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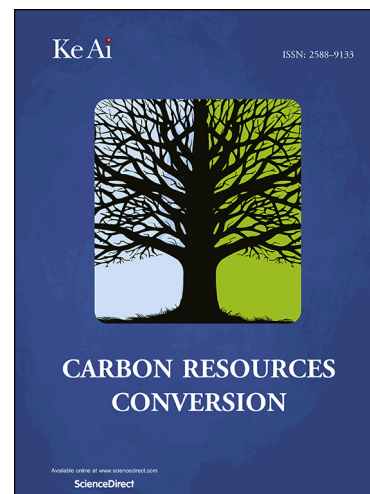
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## Synthetic and lignin based surfactants: challenges and opportunities

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### Abstract

Surface active agents (surfactants) are chemicals that can accumulate at the surface of a liquid, or interface between two phases with the role of changing the surface tension of the interface. Depending on their structures, they have many applications in industries, such as the petroleum, mining, pulping and textiles, wherein they are utilized as detergents, wetting agents, emulsifiers, foaming agents and dispersants. Most of commonly used surfactants are oil-based chemicals. However, using environmentally friendly feedstocks to produce surfactant is desirable to lessen the environmental impact of surfactant production and use in industry. Lignin is an attractive candidate for this purpose as it is inexpensive and readily available. Lignin and lignin derivatives, such as lignosulfonates, can be chemically modified to produce surfactants with different chemical and physical properties, which makes them suitable for a wide variety of applications. The lignin types and the processes performed for lignin production affect the properties of generated lignin significantly, which in turn influence the reactivity and the efficiency of the reaction for surfactant generation. In this review, the characteristics and applications of oil-based surfactants, and the efforts to produce lignin-based surfactants are reviewed. As oil-based surfactants with altered properties are available in the market, several different pathways can be followed for producing lignin-based surfactants. The advantages and disadvantages of using lignin-based surfactants are also discussed.

**Keywords:** lignin, surfactant, lignosulfonate, biorefining, organic materials

### 1 Introduction

The environmental concerns as well as the growing shortage of fossil resources are two reasons deriving the chemical industry to utilize renewable materials as feedstocks. Global warming and greenhouse gas emission have also sparked a surge of interest for replacing fossil-based products with biomass-based products [1,2]. It is well-known that the industrial production of chemicals and synthetic polymers relies greatly on fossil-based resources,

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