Title:	Development of a light activatable lignin nanosphere based spray coating for bioimaging and antimicrobial photodynamic therapy
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Abstract:	Many coating materials are commercially available to combat microbial infections. However, these coatings are difficult to synthesize, and are mostly composed of toxic chemicals. Lignin is an under-explored natural biopolymer with multifaceted potential. Lignin, with adhesive, UV resistant, and antimicrobial properties, is a suitable candidate to develop coating materials. Here we report a smart method to fabricate a sustainable nanospray coating from lignin which does not require any toxic chemicals or additives during synthesis. Initially, we have developed stable lignin nanospheres in a single step in aqueous medium, which were later utilized as a lignin nanospray (LNSR). The LNSR was characterized by dynamic light scattering, scanning electron microscopy, FTIR and other analytical techniques. This LNSR showed remarkable UV blocking, antioxidant and light-activated antimicrobial properties. Interestingly, for the first time, the LNSR demonstrated photoluminescence, making it useful for bioimaging. Moreover, singlet oxygen generation potential was observed in the LNSR, which could render it useful in phototheranostic applications (i.e. light assisted imaging and photodynamic therapy). Further, the LNSR was directly utilized to fabricate a sustainable coating. The nanospray coating exhibited maximum light-induced cell killing when applied to common microbes as detected by live–dead cell imaging. Taken together, the lignin nanospray coating developed via a direct pathway holds great promise to disinfect microbes in the presence of light.
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