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Dye enzymatic degradation using aqueous biphasic systems as liquid supports for biocatalysts

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PURPOSE OF THE ABSTRACT

Recently, a significant interest in the application of biocatalysts (enzymes) over the commonly used chemical catalyst has emerged due to their more sustainable features. Enzymes, such as laccase, can operate at mild conditions, which may significantly reduce energy input and waste generation compared to synthetic catalysts, while presenting high specificity to substrates. Nevertheless, to guarantee a sustainable process there is need of the enzyme recuperation and reutilization [1]. In addition to the well-know solid support, liquid supports can be used. One of the alternatives correspond to aqueous biphasic systems (ABS), which are ternary liquid-liquid systems majorly composed of water.

In this work, our goal was to investigate ABS composed of cholinium-based ionic liquids (ILs) and polypropylene glycol (PPG 400) as novel liquid supports for enzymes, using laccase in the degradation of the textile dye Remazol Brilliant Blue R (RBBR). At the optimized conditions, the ABS constituted by 46 wt% of PPG 400 and 16 wt% of cholinium dihydrogencitrate ([Ch][DHC]) leads to the complete degradation of the dye, further maintaining the enzyme activity. This ABS also facilitates the immobilization, recovery, and reuse of the biocatalyst for six consecutive reaction cycles, achieving a degradation yield of the dye of 96% in the last cycle.

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FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

aqueous biphasic systems | dye degradation | enzyme immobilization and reuse | ionic liquids

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