.
Products based on lignocellulose are known to be biodegradable (unless non-biodegradable constituents are added during conversion; e.g. plastic coatings, non-biodegradable additives, etc.). However, mechanical properties of paper, paperboard, etc. are generally lower in comparison with plastics and not suitable to meet the required specifications of some products. For some applications where marine biodegradability can be a relevant characteristics (e.g. shopping bags) cellulosic alternatives do exist and can satisfy the customers' requirements.
This technology makes it possible to manufacture products that, still possessing the main characteristics of plastics (mechanical properties, workability, barrier properties), are biodegradable similarly to the cellulosic products (paper). This is the prerequisite for biological recycling by means of composting. On top of that, this technology offers materials that are biodegradable under marine conditions.

2.3 Environmental benefits

The technology currently uses resources both of fossil origin and of natural origin (bio-based). The fossil constituents are made by the conventional petrochemical industry, while the "bio-based" constituents are extracted by plants (starch) or are obtained starting from vegetable oils by means of innovative chemical processes.
According to the proposer the utilization of vegetable constituents is a positive aspect because it decreases the dependence from non-renewable fossil feedstock. This bio-based feedstock is obtained in a sustainable way. No deforested or natural virgin soils are exploited for the production of renewable raw materials used in the technology. Starch, a substance which for decades there has seen significant use as an industrial additive in many products e.g. paper, is produced from non-genetically-modified maize cultivated in Europe following the current agronomical practices applied by the European farms. Vegetable oils are derived from non-genetically-modified crops cultivated in Europe. Neither palm oil nor soybean oil are used in the technology. Non-food dedicated plant-oils are now going to be used with the completion of a biorefinery located in Europe.
The current land requirements per metric ton of the product are approximately: Maize: 0.03 ha (European average); Vegetable-oil: 0.14 ha; Other natural substances (additives): 0.01 ha. Irrigation depends on the geographical location of the farmland. It is estimated that 15-30 litres of irrigation water are needed to grow the renewable raw materials needed to produce one kg of the product. The specific electricity consumption is 0.4 kWh (Environmental Product Declaration ver. 3.3 (SP-00222) Mater-Bi CF05S, November 2012)
No relevant emissions to air or water or specific impacts are caused by the production on the local area.

3. PERFORMANCE CLAIM AND RELATING PARAMETERS SET UP

3.1 Initial performance claim

Two Grades of bio-based polymers (Mater Bi of Third Generation) are evaluated and each of them is identified by an alphanumeric code: **Mater Bi AF03A0** (called RIC1511c2 in test results) and **Mater-Bi AF05S0** (called RIC1532 in test results).
The performance claims (to verify after audit) for the two grades are :

The Mater Bi AF03A0 has a 89,55% of biodegradation after 214 days under marine sublittoral conditions.

The Mater Bi AF05S0 has a 84,68% of biodegradation after 214 days under marine sublittoral conditions.*

*The tests were performed in two marine conditions: sublittoral and eulittoral zone (fully explained below and paragraph 6.1.1). One of two tests, because of the results affected by "priming effects", will be further investigated. In any case, the tests under eulittoral conditions have not been included in the claim at this stage.
The claim will be consolidated after the one day audit planned by Certiquality to the test Laboratory of Novamont (see also par. 4.4 and 5.1 of this verification protocol).

As a general concept plastics can end up also in several habitats in the marine environment. In this ETV the two habitats that are most sensitive for the human activities and environment have been considered: the shoreline (e.g. sandy beaches) and the coastal sea bottom. Currents, waves and tides tend to accumulate plastic debris in these areas that are very sensitive for human activities. In addition the density of biodegradable plastics is higher than 1, so they tend to sink. This has been considered as a priority for this ETV.

The two above zones are called: Eulittoral and Sublittoral.

3.1.1 Eulittoral zone

This zone is the part of the coast affected by the tides and the movement of waves; the test is simulating a sandy sediment kept wet by the sea water.

The substrate used for the trials was a natural sediment withdrawn at Porto di Marina di Campo (LI) from Hydra laboratory personnel. The plastic films were manufactured at the Novamont Laboratory in Novara.

3.1.2 Sublittoral zone

This zone is the interface water/sand where the material that sinks and finally reach the sea floor.
The substrate and the tested material were originated as described above.

3.2 Performance parameters

Performance parameters are defined taking into account the common generally recognized biodegradation standards and state of the art performance. For the verification of the Biodegradation of mater Bi polymers the following 2 performance parameters have been defined:

- Aerobic Biodegradation of Plastics Buried in Sandy Marine Sediment under Controlled Laboratory Conditions" (test method under development for Eulittoral conditions) in absolute terms within two years;
- Aerobic biodegradation of plastic materials sunk at the sea water/sandy sediment interface" (standard In Draft for Sublittoral conditions) in absolute terms within two years

3.3 Operational parameters

The operational parameters evaluated in both the above marine conditions as part of this verification are:

- CO_2 evolution both in grams and percentage of the theoretical generation at defined intervals for material to be tested;
- CO_2 evolution both in grams and percentage of the theoretical generation at defined intervals for reference biodegradable material;
- CO_2 evolution both in grams and percentage of the theoretical generation at defined intervals for reference blank material;
- the minimum required duration of test for getting the desired biodegradation percentage;
- temperature of tested mass to assure it's </= 28°C.

3.4 Environmental parameters

The relevant environmental parameters are included as performance parameters described in section 3.1. e 3.2.

3.5 Parameter definition table

The operational parameters evaluated in both the above marine conditions as part of this verification are listed in table 2.

Table 2: Parameter definition table

PARAMETER	***VALUE***	***EXISTING LEGAL REQUIREMENTS***	***TEST OR MEASUREMENT METHOD(S)***	***TEST / AVAILABLE DATA (+ PERFORMER OF TESTS)***
Performance parameters:				
Aerobic Biodegradation in eulittoral conditions in absolute terms within two years (%);	*Minimum criteria for valid tests are defined by SOP20a* *1) >60 % for reference material (cellulose sample) in 180 days* *2) the difference between the percentage biodegradation of the reference material in the different vessels is less than 20 % of the mean at the end of the test.*	*N.A*	*SOP 20a*[1]	*Existing data: A preliminary evaluation confirms that two criteria are fulfilled.*
Aerobic Biodegradation in sublittoral	*Minimum criteria for valid tests by SOP 20b:*	*N.A.*	*SOP 20b*[2]	*Existing data: A preliminary evaluation confirms that two*

[1] SOP20a is the Novamont's Standard Operating Procedure to be followed to put in practice the test method under development for determining Aerobic Biodegradation of Plastics Buried in Sandy Marine Sediment under Controlled Laboratory Conditions.

[2] SOP20b is the Novamont's Standard Operating Procedure to be followed to put in practice ISO DIS 19679.

conditions in absolute terms within two years (%);	*1) >60 % for reference material (cellulose sample) in 180 days* *2) the difference between the percentage biodegradation of the reference material in the different vessels is less than 20 % of the mean at the end of the test.*			*criteria are fulfilled.*
Operational parameters:				
Temperature (°C)	*max 28°C (range specified in standard drafts)*	*N.A.*	*SOP 20a* *SOP 20b*	*Existing data: the temperature during the whole test was kept at 28°C in aerobic conditions*
CO2 evolution both in grams and percentage of the theoretical generation (average of samples) at defined intervals for material to be tested	*N.A.*	*N.A.*	*See above*	*Existing data: A preliminary evaluation confirms that standard drafts criteria are fulfilled.*
CO2 evolution both in grams and percentage of the theoretical generation (average of samples) at defined intervals for reference biodegradable material	*N.A.*	*N.A.*	*See above*	*Existing data: A preliminary evaluation confirms that standard drafts criteria are fulfilled.*
CO2 evolution both in grams of the theoretical generation (average of samples) at defined intervals for reference blank.	*N.A.*	*N.A.*	*See above*	*Existing data: A preliminary evaluation confirms that standard drafts criteria are fulfilled.*
Minimum required duration of test for getting the desired biodegradation percentage	*Max 2 years*	*N.A.*	*See above*	*Existing data: A preliminary evaluation confirms that standard drafts criteria are fulfilled.*

4. REQUIREMENTS ON TEST DESIGN AND DATA QUALITY

4.1 Test design and standard selection

According to ETV GVP principles all the tests should be run by using recognized International Standards (ie ISO, ASTM, EN, UNI, etc) or in case relevant standard are missing by using drafts or GLP (Good Laboratory Practices). In case of more relevant standards the decision of just using part of them must be justified.
The requirements of tests are described in the standard (in draft) and the method selected: ISO/DIS 19679 "Test method for determining aerobic biodegradation of plastic materials sunk at the sea water/sandy sediment interface "and a method under development for "Determining Aerobic Biodegradation of Plastics Buried in Sandy Marine Sediment under Controlled Laboratory Conditions" (see also paragraph 6.1.1).
A preliminary evaluation confirms that Novamont test design is consistent with the requirements of the two standard drafts.

4.2 Data management

Data storage, transfer and control must be done in accordance with the EU ETV General Verification Protocol (version 1.1, July 2014) and furthermore follow the principles of EN ISO 9001 Quality management systems – requirements (International Standardization Organisation, 2008). Data management shall enable full control and retrieval of documents and records.
A preliminary evaluation confirms that the Laboratory test plans, procedures and manual are consistent with the requirements.

4.3 Quality assurance of the test Lab

The test Laboratory should be ISO 17025 accredited or at least ISO 9001 certified. In case the Lab does not fit the two criteria, an audit by Certiquality must be conducted in order to check that Laboratory is working in conformity with the standards principles. The audit will be both documental and on site, using the VB checklist called "L LAB ED 00 201008".
"Laboratorio di Biodegradazione e Impatto Ambientale" of Novamont is neither accredited according to ISO 17025 as mentioned above, nor certified ISO 9001, even if IIP already released a positive evaluation of the activities. Neverthless Certiquality will need to reassess the conformity to the GLP.

4.4 Test report requirements

All the test reports have to contain the following information:

- Test identification
- General information
- Involved personnel
- Study organization
- Data filing
- Summary and Conclusions
- **Materials and Methods:**
- Materials
- Sediment
- Trial Scheme
- Equipment

- Management of experimental data
- Results
- Reliability of trial

A preliminary evaluation confirms that the Laboratory reports are consistent with the requirements.

5. EVALUATION METHODS

5.1 Analytical laboratory evaluation

All Laboratory activities are managed according to the Novamont laboratory Manual "Laboratorio di Biodegradazione e Impatto Ambientale". The Manual is the main reference for all the Lab procedures, standard operating instructions (SOP), analytical standards. In particular Section 6.6 of the Manual defines the management of data.

The manual has been verified by IIP – Istituto Italiano dei Plastici as well as the test equipment, samples traceability, etc. The IIP in his report of September 26th 2014 declares that, for the reference test, works are done according to the ISO 17025 standard; this is not a real accreditation but a significant support to the Verification Body decision of just planning a one day audit to the test Laboratory of Novamont in order to confirm its own acceptable quality standard. The audit will be carried out by a qualified quality auditor of Certiquality with a large expertise of analytical laboratories.

The audit results will be recorded in a separate report which will support the final evaluation of this technology and will be attached to the final verification report.

5.2 Contractors reliability

As explained in the test plan submitted by the proposer there are three main subcontractors involved in the test management:

REDOX snc: located at viale Stucchi , 62/26 – 24052 Monza (Mi) Tel 039 2847.434 Fax 039 2847.349
www.redox-analyticals.com
Subject of the contract: analysis of C-H-N
Qualification: " laboratorio di appoggio certificato BPL dal Ministero della salute "

COMIE srl: located at via Taulè 15 – 28070 Sizzano (NO) Tel 0321 820340 Fax 0321 820500
www.comie.it
Subject of the contract: analysis of C-H-N and heavy metals (the latter for other purposes)
Qualification: "laboratorio di appoggio certificato Accredia n. 0346."

HYDRA Institut : a German Marine Research Institute providing all the substrates, sea water and sediment required by the test protocols.

The sediment was collected from the Hydra technicians (Hydra field station Centro Marino Elba). the sampling took place near the tourist port of Marina di Campo (Elba), a few meters from the shore with a plastic container directly below the water line. With the solid sediment, was taken also the water for keeping it moist. All samples were transferred in a closed container to be transported to the laboratory. The sediment was placed in the Lab refrigerator at about 4°C and was used within 15 days from sampling.

5.3 Test run conditions evaluation

Test run conditions have been evaluated by IIP; the relevant report of November 27th 2014 will be revised during the Certiquality quality audit step and included as an attachment into the final verification report.

5.4 Test results quality

As reported above the quality of test has been evaluated by IIP as well as run conditions and will be part of the revision from Certiquality during its audit. In addition the test reliability was investigated with the Round Robin Test whose summarized results are reported at point 6.1.1 of this document.

6. EXISTING DATA

6.1 Summary of existing data

6.1.1 Test methods and reference standards.

The test methods are designed to determine the % of biodegradation of a plastic material in film form when exposed to a sediment kept wet with salt-water in a reactor, to simulate the littoral zone (tidal zone and at the interface sea water/sea sediment).
Biodegradation is determined by measuring the carbon dioxide evolved by the plastic material.

The selected materials to be tested are, in both above conditions, listed in table 3:
The test materials (denominated RIC1511c2 and RIC1532) were produced and filmed in Novamont plant in Novara. According to the internal procedure PG17, the film samples were obtained (under the control of Lab Manager) by selecting the reel during the central phase of production i.e. a routine operation after the cleaning of the extruder is completed; three meters of film, at least, were discarded and the film was cut with a clean razor blade, and then it was folded and stored in a polyethylene bag.

Table 3: tested materials (extracted by test results in Italian)

Denominazione	Lotti interni	Forma fisica e Spessore	% Carbonio
RIC1511c2	*2303/4525*	*Film 25 µm*	*56,65*
RIC1532	*IP1932/1*	*Film 25 µm*	*58,85*
Carta da filtro in cellulosa controllo positivo	*Whatman® n. 42 Cat No 1442 125*	*Disco 200 µm*	*44,44*
PHB Ecoman Controllo positivo	*RIC1536*	*Film 60 µm*	*55,65*

The concentration of CO_2 is measured on all 10 lab reactors, (2 for RIC1511c2 material, 2 RIC1532 material, 2 for Filter Paper material as a positive control sample, 2 for PHB Ecoman as a positive control sample and 2 for blank) by titration roughly every week for the first 3 weeks, every two weeks up to the third month and once a month until the end of the test.

No standards have been published yet; therefore the adopted test methods are the following draft standards:

- ✓ A test method under development for determining Aerobic Biodegradation of Plastics Buried in Sandy Marine Sediment under Controlled Laboratory Conditions (for Eulittoral condition, see Novamont operating procedure SOP20a)

- ✓ ISO/DIS 19679 "Test method for determining aerobic biodegradation of plastic materials sunk at the sea water/sandy sediment interface " under preparation at ISO (for Sublittoral condition, see Novamont operating procedure SOP20b)

The ISO/DIS 19679 has been subjected to a Round Robin test organized by the working group "ISO TC61SC5WG22" and coordinated by the proposer. This Round Robin test was performed by 9 laboratories owned by Companies and technology Centers of 7 different Countries in sublittoral conditions.
Each laboratory involved in the RRT tested the same test materials using seawater and sediments sampled independently. As a consequence the tests were totally independent in terms of inoculum and equipment but the same test materials were tested.

Purpose of this RRT was to verify differences due to use of sediment and seawater collected in different locations and gather enough data to assess reproducibility of the test method.
The FINAL REPORT "Round Robin Test ISO/DIS 19679 and ISO/DIS 18830 "Biodegradation in seawater/sediment interface" [3]dated February 27th 2015 " released by ISO TC 61 SC5 WG22 conclusions are reported below[4]:

- ✓ Regarding the results on bio-based materials provided by Novamont: The sediments used by the different laboratories showed a very similar capability to biodegrade the polyester; an average biodegradation of 80,5% was determined by the different laboratories with a standard deviation of 8,3.
- ✓ During the RRT two laboratories measured an high level of biodegradation of negative control LDPE. A possible explanation is the formation of anaerobic conditions caused by the plastic disc covering the sediment. Besides in one case the biodegradation of one of control material was widely above 100% suggesting that a "priming effect" was established. This point has to be further investigated.
- ✓ A factor that could influence the variability between the replicates is the level of contact between the sample and the sediment surface. The level of contact can affect the colonization rate by microorganisms present in the sediment and this in turn can change the biodegradation rate.
- ✓ The use of artificial water or natural seawater seems not to influence the test results.
- ✓ The biodegradation tests were carried at a temperature range: 23-28°C. Seven laboratories worked at 27/28°C, one laboratory at 25°C and finally one laboratory at 23°C. In this range the final results don't seem influenced by the temperature.

The following existing methods have been discarded for the reasons reported below:

- ASTM D7473 - 12 Standard Test Method for Weight Attrition of Plastic Materials in the Marine Environment by Open System Aquarium Incubations: This test methods is based just on physical degradation that is not sufficient to make any statement on ultimate biodegradation. Unsuitable for the purposes of the present ETV.

[3] The final report mentions both the standard drafts ISO/DIS 19679 and ISO/DIS 18830 but, the final results are only about ISO/DI 19679 method which has been selected because is easier and more reliable.
[4] The report is property of ISO. The VB verified it but it cannot be shared without approval by ISO.

- ASTM D 7081 Standard Specification for Non-Floating Biodegradable Plastics in the Marine Environment : This standard specification is considered as not acceptable because it sets the minimum biodegradation level at 30%, a threshold that nowadays is not acceptable by current principles and public expectations. Withdrawn in 2014. Unsuitable for this ETV.
- ASTM D6691 - 09 Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials in the Marine Environment by a Defined Microbial Consortium or Natural Sea Water Inoculum: This is a test method to verify biodegradation in free water. The biodegradable plastics have a density higher than 1 and tend to sink or are swept into the beaches by waves etc. The interest is to verify the ultimate biodegradation when the plastic reaches these environment and accumulates there.
- ISO/DIS 18830 ""Test method for determining aerobic biodegradation of plastic materials sunk at the sea water/sandy sediment interface ". This test methodology is exactly the same of ISO/DIS 19679; the only difference is the method of measuring biodegradation. In this case measurement is made by consumption of oxygen vs generation of CO2 of the ISO/DIS 19679. According to Round Robin experience, organized by the working group "ISO TC61SC5WG22", the CO_2 measurement method is more easier to conduct and more reliable than O_2 measurement method.

6.1.2 Test results.

Two campaigns of tests have been carried out by the Novamont Biodegradation Laboratory in 2014 according to the standards mentioned above in this paragraph and on the samples shown on the table 2.
The results of these tests are summarized herein:

Test of eulittoral zone simulation

The samples of MaterBi of third generation identified as RIC1511c2 e RIC1532, reached a level of biodegradation respectively of 76,4% and of 110,8% and the reference paper filter of pure cellulose reached a level of biodegradation of 77,3%. Therefore, the biodegradation relative to cellulose was: RIC1511c2= 98,9% and RIC1532=143,3%. Test was run for 195 days in conditions that simulates the "beach" i.e in contact with natural sediment according to the internal standard method Sop20a; the temperature during the whole test was kept at 28°C. in aerobic conditions..

Test of interface sand/water, sublittoral zone simulation

The samples of MaterBi of third generation identified as RIC1511c2 e RIC1532 (same material as above) , reached a level of biodegradation respectively of 93,2 % and of 92,6 % in 259 days of test at the interface water/sediment according to the internal standard method Sop20b; the temperature during the whole test was kept at 28°C. in aerobic conditions. The reference paper filter of pure cellulose reached a level of biodegradation of 130,3%.

6.2 Acceptance of existing data

The existing data have been already evaluated and judged reliable by the Istituto Italiano Plastici; anyway both the methodology and the test results will be reviewed again by Certiquality as part of the planned auditing activity.

6.3 Evaluation of the need of additional tests

This evaluation has to be performed according to the results of the previous step 6.2.

6.4 Conclusions

The further step managed by the verification body Certiquality should assess whether the existing tests with their relevant results are acceptable and sufficient for supporting the proposer claim.

7. VERIFICATION SCHEDULE

The verification started in March 2014, in table 4 a detailed schedule is given.

Table 4: Detailed Verification Schedule

Phases/Timing	Mar – Apr 2014	Nov – Dec 2014	Feb – Mar 2015	Apr 2015	May 2015
Quick scan					
- *First version and first request of information*	*X OFF SITE*				
- *Test plan requests and evaluation*		*X (OFF SITE – ON SITE)*			
- *Final version of Quick scan/proposal*		*X (OFF SITE)*			
Contract					
Specific Verification Protocol:					
- *Evaluation of existing data*			*X (OFF SITE)*	*X (OFF SITE)*	
- *Evaluation of test plan*				*X (OFF SITE)*	
- *Final version of Verification Protocol*				*X (OFF SITE)*	
Verification Report:					
- *Audit of test results*				*1 DAY (OFF SITE)*	
- *Test Laboratory Audit on Quality management*				*1 DAY (OFF SITE) +1 DAY (ON SITE)*	
- *Final version of Verification Report*				*X (OFF SITE – ON SITE)*	
Verification Statement				***To be defined***	

8. QUALITY ASSURANCE OF VERIFICATION PROCESS

The overall process of verification will be managed according Certiquality Quality Manual and related procedures/instructions.

Certiquality is accredited ISO 17021 which requires Certiquality to have a Quality assurance system in line with ISO 9001. The Italian Accreditation Body (ACCREDIA) verifies every year our conformity.

The staff and the experts responsible for quality assurance as well as the different quality assurance tasks are reported in Table 5.

Table 5: Quality assurance steps for verification process

	Verification Body: CERTIQUALITY				Proposer: NOVAMONT		External Expert
TASKS/INITIALS	*PF*	*MM*	*SM*	*CG*	*FDI*	*MT*	*IC*
Specific verification protocol	*Author*		*Review*	*Approve*	*Review*		*Review*
Test plan	*Review*	*Review*			*Review + Approve*	*Author*	
Test system at test site	*Audit*	*Audit*					
Test report	*Review*	*Review*			*Review + Approve*	*Author*	
Verification Report	*Author*		*Review*	*Approve*	*Review*		*Review*
Statement of verification	*Author*		*Review*	*Approve*	*Acceptance*		*Review*

The specific verification protocol and the verification report require internal (by verification body) and external review according to the EU ETV General Verification Protocol (European Commission, 2014). The internal review for specific verification protocol, verification report and Statement of verification will be carried out by Sabrina Melandri (SM), as Coordinator of Technology Area "Material, Resources and Waste". The internal approval for specific verification protocol, verification report and Statement of verification will be carried out by Claudia Gistri (CG), as Project Manager of ETV. The external review will be carried out by Irma Cavallotti (IC), from Università di Brescia.

The verification body will review the test plan and the test report. The review is done by Piero Franz (PF) and Marina Mari (MM).

A test system audit is conducted following general audit procedures by qualified auditors (Piero Franz for ETV procedures and Marina Mari for laboratory management system) from Certiquality.

During the verification process the proposer NOVAMONT representatives Maurizio Tosin (MT), as Lab Manager, and Francesco Degli Innocenti (FDI), as Ecology of Products and Environmental Communication Director were in charge of the following tasks:

- Review the specific verification protocol and the verification report
- Review and approve the test plan
- Review and approve the test report
- Accept the Statement of Verification.

9. REFERENCES

1) European Commission (2014): EU Environmental Technology Verification pilot Programme. General Verification Protocol. Version 1.1 - July 7th, 2014.
2) Regulation 17020 ETV of Certiquality and internal procedures.
3) International Standardardization Organisation ISO/DIS 19679 (Draft)
4) International Standardardization Organisation ISO/DIS 18830 (Draft)