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8 Photoprotective potential in medicinal plants

8.1 Introduction

The general opinion among humans is that exposing to the direct sunlight is harmful. The ultraviolet (UV) component of the solar radiation is considered as harmful to the human skin. There are three different categories of solar UV radiation classified according to the wavelengths. Those are UV-A (315–400 nm), UV-B (280–315 nm) and UV-C (100–280 nm) [1, 2]. About 90% of UV radiation comprises UV-A which is known as "Aging rays." UV-B is specially known as "Burning rays" and it is more gene-toxic than UV-A. The solar UV radiation contains 4–5% of UV-B. UV-C is the most dangerous type of UV radiation; however, it cannot cause any harm to the human skin because it is effectively filtered by the atmospheric ozone layer [3].

Exposure to UV radiation could lead to acute and chronic effects on the human skin. The acute effects of exposure are short-lived and reversible. These effects include mainly sun burn (erythema), inflammation and pigment darkening. Apart from these, inflammation is somewhat correlated with chronic effects. The excess amounts of reactive oxygen species (ROS) which are generated due to excessive exposure to the UV radiation have a major impact on UV-induced chronic effects such as photocarcinogenesis and photoageing [2–5]. ROS are generally produced in the body in low concentrations by enzymatic and also non-enzymatic reactions. They mainly involve signal transduction pathways, gene transcription, etc. [6, 7]. Singlet oxygen, peroxyl radicals, superoxide radicals, hydroxyl radicals, and peroxynitrite are some examples for ROS. The harmful effects occur with the generation of ROS beyond the threshold limit by UV irradiation, particularly when it exceeds the elaborate anti-oxidative defense mechanisms in the body.

Photosensitizer molecules such as riboflavin, porphyrins, and quinones are responsible for the generation of ROS in mammalian cells upon the exposure to UV radiation. The absorption of photons/energy by these molecules initiates photosensitization reaction leading to an excited state called the singlet excited state. Thereafter two reactions can occur: either falling back to the ground state by emitting

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