KBBPPS

Pre-Standardization Research for Bio-based Products

KBBPPS

Knowledge Based Bio-based Products' Pre-Standardization

Final Project Report

Figures and tables

Version: 1
Delft, 28 September 2015
prepared by:
NEN
Ortwin Costenoble
Netherlands Standardization Institute
NEN Energy Resources
Vlinderweg 6, 2623 AX Delft, the Netherlands
Tel.: +31 (15) 2690 326
Fax: +31 (15) 2690 207
sEmail: energy@nen.nl
Partner website : www.nen.nl
Project website : www.KBBPPS.eu

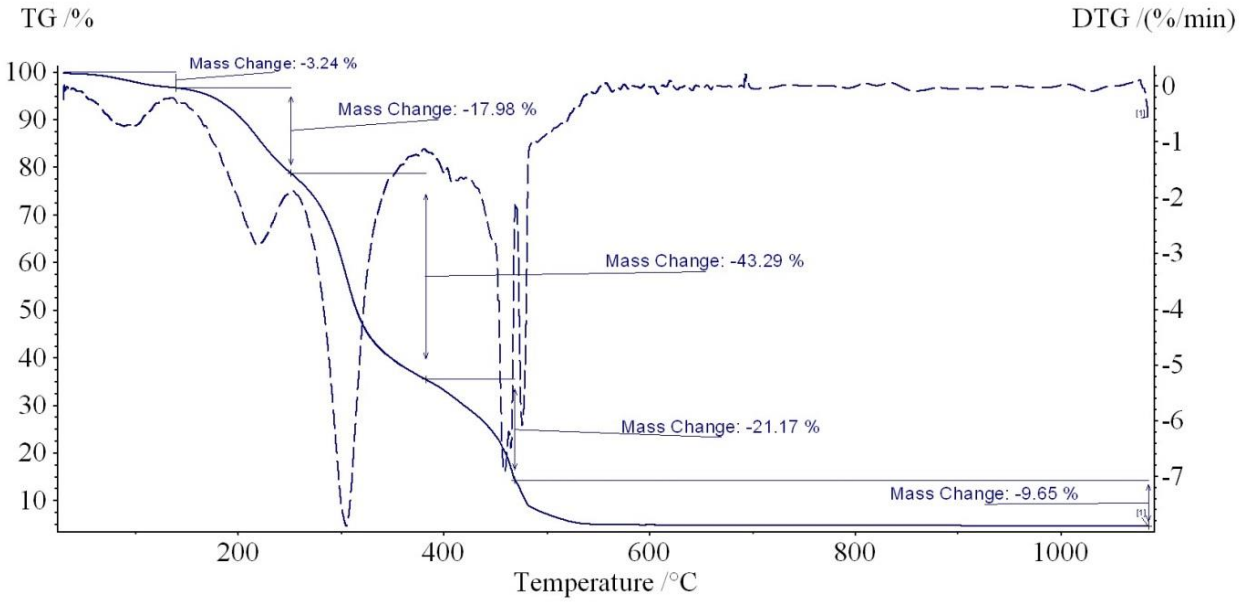

Figure 1 Model starch-PVA blend, TG-IR, heating to 1100 °C, 50% O2 atmosphere.

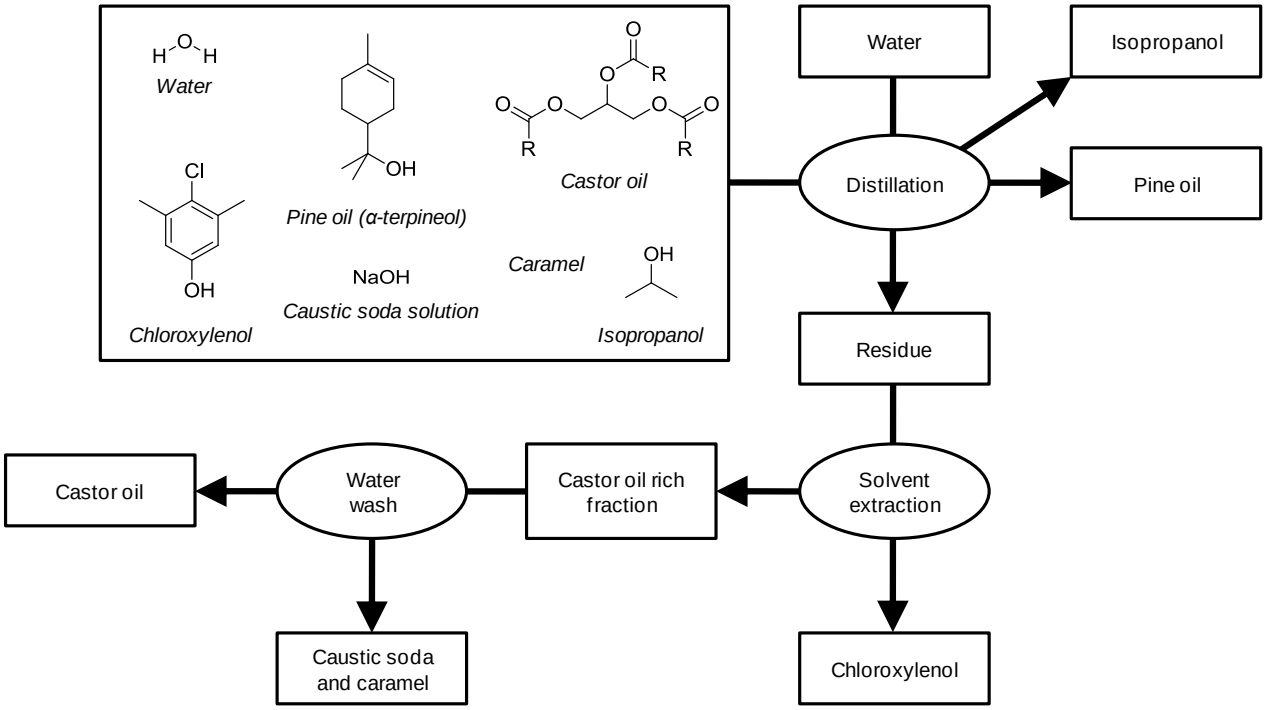

Figure 2 Commercial antiseptic liquid fractionation schematic.

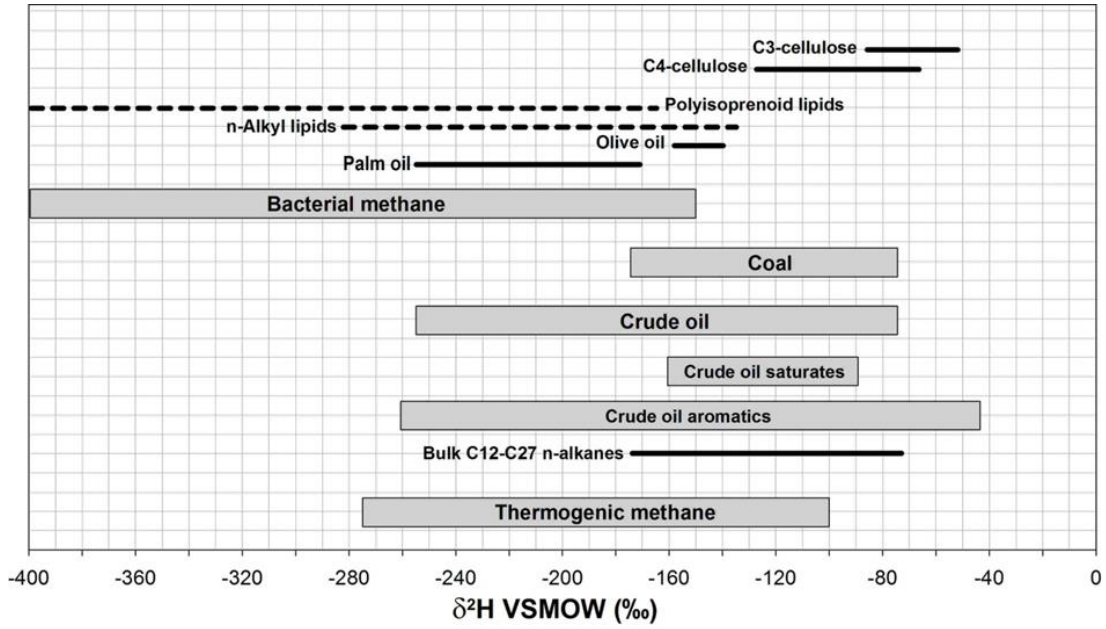

Figure 3 - Stable isotope ratio ranges for hydrogen ($^{2}H/^{1}H$) with clear overlap between

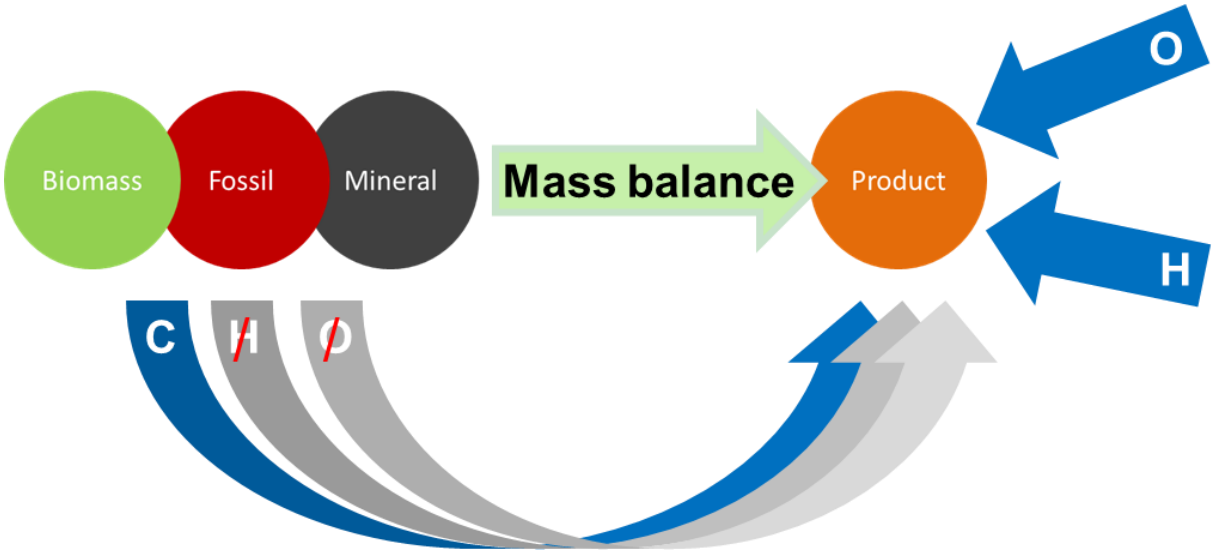

Figure 4 - Scheme of a bio-based carbon calculation by means of a material balance, supplemented by atom connectivity to give the total bio-based content.

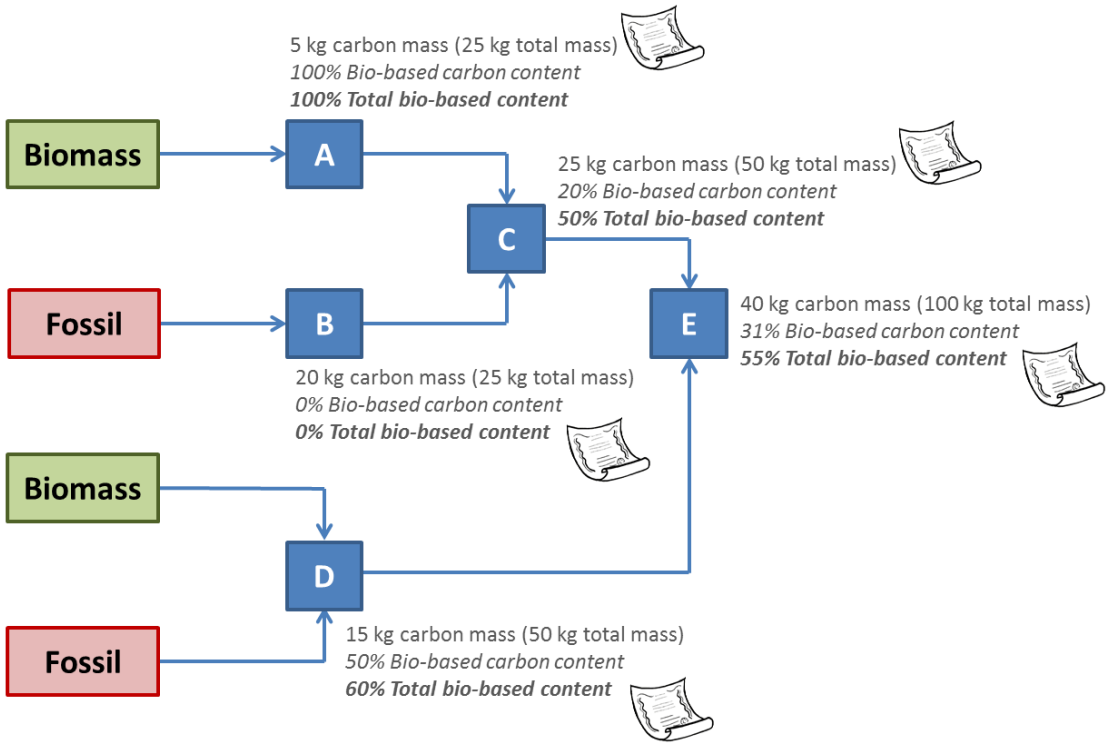

Figure 5 - Bio-based content claims in line with prEN 16785-2 applied throughout a representative material balance.

Table 1: Resolutions developed

Product group	**Barrier**	**Suggested resolution / next steps**
Packaging films	Overly ambitious barrier properties	Testing in Open-BIO
WPC	Thermosets excluded / no mention of bio-based / lack of modulus of elasticity	CEN working group on WPC revisiting EN15534 should address these issues
Natural fibre insulation	Heat decrement delay / acoustic performance not included; automatic moisture correction factor	Adapt the relevant standards EN ISO 10456, DIN 4108-4 and DIN 52612-2
Mulch films	No specific standard; no differentiation from conventional films	CEN working group should make exceptions for minimum thickness for bio-based, biodegradable mulch films
Adhesives	Adhesion strength on wet surfaces	Testing in Open-BIO

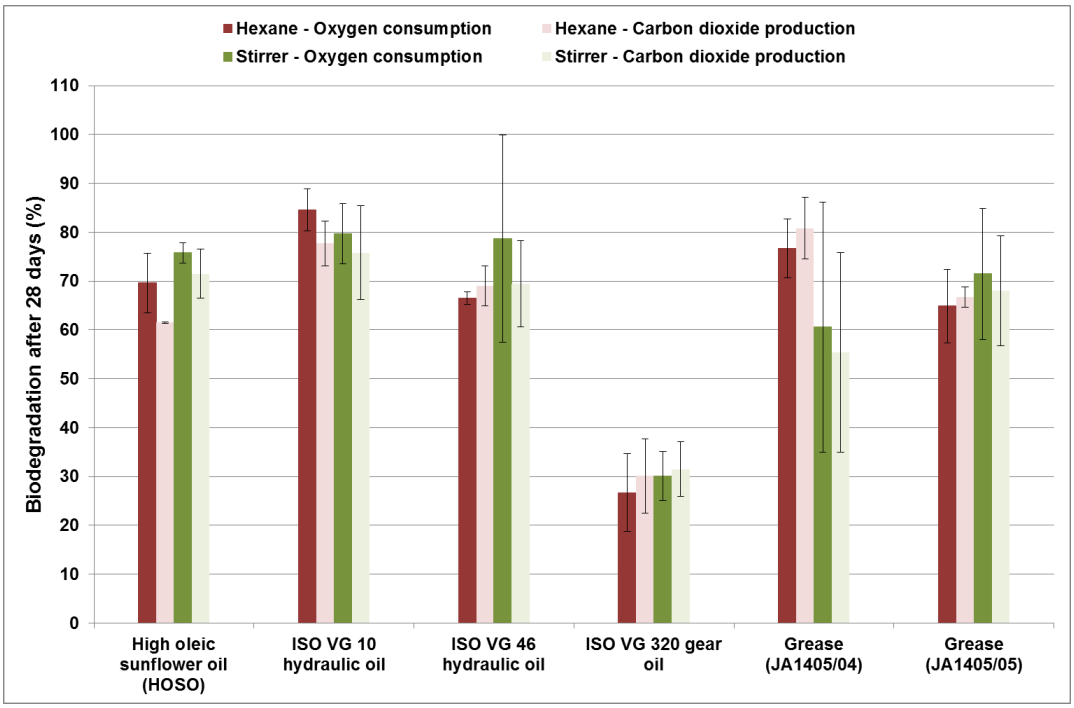

Figure 6. Summary of the biodegradation percentages of lubricants after 28 days (interlaboratory test – part 1).

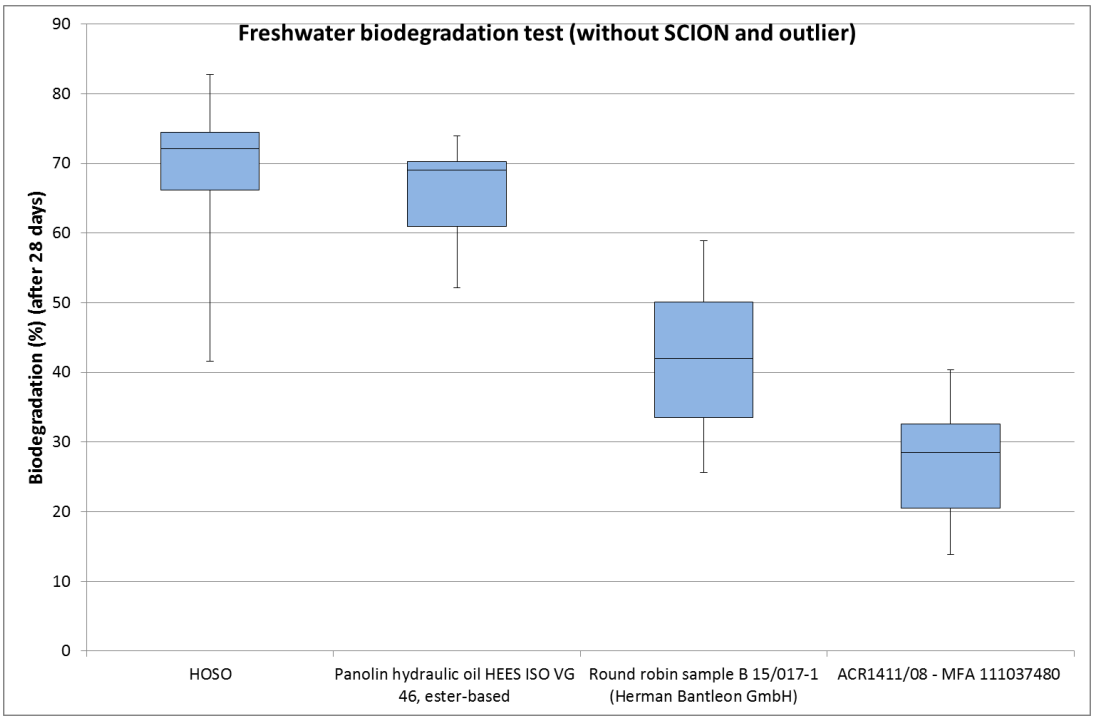

Figure 7 - Boxplot with results biodegradation in freshwater after 28 days

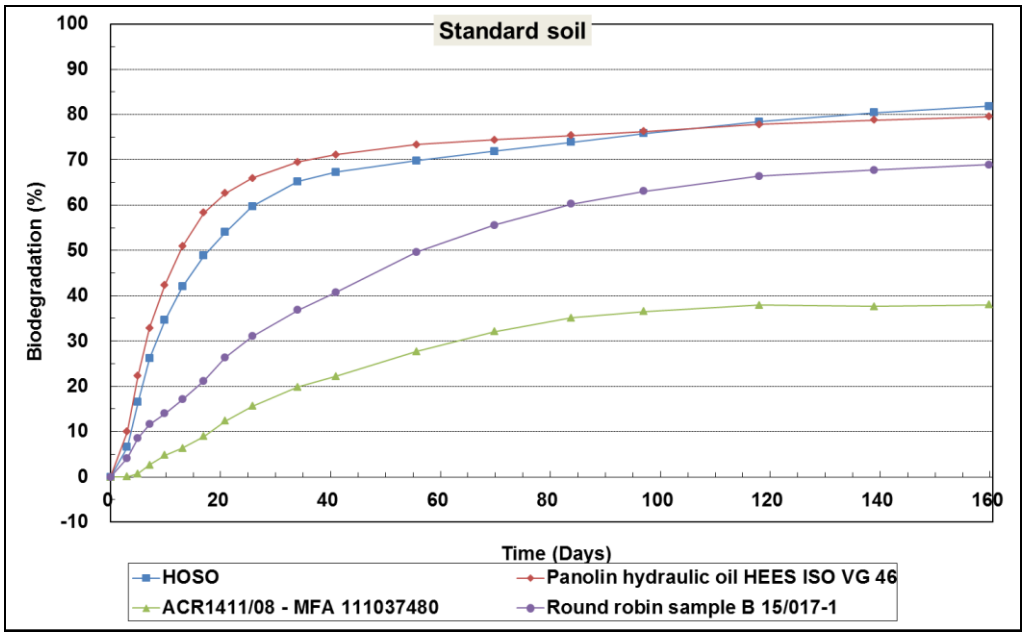

Figure 8 - Evolution of the biodegradation in standard soil (ISO 17556)

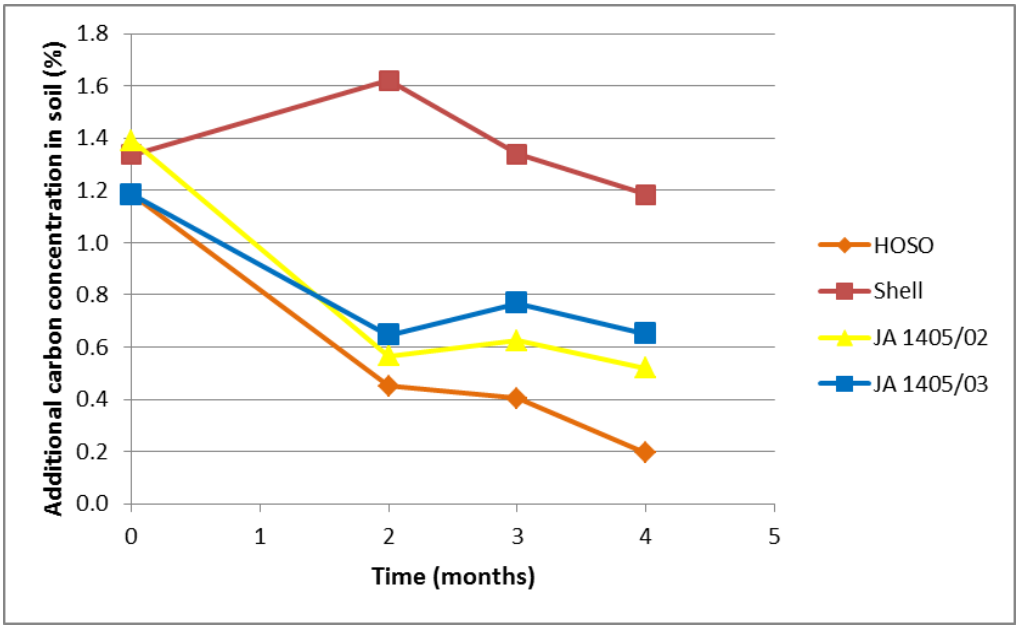

Figure 9 - Additional carbon concentration in soil due to the addition of various lubricants (Shell = fossil-based motor oil (Shell Advance SX) = negative reference; JA 1405/02 = ISO VG 46 hydraulic oil; JA 1405/03 = ISO VG 320 gear oil).

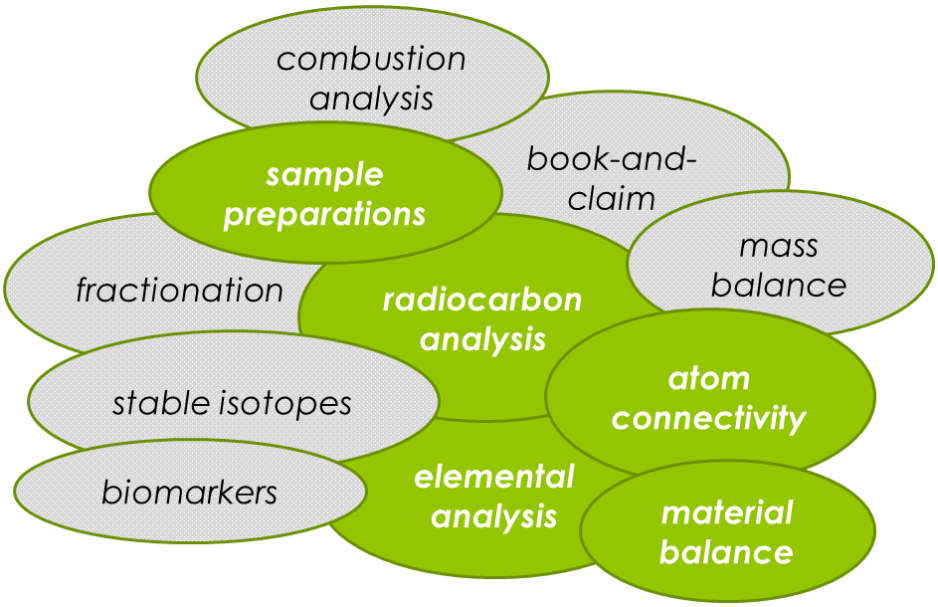

Figure 10 Viable options for total bio-based content determination in dark green, unsuitable approaches in light grey.

Table 2: List of 26 products to be investigated by the project

	Bio-based product	Market Sector	Biodegradability	Typical average biomass content for this application	Biomass source	Value chain position	Mixing level
1	Packaging films (PLA + PBAT / PBAT + additives)	Packaging films	Industrially compostable	40 - 50%	starch, sugar	end product (b2b) (film, printed)	blend /layered
2	Disposable cups and plates (PHA-coated paper), high calcium carbonate containing (mineral fillers)	Food service - Paper cups	Anaerobic degredation, industrially compostable, home composting	80 - 90%	cellulose, starch	end product	layered
3	Beverage bottles (bio-based PET from bio-based MEG)	Packaging - plastic bottles	No	30 - 100%	sugar	end product (b2b)	at monomer level
4	Packaging chips (starch-based loose fill flips)	Packaging - Loose fill	Home compostable, industrial compostable	100%	starch	end product (b2b)	pure starch
5	Seat cushions (25% soy-based polyols in PU foams)	Automotive Interior	No	20 - 30%	plant oil	semi finished	at monomer level, mixed on site
6	Door trimming, hemp / flax / kenaf / PP - mat, press moulded	Automotive Interior Trimming	No	50%	lignocellulose	semi finished	composite
7	Tires	Automotive - Tires	No	50 - 60 %	natural rubber, starch	end product	blend
8	CO_2-based PPC-PHA vacuum cleaner casing	Casing, Consumer goods - Consumer Electronics	Industrial compostable	0 - 100%	CO_2; carbohydrates	end product (b2b)	blend
9	Technical high performance polyamide	High °C engineering plastics - Polyamides	No	60 - 80%	castor oil	plastic / compound	plastic
10	Consumer electronics casing; cellulose acetate and additives	Casing, Consumer goods - Consumer Electronics	Industrial compostable	40 - 50%	cellulose	end product	blend
11	Particle Board (over 95% wood particles, adhesives and waxes)	Construction and Furniture - Engineered Wood Products	No	90 - 100%	lignocellulose	semi-finished product	composite
12	extruded profiles (60% wood flour + PP + additives)	Building and Construction - Deckings	No	50-70 %	lignocellulose	end product	composite
13	Premanufactured construction components	Building and construction - Premanufactured Houses	No	20 - 80 %	lignocellulose, plant oils, starch	semi-finished product	composed structure
14	NPK-Fertilizer	Agriculture and Horticulture - Fertilizers	n.a.	80 - 100%	starch + byproducts	end product (b2b)	blend
15	Mulch Films (starch blend)	Biodegradable Mulch films	In soil, defined after growing period	50 - 60%	starch	end product (b2b)	blend
16	Natural Paint; plant oil based, inorganic fillers, volatile compounds	Paints and coatings	No	< 10%	plant oil, proteins	semi-finished to end product	emulsion
17	Surfactant (brake cleaner)	Mixed solvent products - brake cleaners	In soil, in marine water	50 - 60%	plant oil, carbohydrates, starch	end product (b2b)	pure
18	Lubricant	Industrial Lubricants	In soil, in marine water, in fresh water	50 - 80%	plant oil	end product (b2b)	solution
19	Facial scrub cream with PHA pearls	Personal care Facial care products	Disposable in waste water treatment plants	80 - 100% (dry matter)	plant oil, carbohydrates	end product	emulsion
20	Blended fabric: Viscose, Cotton, wool, polyester	Textiles	No	5 - 95%	cellulose (viscose, cotton), protein (wool)	semi-finished product	fibre mix
21	Boat hulls (glass/carbon fibre mats in bio-based matrix, handlaminated)	Sport Yachts	No (inert in marine and fresh water environment)	50 - 60 %	plant oil	end product	composite
22	Natural Oil Polyols (NOPs)	Thermoset-Precursors	No	50 - 100%	plant oil	building block	solution
23	High grade pulp	Resource for cellulose-based chemicals	In soil, in marine water, in fresh water, industrial compostable	99 - 100% (dry matter)	lignocellulose	treated biomass	powder
24	Adhesives and binders	Production Accessory-Adhesives / Binders	In soil, in marine water, in fresh water	70%	plant oil, proteins, starch	end product (b2b)	emulsion
25	Liquid Biogas (LBG / "bio-LPG")	LPG	n.a.	100%	carbohydrates	end product	pure
26	Bio-butane	Butane	n.a.	100%	carbohydrates	precursor	pure