

AFTERLIFE

Production of bio-based Volatile Fatty Acids from organic waste as chemical building blocks

Stakeholder Workshop - 9th Oct 2020







AFTERLIFE has received funding from the Bio-Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation program under grant agreement No. 745737 .







- What are VFAs building blocks?
- Where and how are bio-based VFAs/bioplastics considered at EU level?
- Configuration strategies for VFAs production within the AFTERLIFE project;
- Conclusion



VFAs as builling blocks



Industrial applications

VFAs applications:

- Pharamaceutics
- Food/Feed additives
- Chemicals
- Petrolchemical industry

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VFAs as bio-based molecules

in the EU scenario

JRC SCIENCE FOR POLICY REPORT

Insights into the European market for bio-based chemicals

New databases of interesting and innovative bio-based compounds for EU open new market opportunities

The **European Green Deal** would accelerate the industry transition to a more sustainable model, supporting the **circular design** of all products by prioritising the reduction and reutilisation of materials before recycling. (European Green Deal 2019).

INNOVATION FOR THE ENVIRONMENT

Most interesting bio-based chemicals and polymers for plastics

Share of bio-based chemicals

in the EU scenario

Product category	EU bio- based production (kt/a)	Total EU production (kt/a)	EU bio-based production share (%)	EU bio-based consumption (kt/a)
Platform chemicals	181	60,791	0.3	197
Solvents	75	5,000	1.5	107
Polymers for plastics	268	60,000	0.4	247
Paints, coatings, inks and dyes (a)	1,002	10,340	12.5	1,293
Surfactants	1,500	3,000	50.0	1,800
Cosmetics and personal care products (^a)	558	1,263	44.0	558
Adhesives (^a)	237	2,680	9.0	320
Lubricants (ª)	237	6,764	3.5	220
Plasticisers (^a)	67	1,300	9.0	117
Man-made fibres	600	4,500	13.0	630
Total	4,725	155,639	3.0	5,489

(^a) No total EU production data were found; it has been assumed that total EU production (fossil- and biobased) equals the total EU market (fossil- and bio-based consumption).

Price of bio-based chemicals

in the EU scenario

Product category	Price (EUR/kg)	Turnover (EUR million/a)
Platform chemicals	1.48	268
Solvents	1.01	76
Polymers for plastics	2.98	799
Paints, coatings, inks and dyes	1.62	1,623
Surfactants	1.65	2,475
Cosmetics and personal care products	2.07	1,155
Adhesives	1.65	391
Lubricants	2.33	552
Plasticisers	3.60	241
Man-made fibres	2.65	1,590
Total	1.94	9,167

Product category	CAPEX	Replacement investments		Expansion investments		Total private investment	
	Million EUR/kt	Million EUR/a	Million EUR 2018-	Million EUR/a	Million EUR 2018-	Million EUR/a	Million EUR 2018-
Platform chemicals	3	54	380	74	515	128	896
Solvents	1.9	14	100	1	10	16	110
Polymers for plastics	3.7	99	694	45	313	144	1,007
Paints, coatings, inks and dyes	3.6	361	2,525	77	536	437	3,061
Surfactants	3.7	555	3,885	250	1,753	805	5,638
Cosmetics and personal care products	4.7	262	1,837	86	603	349	2,440
Adhesives	3.5	83	581	112	787	195	1,368
Lubricants	2.4	57	398	6	41	63	439
Plasticisers	5.8	39	273	13	90	52	363
Man-made fibres	6.2	372	2,604	122	855	494	3,459
Total		1,897	13,277	786	5,505	2,683	18,782

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VFAs production

From waste raw materials to VFAs

SW, October 2020, Innoven

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Solid/liquid separation

VFAs recovery

Solid/liquid separation

VFAs recovery

Solid/liquid separation VFAs recovery

INNOVATION FOR THE ENVIRONMENT

Afterlife purpose

VFAs production from 3 food industrial wastewaters

Volatile fatty acids (VFA) production, concentration and purification

Anaerobic digestion of the solid residues from the process

Food Industry Feedstocks

Jake wastewater

Food Industry Feedstocks

Heritage wastewater

Food Industry Feedstocks

Citromil wastewater

ESSENTIAL OIL

Food Industry Feedstocks

Substrates characterization for anaerobic fermentation

Parameter	Unit	Jake ww	Heritage ww	Citromil JL	Citromil EOL
TS	%	7,9	4,4	18,5	4,1
TVS/TS	%	96	89	88	31
tCOD	gCOD/L	97,4	61,6	36,8	2,5
sCOD	gCOD/L	88,2	52,6	23,1	2,1
ΤΚΝ	mgN/gTS	23,2	31,3	7,3	4,4
NH4-N	mgN/L	0,9	0,9	0,4	3,5
ТР	mgP/gTS	2,9	10,8	1,7	0,7

Bioreactors used for the VFAs production

under semi-continuous conditions

Acidogenic fermentation units

- 5 and 10 L auto-feeding
- Automatic mixing
- Heating jacket
- Automatic digestate outflow remov

VFAs production

VFAs amount and yields for Jake and Heritage ww

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Conclusions

- VFAs are bio-based molecules suitable for different **industrial applications**
- VFAs can be produced from different raw materials, allowing industrial waste valorization
- VFAs production, in the Afterlife scenario, was succesfully performed using anaerobic fermentation:
 - Jake ww: 27% COD converted to VFAs (20gCOD/L)
 - Heritage ww: 20-40% COD converted to VFAs (10gCOD/L)
 - Citromil ww: 40% COD converted to VFAs (7-20 gCOD/L)
- **Solid/liquid separation** of the fermentation effluent was succesfully performed:
 - The VFAs-rich liquid fraction was used for PHAs production
 - The solid fraction was employed for biogas and fertilizers production

Thank you for your attention