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Abstract

Stilbenes: a review of their physicochemical properties, biological activities, molecular encapsulation and structural modifications

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ABSTRACT: Stilbenes are secondary metabolites produced by some plant species like grapes, peanuts or mulberries as a defense mechanism against biotic and abiotic stress conditions (fungal infections, UV radiation, etc.). These compounds are produced through the shikimic acid pathway and they share the 1,2-diphenylethylene structure with different substituents. These substituents are responsible for the vast variety of stilbenes that we know (resveratrol, piceatannol, pterostilbene, gnetol, pinosylvin, piceid, etc.), as well as responsible for their different physicochemical properties (solubility, polarity, stability, fluorescence and spectrophotometric features, among others) and their different biological activities (anticancer, antifungal, antioxidant, cardioprotective, antiobesity, etc.). Resveratrol is the most studied stilbene, but recently there is a growing interest for other stilbenes (both natural and synthetic) with better properties due to their structure.

However, these beneficial properties that stilbenes have are accompanied by some pharmacokinetic and physicochemical drawbacks that have to be solved to use them in cosmetic, food and pharmaceutical industries. Among these problems, the most important is the low water solubility of stilbenes (they are highly hydrophobic) and their fast degradation because of pH, temperature, oxidation or radiation. Moreover, the good bioactive results showed in in vitro studies do not correspond with those seen in the in vivo ones, probably because of the low bioavailability of stilbenes and their fast metabolization. To overcome these issues, 2 possible solutions have been proposed: the molecular encapsulation of stilbenes in cyclodextrins and the structural modification of native stilbenes.

The molecular encapsulation of stilbenes can be performed with liposomes, cyclodextrins or nanosponges, among other encapsulating agents. All of them have hydrophobic regions where stilbenes can be included, enhancing their water solubility and protecting them from degradation. On the other hand, the stilbene derivatization with different functional groups (hydroxyl, methoxyl, glycosyl, etc.) frequently improve the physicochemical properties and/or biological activities of native stilbenes.

KEYWORDS: Stilbenes; Encapsulation; Cyclodextrins; Antioxidant; Resveratrol

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