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The ambivalent green role of laccase: From the production of bioinks to the design of de-inking systems

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Laccase catalyzes the reduction of dioxygen to water in synthetic and degradative processes. This ambivalent reactivity is relevant for the design of advanced biotechnology. Considering this ambivalent role, here we describe the application of laccase in the large-scale production of biodegradable tattoo bio-inks, as well as in the formulation of novel de-inking agents for the decolorization of eumelanin. The production of bio-inks involves the use of lignin nanoparticles bearing laccase able to contemporary perform as catalyst, vehicle, binder, and additive. These novel platforms work for the "in situ" polymerization of pigments covering different shades of color. Noteworthy, the pigment was stably linked to the surface of lignin nanoparticles and showed high resistance toward UV-visible irradiation and alkaline treatment. Conversely, the degradative ability showed by laccase in association to redox mediators inspired us to prepare topical de-inking cream against eumelanin. The hyperproduction of eumelanin leads to a panel of hyper-pigmented skin diseases including melasma and age spots. The treatment of these diseases often requires the use of inhibitors of tyrosinase, which act as skin whitening agents in the inhibition of the synthesis of eumelanin at metabolic level with harmful side effects. In this context, we describe the use of laccase in association with cocktail of natural redox mediators (Laccase cocktail mediator system, LCMS) for the efficient degradation of eumelanin, offering an alternative treatment to systemic skin whitening agents. In addition, LCMS was effective in the degradation of previously described bio-inks.

Biography

Eliana Capecchi is a phD and post-DOC in biotechnology and bionanotechnology at the University of Tuscia, Viterbo (Italy). Her areas of research are focused on the preparation and characterization of innovative heterogeneous bio-catalysts based on nanostructured and functional platforms of natural and renewable polyphenols, with particular attention to their application in organic synthesis, cosmeceutical field and advanced materials. He has published more than 13 papers in reputed journals.