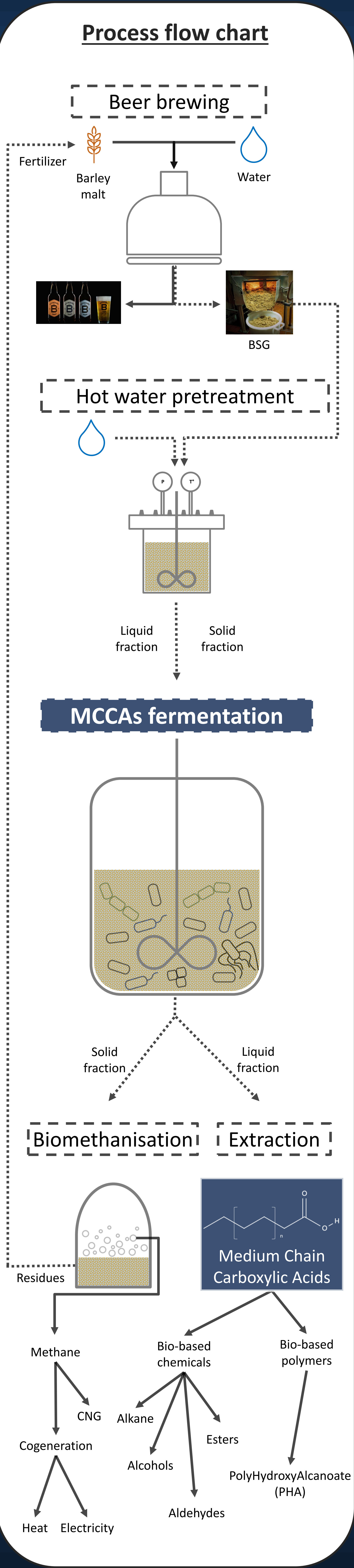


From Belgian agro-industrial residues to bio-based chemicals: Semi-continuous fermentation of brewer's spent grain by mixed microbial community

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Development of a valorization process for a complex feedstock



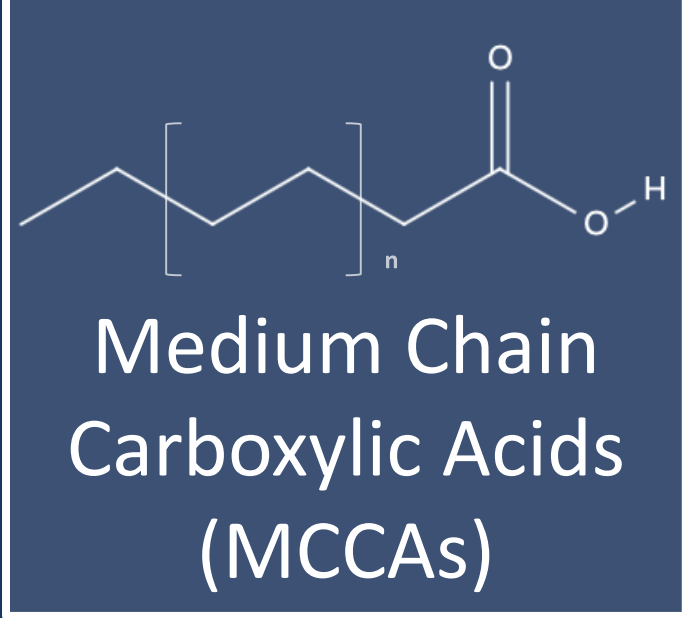
Brewer's Spent Grain (BSG)

BSG Fresh Matter Composition	
Dry Matter _{105°C}	23,2 % _{FM}
Volatile Solids _{550°C}	95,9 % _{DM}
Lignin	4,8 % _{DM}
Hemicelluloses	33,4 % _{DM}
Cellulose	17,9 % _{DM}
Starch	7,0 % _{DM}
Soluble sugars	0,8 % _{DM}
Proteins	25,1 % _{DM}
Minerals	4,1 % _{DM}
Other	7,0 % _{DM}

Acidogenesis

Small Chain Carboxylic Acids (SCCAs) & Alcohols

Microbial Elongation



Research aim

1. Is the production of MCCAs achievable in a semi-continuous fermentation process thanks to a Mixed Microbial Community (MMC) and a complex substrate?
2. Does the Organic Loading Rate (OLR) and Hydraulic Retention Time (HRT) influence the carboxylate production?
3. Does ethanol directly influence the elongation of SCCAs to MCCAs?

Conditions

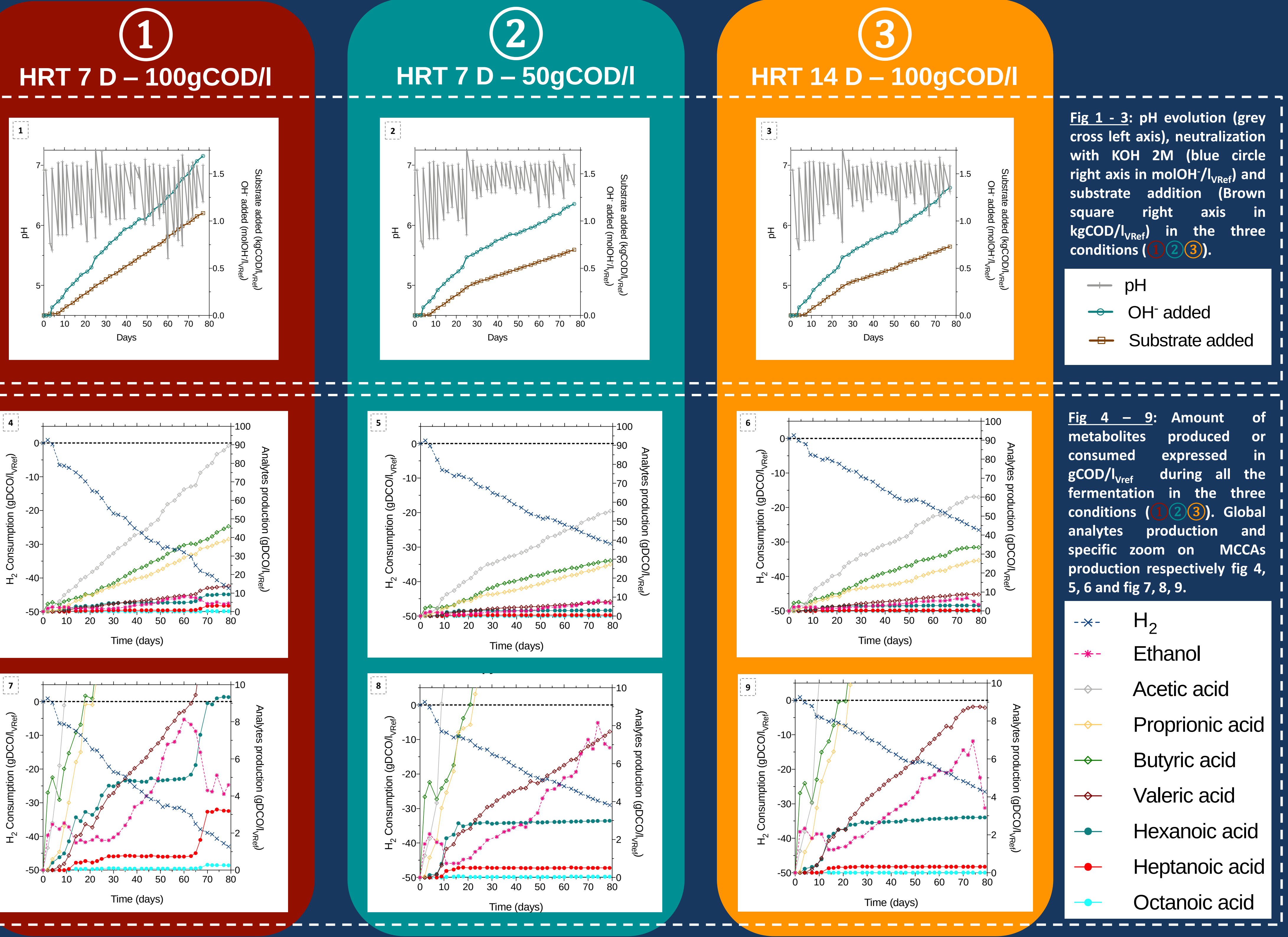
Inoculum : wastewater sludge - Oligo elements - Phosphate buffer - pH7 - H₂ - exogenous EtOH addition - Schott Bottle 2l - Mixed Liquor Volume Ref 0,18l - 35°C - 120 RPM

	①	②	③
HRT (days)	7	7	14
Feed (gCOD/l _{Vref})	100	50	100
OLR (gCOD/l _{Vref} -D)	79.50	39,75	39,75

Analytical methods:

Gas fraction : Pressure by gauge methods, composition by GC-TCD - Liquid fraction : COD by Spectroquant® kit and metabolites by GC-FID - Solid fraction : DM (105°C), VS (550°C), COD method⁶

MCCAs fermentation Results



Substrate added

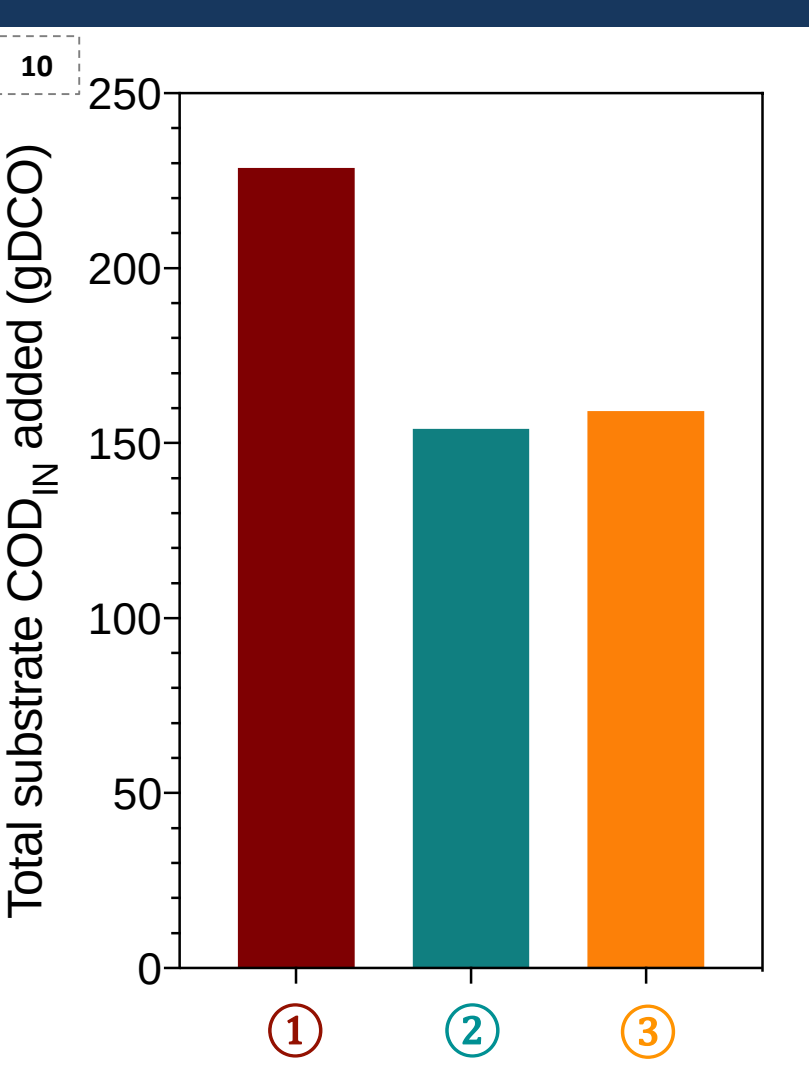


Fig 10: Total BSG added during the fermentation in gCOD.

Bioconversion yields

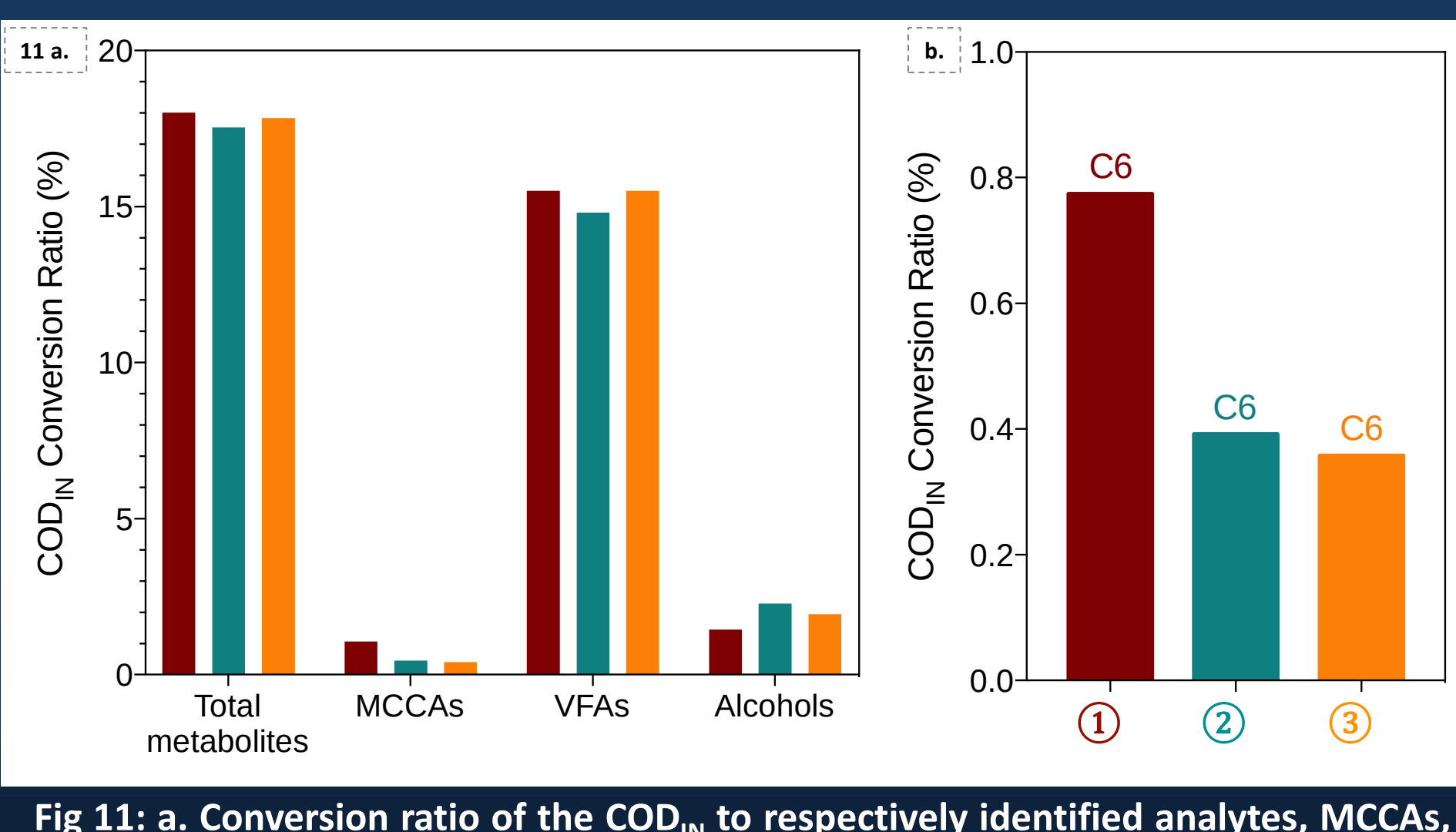


Fig 11: a. Conversion ratio of the COD_N to respectively identified analytes, MCCAs, VFAs and alcohols expressed in (gCOD_N/gCOD_N)*100. b. Conversion ratio of the COD_N to hexanoic acid (C6) expressed in (gCOD_{C6}/gCOD_N)*100.

Conclusion

1. BSG ⇒ SCCAs ⇒ MCCAs ✓
2. OLR ↗ ⇒ MCCAs ↗
HRT ↘ ⇒ MCCAs ↗
3. EtOH ↗ ⇒ MCCAs ↗

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6. Chemical Oxygen Demand COD method adapted from NBN T 91-202 (1974)

Image 1: <https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwlt-N3pHnANvNzBoKHtdfAhcQJRx6BAGBEAQ&url=http%3A%2F%2Fwww.etvoweb.be%2F82276-100-belge-la-bertinchamps&sig=ADUvawdgLNkitaWaiB-SnufK0k&ust=1579594034801068>
Image 2: <http://berichxap-content/uploads/sites/2/2015/05/glossaire-creches-big.jpg>

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