

# Recycling and upcycling of poly(succinates) via aminolysis reaction catalyzed by earth abundant metals

Bianca C. Rocha (PG),<sup>1</sup> Leandro H. Andrade (PQ).<sup>1\*</sup>

leandroh@iq.usp.br

<sup>1</sup>Departamento de Química, Universidade de São Paulo, SP, Brasil.

Key words: Upcycling, recycling, polymers, aminolysis, succinimides, succinamides.

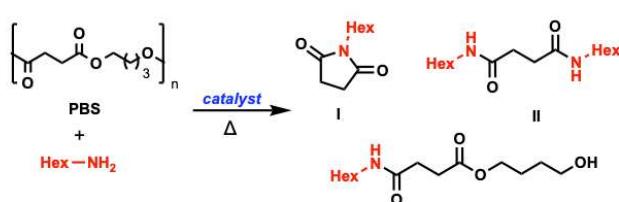
## Highlights

Upcycling and recycling of polyesters via aminolysis reaction. Production of succinimides and succinamides employing non-expensive and non-toxic catalysts. Excellent yields were obtained.

## Resumo/Abstract

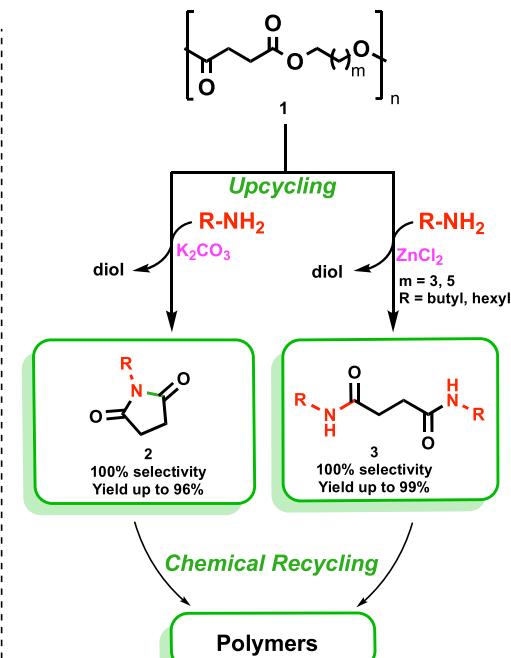
Given that polymeric waste is a significant concern in the 21st century, this study proposes the upcycling and chemical recycling of poly(succinates). The upcycling involves the transformation of poly(succinates) into different compounds, *N*-substituted succinimides and succinamides. This approach was based on the reaction of poly(succinates) **1** with amines and Lewis-acid ( $ZnCl_2$ ) as catalyst to afford *N*-substituted succinimides **2**. By changing the catalyst to a weak base ( $K_2CO_3$ ), poly(succinates) **1** were transformed into succinamides **3**. Both processes showed 100% selectivity and excellent yields (up to 99%) (Table 1). Succinimides and its *N*-substituted derivatives can be found in pharmaceuticals.<sup>1,2</sup> Our work also describes that these compounds can be used in polymerization reactions with diols or diamines to produce polyesters or polyamides, respectively<sup>3</sup> (Scheme 1).

Table 1: Aminolysis of polybutylene(succinate) with different catalysts



Entry	Catalyst	Time (h)	Temp. (°C)	Conv. I/II/III (%) <sup>a</sup>	Yield (%)
1	$ZnCl_2$	12	130	I (100)	23 <sup>b</sup>
2	TsOH	12	130	I (27)/ II (36)/ III (26)	-
3	$K_2CO_3$	12	130	I (23) / II (60)/ III (17)	-
4	$ZnCl_2$	24	130	I (100%)	96 <sup>c</sup>
5 <sup>d</sup>	$K_2CO_3$	18	130	I (40%) / II (60%)	-
6 <sup>d</sup>	$K_2CO_3$	18	110	II (100%)	99 <sup>c</sup>
7 <sup>d</sup>	$K_2CO_3$	18	90	-	-

General conditions: The reactions were carried out in batch using 0.5 mmol of PBS (relative to the repeating unit), 2 equiv. of hexylamine and 20 mol% of the catalyst. <sup>a</sup>Conversion was determined by GC-MS. <sup>b</sup>Purification was performed by liquid-liquid extraction, followed by filtration in silica gel. <sup>c</sup>Purification was performed by filtration in silica gel. <sup>d</sup>Reaction was carried out using 22 equiv. hexylamine.



Scheme 1: Upcycling and chemical recycling of poly(succinates)

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