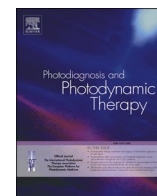




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Photodynamic therapy with curcumin for combating SARS-CoV-2

Dear Editor,

Could photodynamic therapy (PDT) be a treatment for COVID-19? PDT consists of a photosensitizer (PS) and a suitable light source. The PS upon light activation undergoes an oxygen-mediated photo-chemical reaction forming the reactive oxygen species (ROS), particularly singlet oxygen, causing apoptosis and necrosis (Fig. 1). It is selective method and a good choice for the treatment of some diseases. [1]. PDT often has mild to moderate side effects [2].

Curcumin (Fig. 2) is traditional Chinese medicine, non-toxic and has been a PS in the application of PDT [3]. It possesses a wide range of biological and pharmacological activities including anti-inflammatory, antioxidant, anti-infection properties [4]. Growing evidence has shown that curcumin in the photobleaching experiments produces ROS, more specifically singlet state oxygen, hydrogen peroxide, and hydroxyl radicals after the blue light activation between 300 and 500 nm to achieve the above characteristics [5].

Up to the present, we have known the COVID-19 caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) which was attached to an angiotensin-converting enzyme 2 (ACE2) receptor of spike glycoprotein for replication. The transmembrane protease serine 2 (TMPRSS2) and a disintegrin metalloproteinase domain 17 (ADAM17) interacted resulting in a high level of ACE2 expression. This increased the lung vascular permeability causing pulmonary oedema. It was believed that SARS-CoV-2 infected the upper respiratory tract first invades the human lungs and pneumonia appeared [6].

Dias LD et al. considered that PDT was applied to decrease the loading of SARS-CoV-2 in the upper respiratory tract by generating the ROS and 1O_2 to prevent the attachment of SARS-CoV-2 on the ACE2 receptor, and damage the nucleic acids either DNA or RNA. PDT combined with the usage of

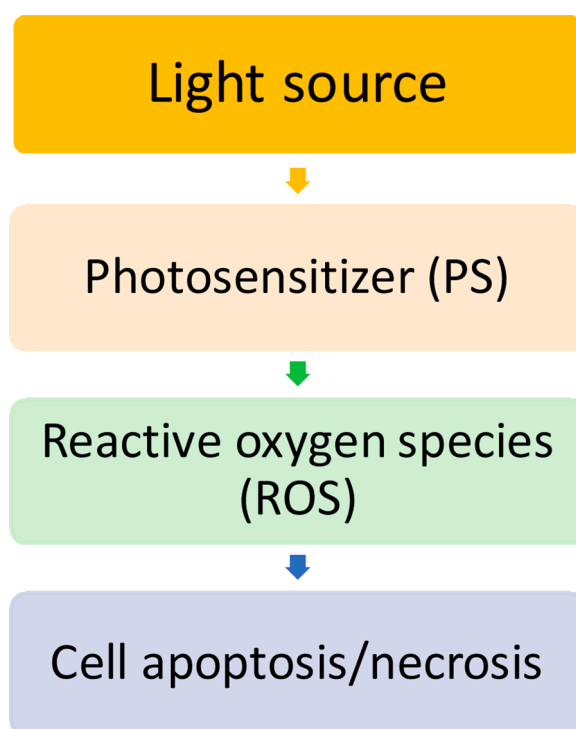


Fig. 1. Flow chart of photodynamic therapy (PDT).

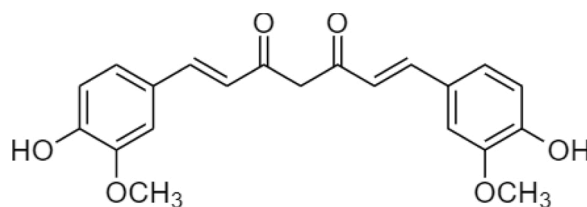


Fig. 2. Chemical structure of curcumin, a photosensitizer (PS).

curcumin (PS) could enhance the function of anti-bacterial [7]. Blanco KC et al. reported upper respiratory tract infections (URTI) were caused by acute, chronic, or recurrent infections including pharyngitis and tonsillitis. The use of curcumin formulations in PDT presented a microbial reduction of 5 logs [8]. Astuti SD et al. developed an antimicrobial photodynamic of blue LED for activation of curcumin extract on *Staphylococcus aureus*. As *S. aureus* might lead to severe infections such as pneumonia and empyema occurred. These investigations have shown LED irradiation could activate curcumin to increase the percentage of *S. aureus* bacterial death for preventing infections [9]. Jiang Y et al. also identified the photodynamic action of LED-activated curcumin on cell viability, membrane permeability, and intracellular reactive oxygen species of *S. aureus*. Blue light-activated curcumin markedly damaged membrane permeability, resulting in cell death of *S. aureus* [10].

All of the above information demonstrates that photodynamic therapy with curcumin is a possible candidate to combat the SARS-CoV-2. However, much more works need to be done especially in the safety assessment for human clinical trials.

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Declaration of Competing Interest

The authors report no declarations of interest.

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