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## Synthesis and aggregation properties of new biodegradable amphiphilic derivatives of *p*-*tert*-butylphenol for green separation of Gd(III) ions



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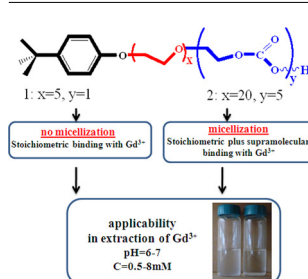
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### HIGHLIGHTS

- Novel amphiphilic ethyleneoxide-ethylenecarbonate derivatives of *p*-*tert*-butylphenol.
- Structure, pH and counterion affects on their aggregation in aqueous solutions.
- Binding with Gd(III) ions as a trigger of a phase separation of the solutions.
- Impact of supramolecular and stoichiometric binding modes in the phase separation.
- Gd(III) induced phase separation in the solutions as extraction procedure.

### GRAPHICAL ABSTRACT



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### ABSTRACT

The work introduces a synthesis of novel amphiphilic *p*-*tert*-butylphenol derivatives with the polyethyleneoxide and biodegradable ionogenic polyethylenecarbonate moieties. The dependence of the aggregation behaviour on the lengths of polyethyleneoxide and polyethylenecarbonate chains indicates the impact of the hydrophilic moieties and ionogenic end-groups in the aggregation behaviour of the amphiphiles. The micelles of the amphiphiles are negatively charged, although neither pH nor counterions (exemplified by Gd(III) ions) affects the values of their critical micelle concentrations. The presence of the ionogenic end-groups is the main reason of the pH and concentration dependent extraction of Gd(III) ions from the neutral (pH 6.2–7.2) aqueous solutions of the amphiphiles through their phase separation at room temperatures. The extraction regularities point on the stoichiometric binding of the amphiphilic molecules with Gd(III) ions as the main reason of the phase separation in their aqueous solutions. Nevertheless the micellization of the amphiphiles is responsible for the peculiar concentration effect on the extraction of Gd(III) ions from the aqueous solutions.

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