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Synthesis, characterization, biodegradability and surfactant properties of bio-sourced lauroyl poly(glycerol-succinate) oligoesters

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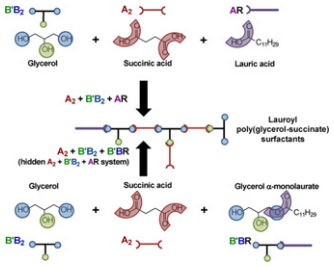
HIGHLIGHTS

- Lauroyl poly(glycerol-succinate) oligoesters as novel surfactants.
- Fully bio-sourced polar head groups based on glycerol and succinic acid.
- Controllable size and topology of the poly(glycerol-succinate) polar head groups.
- Design of a large range of biodegradable surfactants depending on reaction conditions.
- Good properties of foamability, wetting and excellent micellar solubilisation.

GRAPHICAL ABSTRACT



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ABSTRACT

Fully bio-sourced lauroyl oligoester surfactants, based on poly(glycerol-succinate) as polar head group with controllable sizes and topologies were prepared without solvent nor catalyst using $A_2 + B'B_2 + AR$ and $A_2 + B'B_2 + B'BR$ synthesis approaches. The alkyl chain was either derived from lauric acid or from glycerol α-monolaurate. The oligoester surfactants were characterized by quantitative ^{13}C NMR, acid values and size exclusion chromatography. Their surface activity, foamability, foam stability, wetting power, solubilization properties and biodegradability were investigated proving their potential use in a wide set of applications in replacement of petrochemical surfactants. This study underlines the relative impacts of the succinic acid/glycerol monomer ratios and of the strategies of synthesis on the physicochemical behaviour, on the biodegradability and on the stability of the lauroyl poly(glycerol-succinate) surfactants.

1. Introduction

Succinic acid and glycerol were reported in 2008 by the US department of Energy in a list of twelve building block chemicals which can be manufactured from sugars and other renewable raw materials via biological or chemical conversions. Actually, these platform molecules can be converted into various high-value bio-based materials or chemicals [1–5]. Succinic acid (noted A_2) is a polyvalent dicarboxylic acid used in numerous applications including the synthesis of intermediates (e.g. butanediol), green solvents (e.g. γ-butyrolactone), surfactants (e.g. succinate monoesters) and polyesters [1–8]. Until now, it was mainly produced from petrochemical sources through hydrogenation of maleic acid or its anhydride. However, it can also be fully synthesized using

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