

SI: Impact of molecular weight, additives and copolymers on the chemical recycling of (bio)plastics using solid Ruthenium-based catalysts

Abbreviations

1,2-PD	1,2-Propanediol
1,3-BD	1,3-Butanediol
3-HBA	3-Hydroxybutyric acid
3-HHA	3-Hydroxyhexanoic acid
BA	Butyric acid
-BA	Butyric acid functionalized
Bio-PE	Bio-Polyethylene
CA	Crotonic acid
CNC	Nanocellulose
DCM	Dichloromethane
EG	Ethylene glycol
EoL	End of Life
EtOH	Ethanol
FTIR	Fourier transformed infrared spectroscopy
GPC	Gel permeation chromatography
HA	Hexanoic acid
HB	Hydroxybutyrate
-HCl	Hydrochlorid acid functionalized
HHx	Hydroxyhexanoate
HPLC	High pressure liquid chromatography
iPrOH	Isopropanol
LA	Lactic acid
-LA	Lactic acid functionalized
mbar	Milibar
<i>M_{cl}</i>	Medium chain length
Mt	Million metric tons
NCh	Nanochitin
P(HB-co-HHx)	Poly(hydroxybutyrate-co-hydroxyhexanoate)
P(HB-co-HV)	Poly(hydroxybutyrate-co-hydroxyvalerate)
PA	Propionic acid
PA	Polyamide
PDI	Poly dispersity index
PE	Polyethylene
PHA	Polyhydroxyalkanoate
PHB	Polyhydroxybutyrate
PLA	Polylactic acid
Ru(III)Cl ₃ ·H ₂ O	Ruthenium(III)chloride trihydrate
<i>S_{cl}</i>	Short chain length
TEM	Transmission electron microscopy
TFA	Trifluoroethanoic acid
<i>T_g</i>	Glas transition temperature
THF	Tetrahydrofuran
<i>T_m</i>	Melting temperature

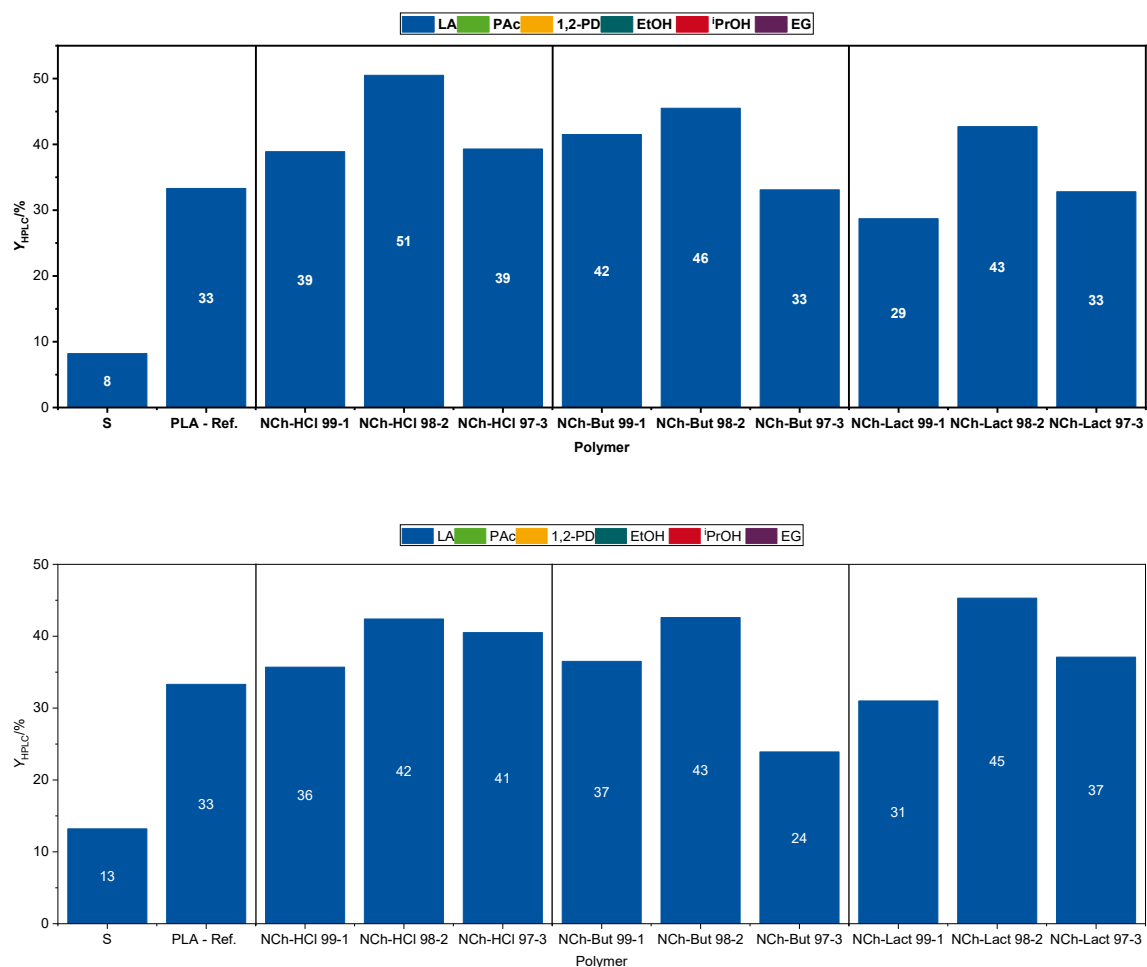


Figure S1: Reproduction chemical recycling results for a variety of reinforced PLA samples. Conditions: 5 mg Ru₅ wt%/CeO₂, 115 mg PLA, 175 °C, 5 bar H₂, 5 mL H₂O, 500 rpm, 0.5 h, 10 mL Hastelloy autoclave. Abbreviations: LA – lactic acid, PA – propionic acid, 1,2-PD – propionic acid, EtOH – Ethanol, iPrOH – isopropanol, EG – ethylene Glycol.

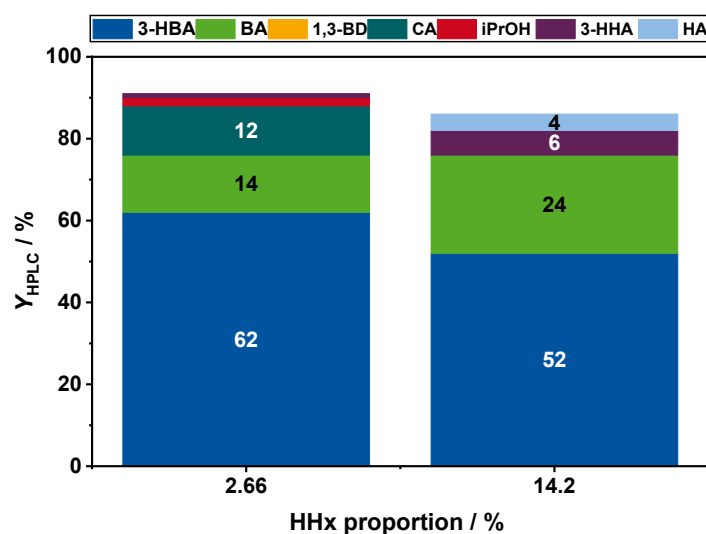


Figure S2: Chemical recycling results for a variety of P(HB-co-HHx) samples. Conditions: 5 mg Ru₅ wt%/CeO₂, 138 mg PHA, 200 °C, 5 bar H₂, 5 mL H₂O, 500 rpm, 3 h, 10 mL Hastelloy autoclave. Abbreviations: 3-HBA – 3-hydroxybutyric acid, BA – butyric acid, 1,3-BD – 1,3-butanediol, CA – crotonic acid, iPrOH – isopropanol, 3-HHA – 3-hydroxyhexanoic acid, HA – hexanoic acid.

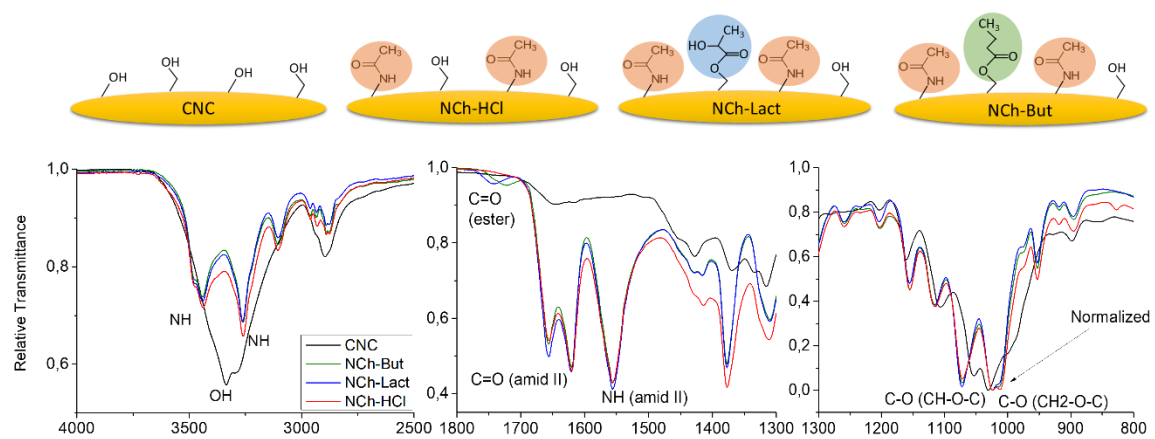


Figure S3 : Nanocrystals FTIR spectra.

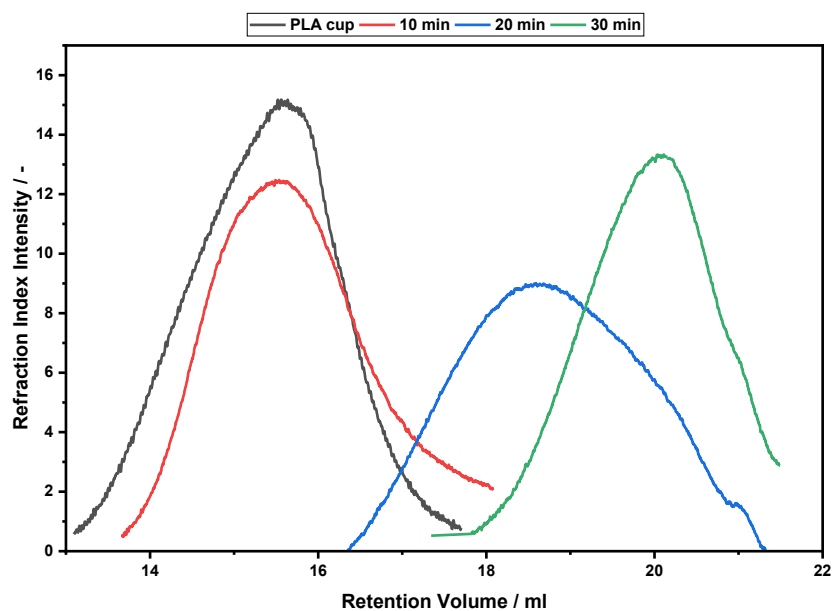


Figure S4: GPC-Chromatogram of PLA after the respective reaction times.

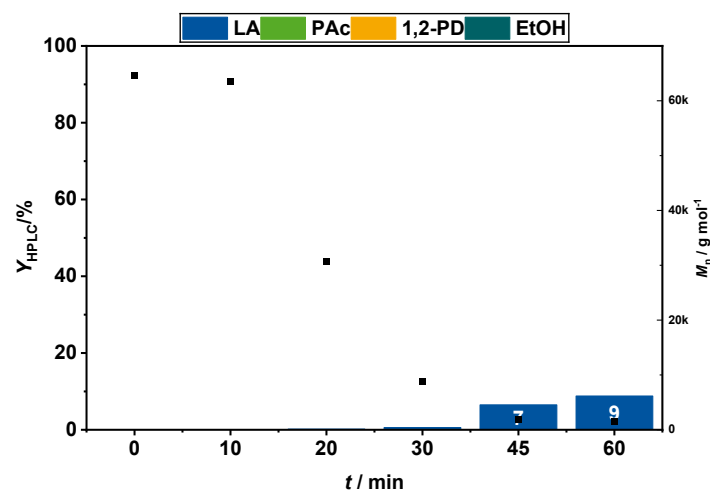


Figure S5: PLA after different reaction times ranging from 0 – 60 min. Black squares are attributed to the right y axis M_n . Conditions: 0 mg Ru_{5 wt%}/CeO₂, 115 mg PLA, 175 °C, 5 bar H₂, 5 mL H₂O, 500 rpm, 0 – 1 h, 50 mL Hastelloy autoclave.

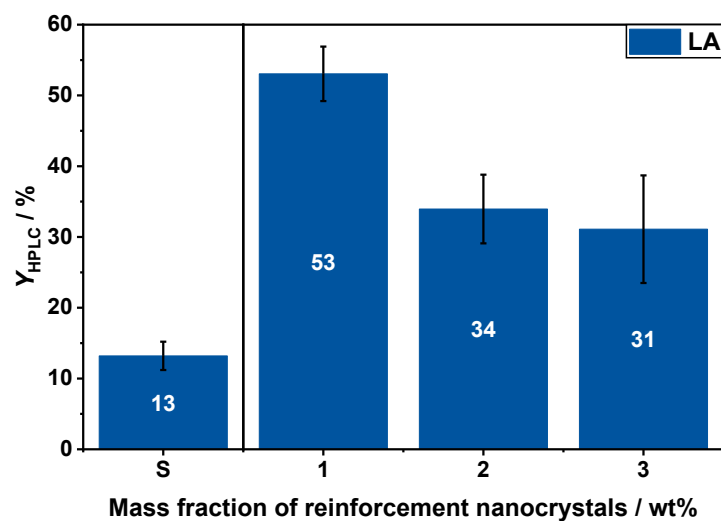


Figure S6: Chemical recycling results for PLA samples reinforced with unfunctionalized CNC. Error bars determined by multiple measurements. Conditions: 5 mg Ru_{5 wt%}/CeO₂, 115 mg PLA, 175 °C, 5 bar H₂, 5 mL H₂O, 500 rpm, 0.5 h, 10 mL Hastelloy autoclave. Abbreviations: LA – lactic acid