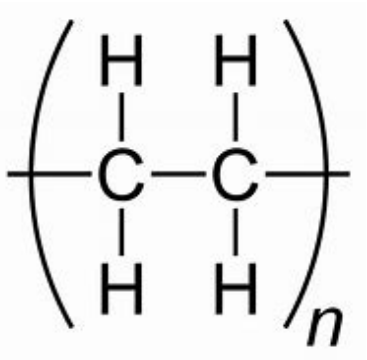
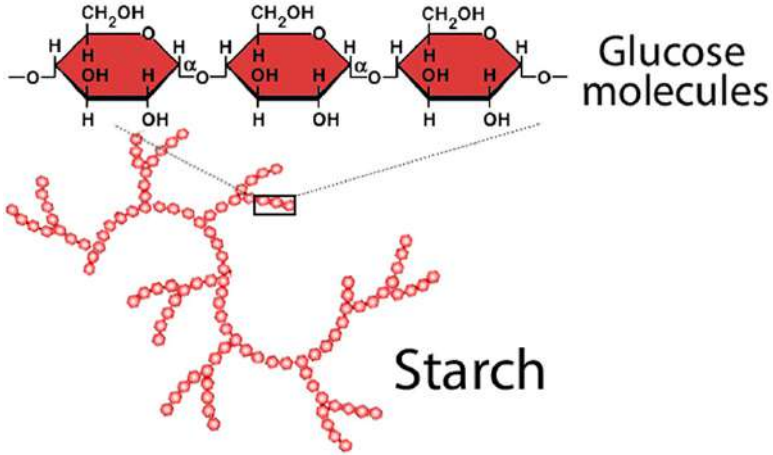
FTPO
Fakulteta za
tehnologijo polimerov

B I O R A Z G R A D N J A

- Biorazgradljivi polimeri so prišli na trg v 80-ih letih prejšnjega stoletja (poliolefini pomešani s škrobom in z drugimi komponentami)





https://healthjade.com/types-of-carbohydrates/

STANDARDI – biorazgradljivost, kompostirnost

Standard	Title
EN ISO 10210:2017	Plastics—Methods for the preparation of samples for biodegradation testing of plastic materials (ISO 10210:2012)
EN 14995:2006	Plastics—Evaluation of compostability—Test scheme and specifications
EN 13432:2000	Packaging—Requirements for packaging recoverable through composting and biodegradation—Test scheme and evaluation criteria for the final acceptance of packaging
EN 14046:2003	Packaging—Evaluation of the ultimate aerobic biodegradability of packaging materials under controlled composting conditions—Method by analysis of released carbon dioxide
EN 17033:2018	Plastics—Biodegradable mulch films for use in agriculture and horticulture—Requirements and test methods
ISO 17088:2012	Specifications for compostable plastics
EN ISO 14855-1:2012 EN ISO 14855-2:2018	Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions—Method by analysis of evolved carbon dioxide—Part 1: General method (ISO 14855-1:2012)—Part 2: Gravimetric measurement of carbon dioxide evolved in a laboratory-scale test (ISO 14855-2:2018)
EN ISO 16929:2019	Plastics—Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test (ISO 16929:2019)
EN ISO 20200:2015	Plastics—Determination of the degree of disintegration of plastic materials under simulated composting conditions in a laboratory-scale test (ISO 20200:2015)
ISO 23977-1:2020 ISO 23977-2:2020	Plastics—Determination of the aerobic biodegradation of plastic materials exposed to seawater—Part 1: Method by analysis of evolved carbon dioxide—Part 2: Method by measuring the oxygen demand in closed respirometer
EN ISO 14853:2017	Plastics—Determination of the ultimate anaerobic biodegradation of plastic materials in an aqueous system—Method by measurement of biogas production (ISO 14853:2016)
EN ISO 14851:2019	Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium—Method by measuring the oxygen demand in a closed respirometer (ISO 14851:2019)
EN ISO 14852:2018	Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium—Method by analysis of evolved carbon dioxide (ISO 14852:2018)

EN 17417:2020	Determination of the ultimate biodegradation of plastics materials in an aqueous system under anoxic (denitrifying) conditions—Method by measurement of pressure increase
EN ISO 10634:2018	Water quality—Preparation and treatment of poorly water-soluble organic compounds for the subsequent evaluation of their biodegradability in an aqueous medium (ISO 10634:2018)
EN ISO 14593:2005	Water quality—Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium—Method by analysis of inorganic carbon in sealed vessels (CO_2 headspace test) (ISO 14593:1999)
EN ISO 11733:2004	Water quality—Determination of the elimination and biodegradability of organic compounds in an aqueous medium—Activated sludge simulation test (ISO 11733:2004)
EN ISO 17556:2019	Plastics—Determination of the ultimate aerobic biodegradability of plastic materials in soil by measuring the oxygen demand in a respirometer or the amount of carbon dioxide evolved (ISO 17556:2019)
EN ISO 11266:2020	Soil quality—Guidance on laboratory testing for biodegradation of organic chemicals in soil under aerobic conditions (ISO 11266:1994)
EN ISO 15985:2017	Plastics—Determination of the ultimate anaerobic biodegradation under high-solids anaerobic-digestion conditions—Method by analysis of released biogas (ISO 15985:2014)
EN ISO 18830:2017	Plastics—Determination of aerobic biodegradation of non-floating plastic materials in a seawater/sandy sediment interface—Method by measuring the oxygen demand in closed respirometer (ISO 18830:2016)
EN ISO 19679:2020	Plastics—Determination of aerobic biodegradation of non-floating plastic materials in a seawater/sediment interface—Method by analysis of evolved carbon dioxide (ISO 19679:2020)
ISO 13975:2019	Plastics—Determination of the ultimate anaerobic biodegradation of plastic materials in controlled slurry digestion systems—Method by measurement of biogas production
ISO 22404:2019	Plastics—Determination of the aerobic biodegradation of non-floating materials exposed to marine sediment—Method by analysis of evolved carbon dioxide
ISO/DIS 23517-1 (under development)	Plastics—Biodegradable mulch films for use in agriculture and horticulture Part 1: Requirements and test methods regarding biodegradation, ecotoxicity and control of constituents

EN 13432 Packaging—Requirements for packaging recoverable through composting and biodegradation—Test scheme and evaluation criteria for the final acceptance of packaging

Karakteristike:

- Razpad na manjše delce (EN 14045)
- Biorazgradnja (ISO 14855)

RAZGRADNJA

- Vsebnost težkih kovin pod določeno mejo
- Netoksičen kompost

VPLIV NA OKOLJE

- 90% organskega ogljika se mora pretvoriti v CO2
- Industrijsko kompostiranje: 6 mesecev, domače kompostiranje: 12 mesecev
- Pogoji kompostiranja:
  - Industrijski kompost: 58 °C
  - Domač kompost: 28 °C

AEROBNA RAZGRADNJA

$C_{polymer} + O_2 \rightarrow CO_2 + H_2O + C_{biomas}$

$C_{polymer} \rightarrow CH_4 + H_2O + C_{biomas}$

ANAEROBNA RAZGRADNJA

AEROBNA in ANAEROBNA RAZGRADNJA

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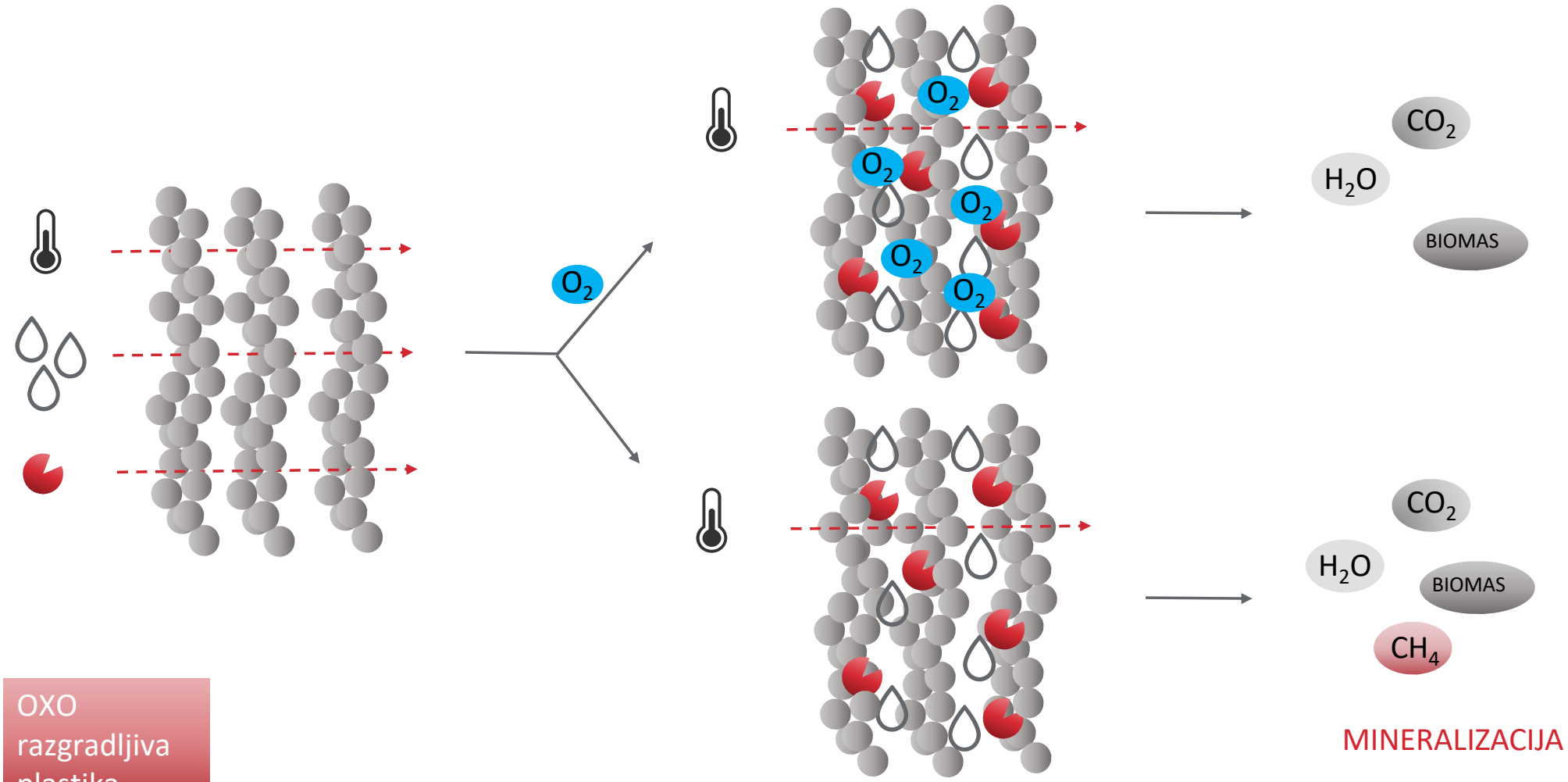
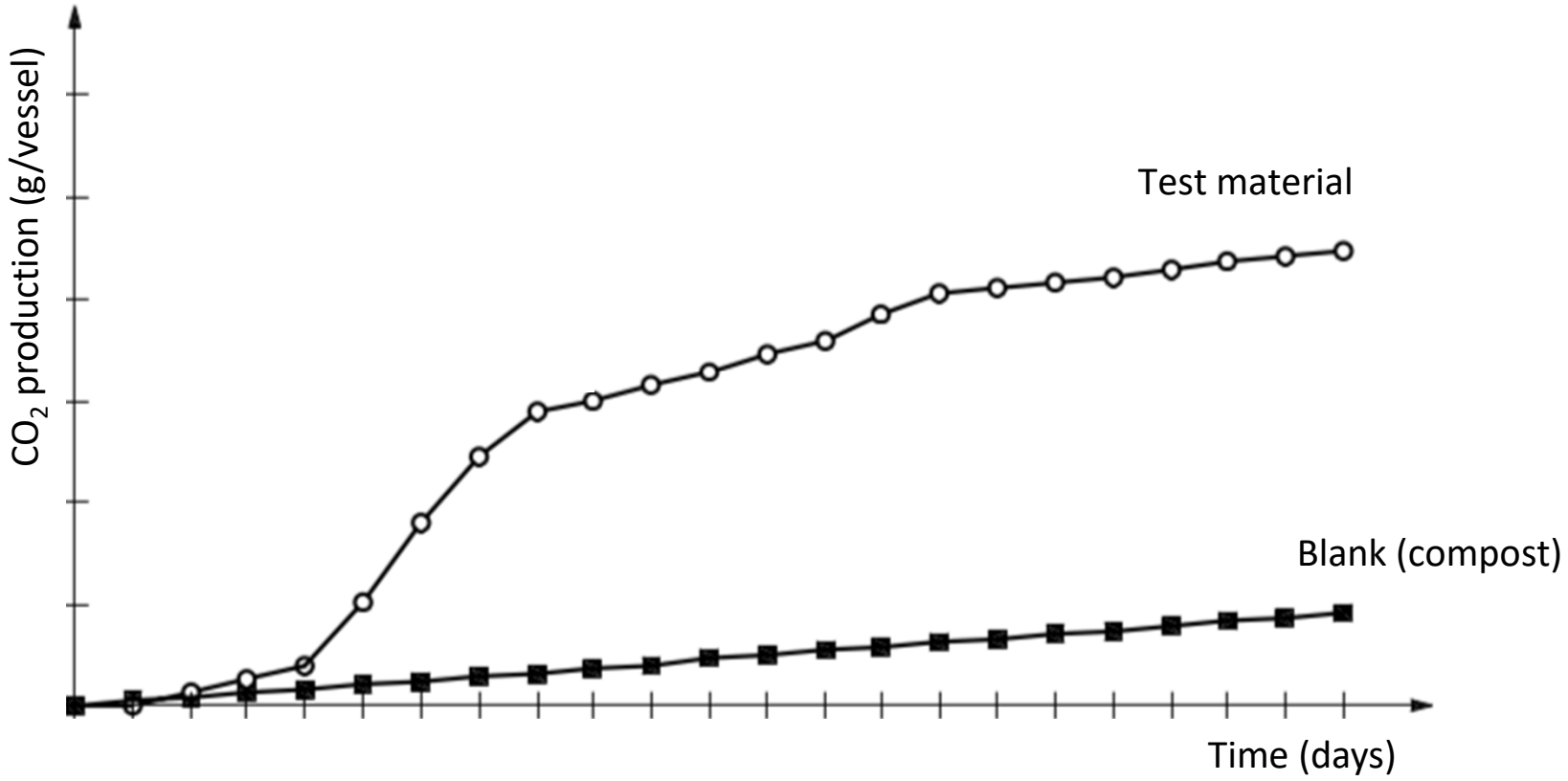


OXO razgradljiva plastika

- Rezultat testa: krivulja sproščenega CO_2



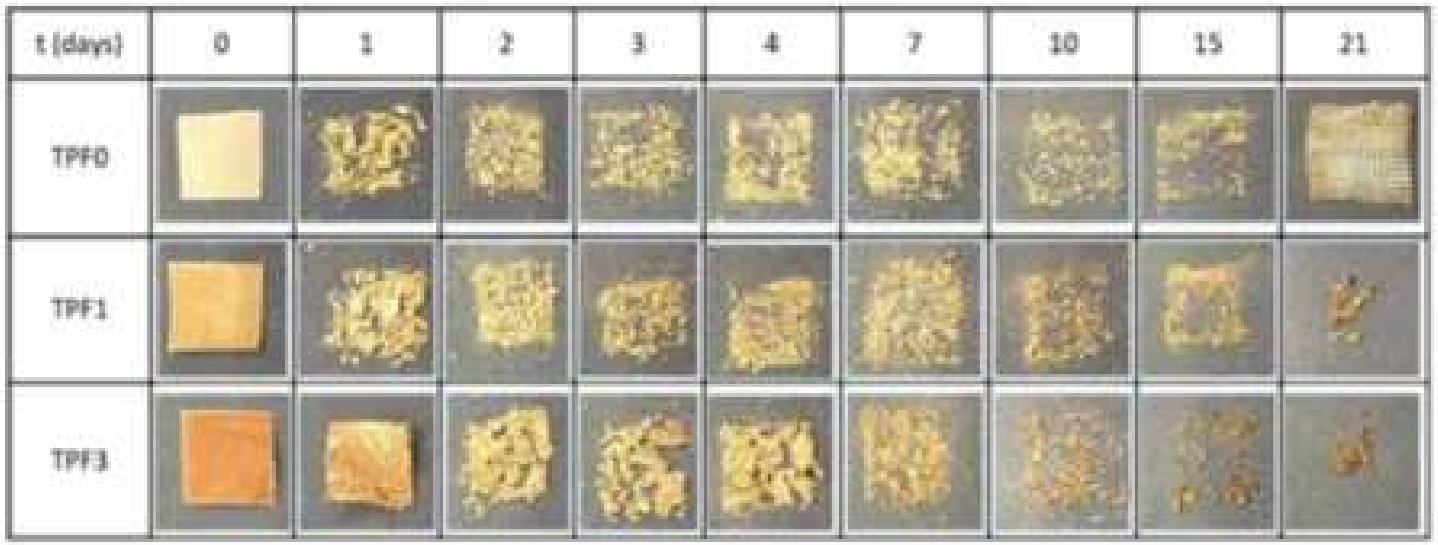
IZVEDBA EKSPERIMENTA

Vsaj 90% materiala mora razpasti v delce, ki se lahko presejejo skozi sito z velikostjo rež 2x2 mm.

Industrijski kompost: 12 tednov, domač kompost: 26 tednov

Na razgradnjo vpliva:

- oblika,
- gostota,
- debelina,…

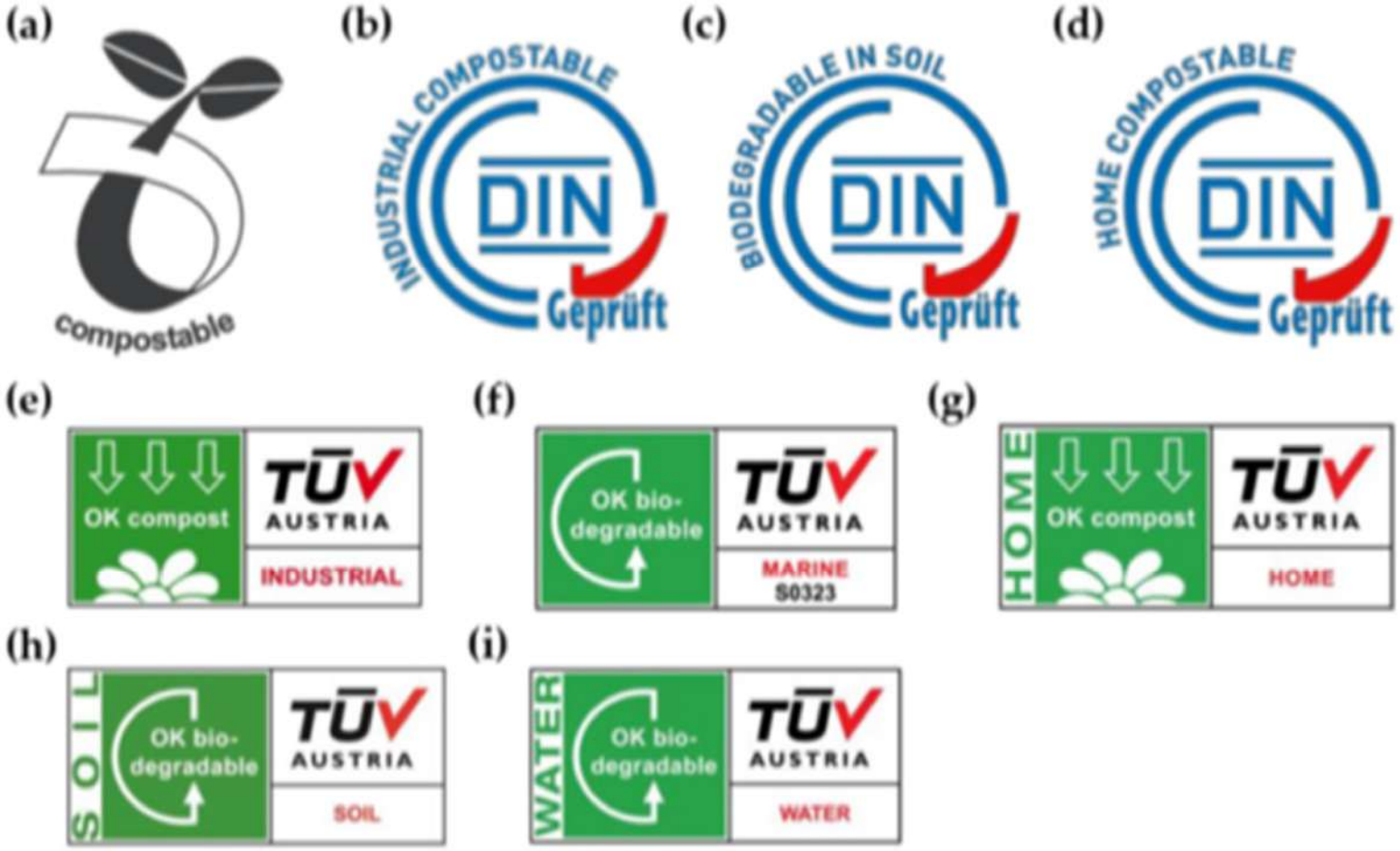


polymers-12-02248-g008-550.jpg (463×550) (mdpi.com)

- Maksimalni delež anorganskih snovi: 49%

Element	mg/kg on dry substance	Element	mg/kg on dry substance
Zn	150	Cr	50
Cu	50	Mo	1
Ni	25,0	Se	0,75
Cd	0,5	As	5
Pb	50	F	100
Hg	0,5		

- Test se izvede z različnimi vrstami sadik
- Rast mora dosegati 90% rast kontrolnih rastlin


(a)
compostable
(b)
INDUSTRIAL COMPOSTABLE
DIN
Geprüft
(c)
BIODEGRADABLE IN SOIL
DIN
Geprüft
(d)
HOME COMPOSTABLE
DIN
Geprüft
(e)
OK compost
TÜV AUSTRIA
INDUSTRIAL
(f)
OK bio-degradable
TÜV AUSTRIA
MARINE
S0323
(g)
HOME
OK compost
TÜV AUSTRIA
HOME
(h)
SOIL
OK bio-degradable
TÜV AUSTRIA
SOIL
(i)
WATER
OK bio-degradable
TÜV AUSTRIA
WATER

Environment	European Reference Standard	Certification and logos	Notes
Industrial composting	EN13432	OK compost INDUSTRIAL; kompostierbar; CIC; DIN Geprüft	EN 13432 refers to packaging. In addition, EN 14995 is a similar European standard for compostability of non-packaging products in industrial composting plants.
Well-managed home composting conditions	No European standard	OK compost HOME; DIN Geprüft	The OK compost home label builds on a certification scheme developed by TÜV Austria Belgium NV. The DIN-Geprüft Home Compostable label is based on French standard NF T51-800 and/or the Australian standard AS 5810. National standards also exist in Belgium and Italy. A draft European standard exists for plastic carrier bags suitable for treatment in well-managed home composting installations (prEN 17427:2020).
Soil	EN17033	DIN Geprüft	EN17033 applies to mulch films only.
		OK bio-degradable SOIL	Based on a certification scheme developed by the label provider, but can be compliant with EN 17033 on request by adding two additional ecotoxicity tests.
Freshwater	No European standard	OK bio-degradable WATER	Based on a certification scheme developed by the label provider.
Marine water	No European standard	OK bio-degradable MARINE	Based on a certification scheme developed by the label provider, using American standard ASTM D7081 (withdrawn) as a basis.

Biodegradable and compostable plastics — challenges and opportunities — European Environment Agency (europa.eu)

PRODUKTI NA TRGU

https://materbi.com/, https://www.unni.world/product-page/55-gallon-compostable-large-trash-bags,

SOUSTVARJAMO PRIHODNOST

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HVALA ZA POZORNOST

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